STATE OF CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REAL ESTATE SERVICES DIVISION
PROJECT MANAGEMENT AND DEVELOPMENT BRANCH

PROJECT MANUAL – Book I of I

INTRODUCTORY INFORMATION
BIDDING REQUIREMENTS
CONTRACTING REQUIREMENTS
SPECIFICATIONS

FOR:

DMV DELANO AREA OFFICE REPLACEMENT

DEPARTMENT OF MOTOR VECHILES

DELANO, KERN COUNTY, CALIFORNIA

Ryan Beck, Project Director
West Sacramento, California

Consultants: Nacht & Lewis Architects

April 8, 2020 140724

DOCUMENT 00 01 01

PROJECT TITLE PAGE

Title	:	DMV Delano Area Office Replacement
Client Agency	:	Department of Motor Vehicles
Location	:	Delano, Kern County, California
Project Number	:	140724
Project Director	:	Ryan Beck State of California Department of General Services Real Estate Services Division Project Management and Development Branch 707 Third Street, 4th Floor West Sacramento, California 95605 Telephone Number: (916) 628-8192 Email: ryan.beck@dgs.ca.gov
Consultant	:	Nacht & Lewis Architects Mike Smith, AIA Telephone Number: (916) 329-4000 Email: msmith@nachtlewis.com

STATE OF CALIFORNIA
DEPARTMENT OF GENERAL SERVICES
REAL ESTATE SERVICES DIVISION
PROJECT MANAGEMENT AND DEVELOPMENT BRANCH

Department of Motor Vehicles

Delano, California

NO CORRECTIONS

N

April 8, 2020

OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY
01/07/21
20-1059
Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

STATE FIRE MARSHAL APPROVAL

DOCUMENT 00 01 05
CERTIFICATIONS PAGE

PROJECT TITLE	:	DMV DELANO AREA OFFICE REPLACEMENT
CLIENT AGENCY	:	CALIFORNIA DEPARTMENT OF MOTOR VEHICLES
LOCATION	:	Dover Parkway, Delano Ca.
PROJECT NUMBER	:	140724
OWNER	:	STATE OF CALIFORNIA
PROJECT DIRECTOR	:	Ryan Beck Department of General Services Real Estate Services 707 Third Street, Suite 4-040 West Sacramento, California 95605 Telephone Number: (916) 375-4310 Email: Ryan.Beck@dgs.ca.gov

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

CONSULTANT :

LICENSED ARCHITECT MICHAEL J. PARROTT No. C-27624 Ren: December 31, 2021 STATE OF CALIFORNIA 8 APR 2020	REGISTERED PROFESSIONAL ENGINEER GORDON HO-MAN FONG C 87304 CIVIL STATE OF CALIFORNIA 04/08/2020	LICENSED LANDSCAPE ARCHITECT BRYAN HOLLIS WALKER 5453 SIGNATURE 4/8/20 DATE 7/31/19 RENEWAL DATE STATE OF CALIFORNIA
ARCHITECT	CIVIL ENGINEER	LANDSCAPE ENGINEER
REGISTERED PROFESSIONAL ENGINEER LAWRENCE E. JONES No. 3138 STRUCTURAL STATE OF CALIFORNIA 8 APR 2020	REGISTERED PROFESSIONAL ENGINEER SHANE E. RUSSELL No. 33415 EXP. JUNE 2020 MECHANICAL STATE OF CALIFORNIA 8 APR 2020	LICENSED PROFESSIONAL ENGINEER SHEA CULBERTSON E22311 ELECTRICAL STATE OF CALIFORNIA 8 APR 2020
STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRIAL ENGINEER

PROJECT TITLE : DMV DELANO AREA OFFICE REPLACEMENT

CLIENT AGENCY : CALIFORNIA DEPARTMENT OF MOTOR VEHICLES
LOCATION : Dover Parkway, Delano Ca.

PROJECT NUMBER : 140724

OWNER : STATE OF CALIFORNIA

PROJECT DIRECTOR : Ryan Beck
Department of General Services
Real Estate Services
707 Third Street, Suite 4-040
West Sacramento, California 95605
Telephone Number: (916) 375-4310

Email: Ryan.Beck@dgs.ca.gov

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

CONSULTANT :

REGISTERED PROFESSIONAL ENGINEER CHARLES A. DAVIS FP 1853 FIRE PROTECTION STATE OF CALIFORNIA		
FIRE SPRINKLER		

PROJECT TITLE : DMV DELANO AREA OFFICE REPLACEMENT

CLIENT AGENCY : CALIFORNIA DEPARTMENT OF MOTOR VEHICLES

LOCATION : Dover Parkway, Delano Ca.

PROJECT NO. : 140724

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STATE OF CALIFORNIA
DEPARTMENT OF GENERAL SERVICES
REAL ESTATE SERVICES DIVISION
PROJECT MANAGEMENT AND DEVELOPMENT BRANCH

DOCUMENT 00 11 00

INVITATION FOR BIDS

This project is being bid informally to select prime Contractors in accordance with Public Contract Code §10122(d). Bid forms will be provided to bidders via email.

Bids are due before 2:00 P.M., August 29, 2023. Bids shall be submitted electronically to Pavan.Randhawa@dgs.ca.gov. Bids received after this date/time will not be considered received on time.

Please ensure the subject line of the emailed bid submission reads:

BID SUBMITTAL: PROJECT 140724 - DMV DELANO AREA OFFICE REPLACEMENT

Scope of Work: Major components of Project Work consist of excavation, grading, underground utilities, concrete, asphalt, landscaping and irrigation, striping, masonry, structural steel, metal fabrications, steel fencing and gates, carpentry, waterproofing, roofing, caulking, skylights, doors and hardware, storefront glass and glazing, sheet rocking, tiling, acoustical ceilings, flooring and base, painting, signage, restroom partitions and accessories, equipment and furnishings, fire suppression, plumbing, HVAC, electrical and related work.

License: Contractors' State License Classification required to bid Project is **B.**

HEALTH AND SAFETY PROVISIONS: Contractor and all subcontractors shall abide by all health and safety mandates issued by federal, state, and local governments and/or public health officers as well as those issued by DGS, and worksite specific mandates. If multiple mandates exist, the Contractor and subcontractors shall abide by the most restrictive mandate. The term “employee”, “worker”, “state worker” or “state employee” in health and safety mandates includes contractor and subcontractor personnel. Costs associated with adhering to health and safety mandates are the responsibility of the Contractor. Contractor is responsible for the tracking and compliance of health and safety mandates and may be audited upon request.

Availability of Funds: Award of this contract is subject to the availability of funds through the State’s normal budget process and/or transfer of funds to the Department of General Services through the Architecture Revolving Fund.

Pre-bid Site Inspection: Bids will only be accepted from those Contractors having attended the **MANDATORY** pre-bid site inspection tour on **August 16, 2023, at 1:00 P.M.,** at which time representatives of the State and prospective bidders shall meet at the site located at 448 Dover Parkway, Delano, CA (east side of the intersection of Dover Parkway and Morse Blvd in Delano, CA). The State’s requirements for Disabled Veteran Business Enterprise (DVBE) participation and other Contract requirements will be presented. Prime Contractors are encouraged to have their Key Administrator and DVBE office coordinator attend to receive this information and to have their questions answered. **Attendance for the entire inspection is required in order for bidders to be eligible to submit a bid.**

Executive Order N-6-22: The Bidder must be advised of Executive Order N-6-22 Russia Sanctions. On March 4, 2022, Governor Gavin Newsom issued Executive Order (EO) N-6-22 regarding Economic Sanctions against Russia and Russian entities and individuals. “Economic

Sanctions" refers to sanctions imposed by the U.S. government in response to Russia's actions in Ukraine, as well as any sanctions imposed under state law. By submitting a bid, Bidder represents that it is not a target of Economic Sanctions. Should the State determine Bidder is a target of Economic Sanctions or is conducting prohibited transactions with sanctioned individuals or entities, that shall be grounds for rejection of the Bidder's bid any time prior to contract execution, or, if determined after contract execution, shall be grounds for termination by the State.

Bid: Submit on Lump Sum basis with Allowances as set forth in Bid Forms.

Drawings and Project Manual: Plans and specifications will be available to download at the Department of General Services, Office of Business and Acquisition Services website. **Bid Opportunities (ca.gov).**

Bid Forms, RFBI and Addenda: Will be emailed out to individual contractors.

DVBE: Participation in Disabled Veterans Business Enterprises (DVBE) program **may** be required for this project. Refer to Project Manual Document 00 21 00, Project Manual Document 00 22 10 and Bid Forms for requirements. Bidders are advised to commence the required DVBE procedures immediately upon receipt of drawings and project manual.

Bonds: Successful bidder shall furnish payment and performance bonds, each in the amount of 100 percent of the Contract price.

Non-Discrimination Program (Gov. Code, Section 12990): Refer to Project Manual Document 00 72 00, General Conditions of the Contract for Construction.

Labor Code: Pursuant to Labor Code, Section 1774, the Contractor to whom the contract is awarded, and any subcontractor under him, shall pay not less than the specified general prevailing rates of per diem to all workers employed in the execution of the contract. Pursuant to Labor Code, Section 1770 et seq., the Department of Industrial Relations (DIR) has ascertained general prevailing rate of per diem wages in the locality in which the work is to be performed. Copies of the general prevailing rate of per diem wages are available from the Department of Industrial Relations, Labor Statistics & Research Division, P.O. Box 420603, San Francisco, CA 94142, (415) 703-4780; or general prevailing rate of per diem may be accessed on the internet at Department of Industrial Relations website for the February 2023 published general prevailing rate of per diem wages for this contract. Copies of the general prevailing rate of per diem wages are on file at DGS' principal office, which shall be made available to any interested party on request. Note that when the general prevailing rate of per diem determination shows an expiration date (noted by a double asterisk**), to expire during the term of the contract, the Contractor must call or write the DIR to obtain the new rates and incorporate them in this contract for submittal of bid. The Contractor is responsible to comply with the Labor Code Sections and general prevailing rate of per diem determinations, including all the guidelines and the fine print in the general prevailing rate of per diem determinations. Refer to Project Manual Document 00 72 00, General Conditions of the Contract for Construction.

Labor Compliance Monitoring and Enforcement: This project is subject to monitoring and enforcement by the Department of Industrial Relations (DIR), Compliance Monitoring Unit. All Contractors and subcontractors, regardless of tier, shall be required to comply with the Monitoring and Enforcement Program, including, but not limited to, contractor registration, submittal of electronic certified payroll reports directly to the DIR as applicable and cooperation with on-site monitoring by DIR personnel. Refer to Labor Code 1771.4 et seq. and the General Conditions of the Contract for Construction, Document 00 72 00, Article 3.3.3 for more information.

END OF DOCUMENT

STATE OF CALIFORNIA

DEPARTMENT OF GENERAL SERVICES

REAL ESTATE SERVICES DIVISION

DOCUMENT 00 21 00

INSTRUCTIONS TO BIDDERS

Index

May 2018 Edition

DOCUMENT 00 21 00
INSTRUCTIONS TO BIDDERS

1. GENERAL

1.1 Bidder shall examine these instructions carefully and be responsive to conditions with which must be complied with prior to bid.

1.2 Bidders shall be aware of the requirements of codes referenced in the Bidding Requirements and in the Contract Documents. Bidders may access codes included in California law through publications or through the Internet. The web site for California law is: http://leginfo.legislature.ca.gov/faces/codes.xhtml.

2. COMPETENCE OF BIDDERS

2.1 License:

.1 Bidder may only bid on work for which Bidder is properly licensed by the Contractors' State License Board.

.2 Joint venture Bidders must possess a joint venture license. Each party to a joint venture shall be properly licensed for the Work of this Project.

2.2 Prior Disqualification: Public Contract Code Section 10162 provides that a bid may be rejected on the basis of a Bidder, any officer of such Bidder, or any employee of such Bidder who has a proprietary interest in such Bidder, having been disqualified, removed or otherwise prevented from bidding on, or completing a Federal, State or Local project because of a violation of a law or a safety regulation.

If the answer to the questionnaire included in the Bid Form is "yes" the Department will review the circumstances presented and if the Director deems acceptance of the bid is not in the best interest of the State, bid may be rejected.

2.3 Employment of Undocumented Aliens: Pursuant to Section 6101 of the Public Contract Code, the State may not award a public works contract to a bidder or contractor, nor shall a bidder or contractor be eligible to bid for or receive a public works contract, who has, in the preceding five years, been convicted of violating a state or federal law respecting the employment of undocumented aliens.

2.4 Contractor Registration:

.1 Pursuant to Sections 1725.5 and 1771.1 of the Labor Code, all contractors and subcontractors must be currently registered with the Department of Industrial Relations in order to qualify to bid on; be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code; or engage in the performance of any contract for public work.

.2 Limited exceptions for Joint Venture Bidders and Projects with Federal Funds may apply pursuant to Section 1771.1 of the Labor Code.

2.5 Ineligible Subcontractors: Pursuant to Section 1777.1 or 1777.7 of the Labor Code, a contractor is prohibited from bidding on, being awarded or performing work on a public works project with a subcontractor who is ineligible to perform work on the public works project. Refer to the General Conditions of the Contract for Construction, Article 4.1.3.

2.6 Asbestos Abatement Certification: If Contractor performs the asbestos abatement work; Contractor must be certified for asbestos abatement work by the Contractors' State License Board. If Contractor subcontracts the asbestos abatement work, Contractor need not be certified for asbestos abatement, but the subcontractor must be certified by the Contractor's State License Board.

2.7 Hazardous Substance Removal Certification: If Contractor performs the hazardous substance removal work or remedial action; Contractor must be certified for hazardous substance removal work by the Contractors' State License Board. If Contractor subcontracts the hazardous substance removal work or remedial action, Contractor need not be certified for hazardous substance removal, but the subcontractor must be certified by the Contractor's State License Board.

3. EXAMINATION OF BID DOCUMENTS AND SITE

3.1 Bidder's Responsibility:

.1 Bidder shall carefully examine the Work site, Drawings, and Specifications (contract documents). This includes reference only documents that will not be part of the agreement, but are provided in addition to documents that will be part of the agreement. See the Office of State Publishing Plan Room https://www.ospplanroom.com/ (Details tab, Documents folder) for reference only documents.

.2 By submitting a bid, Bidder acknowledges that the Bidder understands the character, quality and quantity of surface, locations of utilities, subsurface materials, or obstacles to be encountered; insofar as this information is reasonably ascertainable from inspection of the Work site, Drawings, and Specifications.

.3 Bidder's examination shall include all exploratory work done by the State, as well as information presented in the Drawings, Specifications, and other documents as available.

3.2 Refer to Document 00 11 00, Invitation to Bid, for availability of bidding documents.

3.3 Failure by Bidder to acquaint itself with available information will not relieve Bidder from responsibility for estimating properly the difficulty or cost of successfully performing the Work.

3.4 In connection with the foregoing, Bidder's attention is invited to Paragraphs 3.1 and 9.1 of Document 00 72 00, General Conditions of the Contract for Construction.

4. DISCREPANCIES, CONFLICTS, OMISSIONS, OR ERRORS

4.1 If discrepancies, conflicts, omissions or errors are found in the Drawings and the Project Manual prior to the date of bid opening, Bidder shall request clarification from the State's Representative identified in the Project Manual. Bidder shall submit request on Request for Bidding Interpretation Form, Appendix 00 21 00.1.

4.2 Clarifications will be given only in the form of Addenda to all Bidders.

4.3 If no Addenda are issued related to supposed discrepancy, conflict, omissions or errors in figuring the Work, Bidders shall consider that discrepancies, conflicts, or omission between Drawings and Specifications shall be governed by Paragraph 1.5 of Document 00 72 00, General Conditions of the Contract for Construction.

4.4 Omission of an item in either the Specifications or Drawings does not create a discrepancy or conflict.

5. BIDDING DOCUMENTS

5.1 Bid Form: All bids must be on the forms provided by the Department of General Services. Bid not on the forms provided will be considered nonresponsive.

5.2 Completing the Bid Form:

.1 Bidder's name should be the same as listed on Bidder's license.

.2 Price(s) shall be in the manner required by the Bid Form.

.3 Bid Form shall be signed by Bidder or duly authorized representative.

1) If Bidder is an individual, name must be shown.
2) If Bidder is a partnership, name of the partnership must be shown and one or more partners shall sign the Bid Form.
3) If Bidder is a corporation, name of the corporation must be shown, the state of incorporation must be listed, the title of the signor must be shown, and the corporate seal must be used.
4) Bidder business and mailing address should be shown.

5.3 Required Listing of Proposed Subcontractors:

.1 Failure to list kind of Work, Name, or Location shall cause the bid to be rejected as non-responsive.

.2 Bidders' attention is directed to other provisions of the Subletting and Subcontracting Fair Practices Act, beginning with Public Contract Code Section 4100, related to penalties for failure to comply with the Act by using unauthorized subcontractors or by making unauthorized substitutions. See General Conditions of the Contract for Construction, Paragraph 1.1, for definition of subcontractor, and Article 4 for further reference to subcontractors.

.3 Bidder's attention is directed to Labor Code Section 1771.1, relating to inadvertent errors in the listing of subcontractors not currently registered with the Department of Industrial Relations.

5.4 Bidders Security:

.1 All bids shall be accompanied by the following forms of bidder's security: Bidder's Bond, cashier's check, certified check or cash. Bidder's Bond shall be executed by an admitted surety insurer, authorized to issue surety bonds in the State of California. Bond and checks shall be made payable to the director of the Department of General Services. The security shall be in an amount equal to at least 10 percent of the amount bid. A bid shall not be considered responsive unless one of the forms of bidder's security is enclosed with it.

.2 If Bidder's security is a Bidder's Bond, it must be executed on the form attached to the Bid Form.

5.5 Small Business:

.1 A five percent (5%) small business preference will be granted to Bidders certified as "Small Business" in accordance with Section 1896 et. Seq., Title 2, California Code of Regulations.

.2 If the Bidder is not already a Certified Small Business, applications for certification as "Small Business" must be submitted to the Office of Small Business and DVBE Certification (OSDS), 707 3rd Street, First Floor, Suite 1-400, West Sacramento, CA 95605; https://www.dgs.ca.gov/PD/About/Page-Content/PD-Branch-Intro-Accordion-List/Office-of-Small-Business-and-Disabled-Veteran-Business-Enterprise/Certification-Program. Firms can apply for small business certification online at https://www.dgs.ca.gov/PD/Services/Page-Content/Procurement-Division-Services-List-Folder/Certify-or-Re-apply-as-Small-Business-Disabled-Veteran-Business-Enterprise.

.3 Submit a copy of your OSDS certification letter with the Bid Form.

.4 Pursuant to Section 1896.14, in order to receive the small business preference, bidders must have a completed application (including proof of annual receipts) on file with the OSDS. The bidder must have requested a preference from OSDS and meet all applicable requirements under the subchapter and the State Small Business Procurement and Contract Act, (including but not limited to evidence to rebut presumptions) not later than five o'clock (5:00 p.m.) on the date on which the subject bid is opened.

5.6 Non-Small Business:

.1 The application of the five percent (5%) small business bidding preference is now extended to a bidder, whose business is not certified as a small business but commits to subcontracting at least twenty-five percent (25%) of its net bid price to businesses that are California certified small businesses and/or microbusinesses.

When applicable this preference will be granted when the non-small business:

- Has been determined to be a responsible bidder and submitted a timely responsive bid.
- Completes Document 00 43 16-2 list of California Certified Small Businesses that he/she commits to subcontract with for a commercially useful function in the performance of the project and submits this document no later than forty-eight (48) hours after the time of receipt of bids. Ascertain that the Bidder's Name and project Work Order number are noted. **If bidder fails to submit a properly completed Document 00 43 16-2 within 48 hours after the time of receipt of bids, the claim for non-small business preference will be denied.**

Submit completed Document 00 43 16-2 to Department of General Services, Administration Division, Office of Business and Acquisition Services, Contract Management Section, 707 3rd Street, Suite 2-300, West Sacramento, CA 95605 or by fax to (916) 376-1778.

6. SUBMISSION OF BID FORMS

6.1 It is the sole responsibility of the Bidder to see that its bid is received in proper time. Bid received after scheduled closing time for receipt of bids will be returned to Bidder unopened.

6.2 Bid Forms shall be submitted under sealed cover, plainly identified as a bid for the work of the Project being bid upon and addressed as directed in the Invitation to Bid and the Bid Form. Failure to do so may result in a premature opening of, or failure to open such bid. Bid Forms improperly marked may be disregarded.

7. WITHDRAWAL OF BID FORMS

7.1 Bids may be withdrawn prior to the time fixed in the public notice for opening of bids, provided that

a request in writing, executed by Bidder or Bidder's authorized representative, for withdrawal of such bid is filed with the Administration Division, Office of Business and Acquisition Services, Contract Management Section, or the Director of General Services at the location of the bid opening. Oral, facsimile, electronic, telegraphic, or telephonic request to withdraw the Bid Form is not acceptable. Withdrawal of a bid shall not prejudice the right of a Bidder to file a new bid.

7.2 This article does not authorize withdrawal of any bid after the time fixed in the Invitation to Bid for opening of bids.

8. PUBLIC OPENING OF BIDS

Bids will be publicly opened and read at time and place indicated in Invitation to Bid. Bidders or their authorized agents are invited to be present.

9. REJECTION OF IRREGULAR BIDS

9.1 Bids may be rejected if they show any alterations of form, additions not called for, conditional bids, incomplete bids, erasures, or irregularities of any kind. If bid amount is changed after the amount is originally inserted, the change must be initialed.

9.2 When Bid Form is signed by an agent, other than the officer or officers of a corporation authorized to sign contracts on its behalf, or are signed by an agent other than a partner of a partnership, or by an agent for an individual, a power of attorney must be on file with the Department of General Services prior to opening bids or shall be submitted with the Bid Form; otherwise the bid will be rejected as irregular and unauthorized.

10. COMPETITIVE BIDDING

10.1 If more than one Bid Form is offered by an individual, firm, partnership, corporation, association, or any combination thereof, under the same or different names, all such Bid Forms may be rejected. A party who has quoted prices on materials or work to a Bidder is not thereby disqualified from quoting prices to other Bidders, or from submitting a bid directly for materials or work.

10.2 Bidders are put on notice that any collusive agreement fixing the prices to be bid so as to control or affect awarding of the Contract is in violation of competitive bidding requirements of the State Contract Act and may render void any Contract let under such circumstances.

11. AWARD OF CONTRACT

11.1 The right is reserved to reject any and all bids and waive any irregularity in any bid received.

11.2 Award of the Contract, if awarded, will be to the lowest responsible Bidder whose Bid Form complies with all requirements prescribed.

.1 Such award, if made, will be made within 45 days after opening of bids.

.2 If lowest responsible Bidder refuses or fails to execute the Contract, the Director of General Services may award the Contract to the second lowest responsible Bidder. Such award, if made, will be made within 60 days after opening of bids.

.3 If second lowest responsible Bidder refuses or fails to execute the Contract, the Director of General Services may award the Contract to the third lowest responsible Bidder. Such award if made, will be made within 75 days after opening of bids.

11.3 The above time periods within which award of Contract may be made are subject to extension of such further period as may be agreed upon in writing between the Department of General Services and the Bidder concerned.

11.4 When Project is segregated into more than one prime Contract, and a Bidder upon one of the prime Contracts fail or refuses to execute the Contract, then the time for award of such Contract will be extended as provided by this Article, and the time for award of each of the other segregated prime Contracts will be extended by an equivalent length of time, if required.

12. SUBSTITUTION OF ALTERNATIVE MATERIALS, ARTICLES, OR EQUIPMENT

12.1 Pursuant to Public Contract Code Section 3400, alternative material(s), article(s), or equipment that are of equal quality and of required characteristics for the purpose intended may be proposed during the bidding period; for use in the Work, provided the Bidder complies with the following requirements:

.1 Proposals for alternative material(s), article(s), or equipment, requested during the bidding period, shall be submitted in writing, not later than the deadline date and time identified on the Request for Bidding Interpretation (RFBI), Appendix 00 21 00.1.

.2 The proposal will not be considered unless the submittal is accompanied by complete information and descriptive data necessary to determine equality of offered material(s), article(s) or equipment. Samples shall be provided when requested by the State. Burden of proof as to comparative quality, suitability, and performance of offered material(s), article(s), or equipment shall be upon the Bidder submitting the proposal. The State will be the sole judge as to such matters. In the event the State rejects the use of such alternative(s) submitted, then one of the particular products originally specified in the Contract Documents shall be furnished. If the proposal is accepted, all Bidders will be notified by Addendum.

.3 Refer to the General Conditions of the Contract for Construction, Clauses 2.2.7 and 3.12.10, for substitution requests after Contract Award.

13. RETURN OF BIDDER'S SECURITY

13.1 Within 10 days after the award of the Contract, the Department of General Services will return all Bidder's security, other than Bidder's Bonds, accompanying the Bid Forms that are not to be fully considered in making the award.

13.2 Retained Bidder's security will be held until the Contract has been fully executed, after which all Bidder's security, except Bidder's Bonds, will be returned.

14. CONTRACT BONDS

Contractor will be required to furnish in duplicate the Performance Bond and Payment Bond required by the State Contract Act, each in the amount of 100 percent of the Contract amount; as set forth in Paragraph 11.3 of Document 00 72 00, General Conditions of the Contract for Construction.

15. INSURANCE

Contractor will be required to furnish to the State, concurrently with execution of the Contract, a certificate of insurance coverage as required by Paragraph 11.1 of Document 00 72 00, General Conditions of the Contract for Construction.

16. EXECUTION OF CONTRACT

16.1 Contract shall be signed by successful Bidder and returned within 7 days of receipt. The Contract shall not be binding upon the State until it is executed by the Contractor and the State. Contract Documents required for execution of the Contract consist of the following:

.1 Agreement, Document 00 52 00.

.2 Contract Bonds.

.3 Certificate of Insurance.

.4 Signed set of Drawings and Project Manual for filing with the Contract.

16.2 Should Contractor begin work in advance of receiving notice that the Contract has been approved, any work performed in advance of the date of approval shall be considered as having been done at risk as a volunteer. In no event shall Contractor commence work until Contractor has received notification from the State that the certificate of insurance has been approved.

17. FAILURE TO EXECUTE CONTRACT

Failure to execute Contract within 7 days after successful Bidder has received Contract for execution may be cause for forfeiture of Bidder's security. Failure to provide required bonds and insurance constitutes failure to execute Contract.

18. PARTICIPATION IN DISABLED VETERANS BUSINESS ENTERPRISES (DVBE) PROGRAM

18.1 Pursuant to Section 10115 et seq. of the Public Contract Code, and Section 999 et seq. of the Military and Veterans Code, the Department of General Services has established an overall goal of not less than 3% participation by Disabled Veteran Business Enterprises (DVBE). However, these DVBE Participation Requirements may be modified for this project; reference Document 00 22 10 of the Project Manual for the percentage requirements.

18.2 Bids will only be accepted from those Bidders that certify that they have achieved the required participation, as outlined in Document 00 22 10 of the Project Manual, and as set forth in the Bid Form.

18.3 Applicants for DVBE certification may apply online at https://www.dgs.ca.gov/PD/Services/Page-Content/Procurement-Division-Services-List-Folder/Certify-or-Re-apply-as-Small-Business-Disabled-Veteran-Business-Enterprise. DVBE applicants must submit specific support documentation to the OSDS.

18.4 Bidder's attention is directed to the requirement that certifications and documentation must be submitted with the bid; otherwise bids will be considered non-responsive.

BIDDERS ARE ADVISED TO COMMENCE THE REQUIRED DVBE PROCEDURES IMMEDIATELY UPON RECEIPT OF DRAWINGS AND SPECIFICATIONS, OR NOT LESS THAN THREE (3) WEEKS PRIOR TO THE BID OPENING, WHICHEVER OCCURS FIRST.

18.5 DVBE INCENTIVE

.1 A DVBE Incentive will be granted to Bidders in accordance with Section 999.5(a) and (d) of the Military and Veterans Code and California Code of Regulations 1896.98 et seq.

.2 The DVBE Incentive will be applied during the bid evaluation process and will only be applied to responsive bids from responsible bidders proposing the percentage(s) of DVBE Participation

for the DVBE Incentive specified in the solicitation. Any Small Business Preference must be calculated prior to the DVBE Incentive calculation and evaluation.

.3 The incentive will be applied when a Bidder's DVBE Participation exceeds 3% the DVBE Mandatory participation Requirement, in an attempt to displace the apparent low bidder.

The DVBE Incentive is as follows:

Confirmed DVBE Participation	Incentive
7% and above	5%
6% to 6.99%	4%
5% to 5.99%	3%
4% to 4.99%	2%
3.01% to 3.99%	1%
0% -3%	No incentive – minimum 3% participation required

.4 The percentage of DVBE Incentive will not exceed 5% and will not exceed $500,000.00.

.5 For every bidder qualifying for the DVBE incentive, the amount (dollar value) of the incentive is computed using the qualifying bidder's percentage of DVBE incentive and the lowest responsive and responsible bid price. Calculations to determine adjusted bid price are for consideration only. Bids will be awarded for the actual bid amount as verified by the State.

.6 A certified Small Business may only be displaced by another certified Small Business with a higher percentage of DVBE participation and a lower adjusted bid price.

1) A certified Small Business shall not be displaced by a non-small business.
2) When applying the DVBE Incentive program, bidders claiming the "Non-Certified Small Business preference" are considered a non-small business.

END OF DOCUMENT

REQUEST FOR BIDDING INTERPRETATION (RFBI)

(Email no later than August 22, 2023, 5:00 p.m.)

PMDB RFBI No.: _____
Requestor RFBI No.: _____
Request Date:_____

To: **Ryan Beck, Project Director/Manager**
Project Management and Development Branch
Real Estate Services Division
Phone: 916-375-4310

Email: ryan.beck@dgs.ca.gov

From (Bidder): _____

Contact: _____
Phone: _____
Fax: _____
Email: _____

All RFBIs received prior to deadline identified above, and responses from the State will be published on http://www.caleprocure.ca.gov. Click on "Start Search." In the event name field, enter the project number and click search. While viewing the Event Details, click on "View Event Package" to view RFBI responses.

Project No.: 140724
Project Name: DMV Delano
Location: Delano, CA

Drawing Reference: _____ **Project Manual Reference**: _____

Question:

Bidder's Authorized Signature: _____

[ ] Check here if additional pages attached

Page 1 of ____

DOCUMENT 00 22 00

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

The following requirements supplement Document 00 21 00, Instructions to Bidders:

1. PAYEE DATA RECORD

   Add the following to Subarticle 6.2:

   Bidders are requested to complete and return the State's Payee Data Record form, Std.204 (and Std. 205 if applicable), included with the Bid Forms. The Payee Data Record form is required in lieu of IRS W-9 when doing business with the State of California, and will be used by the State to prepare tax information returns as stated on the form.

   .1 Completion and submission of the form with the Bid Forms will expedite processing of the Award of Contract.

   .2 Failure to submit the completed form with the Bid will not be cause for rejection of a Bid.

   .3 Forms of all Bidders will be kept on file by the State for use in future awarded Contracts.

   .4 Bidders who have a completed and current Payee Data Record form on file with the Department of General Services, Real Estate Services Division, Contracts Section, may so state on the form and will not be required to submit a duplicate form.

   .5 The form is subject to Section 7(b) of the Privacy Act of 1974 (Public Law 93-5791). Refer to the Privacy Statement on the back of the form.

END OF DOCUMENT

DOCUMENT 00 22 10

DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION PROGRAM REQUIREMENTS

Public Contract Code Section 10115 establishes a contract participation goal of at least three percent (3%) for Disabled Veteran Business Enterprise (DVBE) for State agencies.

DVBE participation is required for this contract. Mandatory participation has been set at 3%. **Participation above and beyond the requirement is strongly encouraged.** This bid package provides information for the DVBE Participation Program. Bidders must meet DVBE Participation Program requirements to be viewed as a responsive bidder and considered for contract award.

PLEASE READ THESE INSTRUCTIONS CAREFULLY

Bidders must fully comply with DVBE Participation Program requirements. Bidders that do not submit a complete response may find their bid determined to be non-responsive and the bid rejected.

For assistance with meeting the DVBE participation program requirements, please contact:

Department of General Services
Administrative Division
Office of Business and Acquisition Services
Contract Services Section – SB-DVBE Advocate
707 Third Street, MS 508
West Sacramento, CA 95605
Email: OBASAdvocate@dgs.ca.gov

The **Office of Small Business and DVBE Services** (OSDS) offers program information and may be reached at:

Department of General Services
Office of Small Business and DVBE Services (OSDS)
707 3RD Street, 1st Floor, Room 400
West Sacramento, CA 95605-2811
Homepage: Apply for or Re-Apply for Certification as a Small Business and/or Disabled Veteran Business Enterprise
Receptionist: (916) 375-4940
FAX: (916) 375-4950
Email: OSDSHelp@dgs.ca.gov

Mailing Address:
Office of Small Business and DVBE Services (OSDS)
Room 1-400, MS 210
P.O. Box 989052
West Sacramento, CA 95798-9052

INSTRUCTIONS FOR
DVBE PARTICIPATION PROGRAM COMPLIANCE OPTIONS

If for any reason you fail to meet the DVBE Participation Requirement for this bid, your bid will be considered non-responsive.

Meet or exceed the DVBE participation requirements for the proposed contract by one of the following two (2) ways:

1. **DVBE Bidder -** If you are a DVBE bidder, agree to perform the required percentage of the contract bid amount or value with your firm or in combination with other DVBE firms. You **must** write that commitment on Article 9.2 of the Bid Form, Document 00 41 00. Instructions on how to complete this document are on that page.

2. **Non-DVBE Bidder -** If you are a non-DVBE bidder, agree to use other firms for at least the required percentage of the contract bid amount or value. You **must** write that commitment on Article 9.2 of the Bid Form, Document 00 41 00. Instructions on how to complete this document are on that page.

DVBE Certification: OSDS-DVBE certification is the only acceptable certification. To verify if a contractor is certified refer to the Cal eProcure web-site at The State of California Certifications . Bidders must provide certification verification for each participating DVBE bidder, subcontractor, and/or supplier. Applicants for DVBE certification may apply online at Apply for or Re-Apply for Certification as a Small Business and/or Disabled Veteran Business Enterprise. DVBE applicants must submit specific support documentation to the OSDS.

DVBE Bid Incentive: A DVBE Incentive will be granted to Bidders who have achieved DVBE participation exceeding 3% or greater of the value of the bid in accordance with Section 999.5(a) and (d) of the Military and Veterans Code and California Code of Regulations 1896.98 et seq. Refer to Project Manual Document 00 21 00, Article 18.5.

Pursuant to Military and Veterans Code §999.7, the awarding department shall withhold, on a contract entered into on or after January 1, 2021, ten thousand dollars ($10,000) from the final payment, or the full final payment if less than ten thousand dollars ($10,000), until a prime contractor complies with the certification requirements of subdivision (d) of Section Military and Veterans Code §999.5. A prime contractor that fails to comply with the certification requirement shall, after notice, be allowed to cure the defect. Notwithstanding any other law, if, after at least 15 calendar days but not more than 30 calendar days from the date of notice, the prime contractor refuses to comply with the certification requirements, the awarding department shall permanently deduct ten thousand dollars ($10,000) from the final payment, or the full payment if less than ten thousand dollars ($10,000).

ANSWERS TO FREQUENTLY ASKED QUESTIONS:

The following questions are among the most frequently asked regarding DVBE requirements:

Q: ***If I am awarded the contract, am I required to use the subcontractor/supplier proposed in my bid?***

A: Yes, unless you have requested and received approval from the State for substitution. Written requests should include the person's or firm's name to be substituted, the substitution reason, the reason a non-DVBE subcontractor is proposed, if applicable and describe the business to be substituted including its business status as a sole proprietorship, partnership, corporation or other entity and the certification status of the firm, if any. See Title 2, California Code of Regulations, Section 1896.64 (c) & (d) for substitution criteria.

The request and the State's approval or disapproval is not construed as an excuse for non-compliance with any other provision of the law, including but not limited to the Subletting and Subcontracting Fair Practices Act, or any other contract requirements relating to substitution of subcontractors. Failure to adhere to at least the DVBE participation proposed by the successful Contractor may be cause for contract termination and recovery of damages under the rights and remedies due the State for default section of the contract(s) and any other penalties provided for by statute.

Q: ***Who notifies the subcontractor when an award is made?***

A: Upon award to a prime Contractor, the Awarding Department notifies listed subcontractors of their contract participation. Primes are encouraged to notify their listed subcontractors immediately after an award is made to formalize their business agreements.

Q: ***What happens to bids considered non-responsive to the DVBE Participation Program requirements?***

A: Non-responsive bids are subject to rejection. Many are rejected because of:

- Incomplete documentation
- Documentation not received by bid due date
- Mathematical error related to the percentages

Q: ***If I am a disabled veteran business enterprise, can I meet the percentage requirements as a single company?***

A: Yes.

Q: ***If my submitted bid meets the contract goal and the State decides to make multiple awards to the bid/contract, could my bid be considered non-responsive?***

A: No. The State's decision to make multiple awards will not jeopardize bid compliance.

END OF DOCUMENT

BID FORM

THE STATE OF CALIFORNIA
DEPARTMENT OF GENERAL SERVICES
REAL ESTATE SERVICES DIVISION
PROJECT MANAGEMENT AND DEVELOPMENT BRANCH

FROM: _____
(Name of Bidding Firm)

DELIVER TO: PAVAN.RANDHAWA@DGS.CA.GOV

BEFORE 2:00 P.M., August 29, 2023

FOR: DMV DELANO AREA OFFICE REPLACEMENT
DEPARTMENT OF MOTOR VEHICLES
DELANO, KERN COUNTY, CALIFORNIA
140724

Plainly mark outside of envelope with "Bid For"; followed by the above title and Project Number.

The undersigned hereby proposes and agrees to furnish all labor, materials, and equipment, and to perform all work required for the above-named Project in the manner and time prescribed in the Drawings and Project Manual, dated April 8, 2020 and such addenda thereto as may be issued prior to bid opening date and in accordance with prevailing wage rates ascertained by the Department of Industrial Relations and set forth on the DIR web site (Prevailing Wage Requirements) for General Prevailing Wage Rates as determined by the February 2023 DIR prevailing wage published rates. The Bid Price, set forth below in clear legible figures, includes the cost of Bonds, insurance, sales tax, and every other item of expense, direct or indirect, incidental to the Bid Price.

SCHEDULE OF WORK AND PRICES

WORK ITEM	DESCRIPTION	ITEM TOTAL IN FIGURES
1.	**Performing all other work of this Project, not included in Work Item 2 below, for the lump sum of:**	**$_____**
2.	**Allowance(s) as specified in Section 01 21 00, not included in Work Item 1 above for the sum of:**	**$55,000.00**
COMPLETE WORK: Total of Work Items 1 and 2 for the lump sum of:		**$_____**

DETERMINATION OF BID: Determination of amount of bid will be on the basis of total sum of Work Items as verified by the State.

IMPORTANT - READ BEFORE SIGNING: Bid Form must be executed in same name-style in which the bidder is licensed. Bidder bidding jointly or as a combination of several business organizations is specially cautioned that such bidder must be jointly licensed in the same form and style in which the bid is executed. If making a bid as a joint venture, each person submitting the bid shall provide the information required below with respect to his or her licensure. The undersigned Bidder certifies and agrees to provide the information and comply with the requirements contained in Articles 1 through 10 on the following pages of the Bid Form. By signing, Bidder swears under penalty of perjury that the conditions of Article 2; Article 4, Paragraph 4.2; Article 7 and Article 9, Paragraph 9.2.1 are true.

Legal Name of Bidder:_____ Federal I.D. No.: _____

Contractor's License No.: _____ License Expiration Date: _____License Classification:_____

Contractor's Public Works Registration No. (Dept. of Industrial Relations): _____

Contractor's DGS Small Business/DVBE Certification Number: _____

Business Address: _____
(Street and/or P.O. Box) (City) (State) (Zip)

E-Mail Address:_____

Business Telephone No.:_____ Facsimile No.:_____

SIGN HERE ------>_____
Signature of Bidder

_____
Print Name and Title of Bidder

Executed this _____day of_____, 20_____at_____, California.

ARTICLE 1 – BIDDER'S BUSINESS IDENTIFICATION

THIS BID IS SUBMITTED BY (check one):

☐ Individual ☐ Partnership
☐ Joint Venture ☐ Corporation

_____
State in which Incorporated

NOTE: If Bidder is a corporation, the State in which incorporated shall be inserted above and the legal name of the corporation shall be set forth on Page 1, together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation; if Bidder is a partnership, the true name of the firm shall be set forth on Page 1, together with the signature of a partner authorized to sign contract in behalf of the partnership; and if Bidder is an individual, that person's signature shall be placed on Page 1. If signature is by an agent, other than an officer of a corporation or a member of a partnership, a Power of Attorney must be on file with the Department prior to opening bids or submitted with the bid; otherwise, the bid will be regarded as irregular and unauthorized. If bid is submitted by partnership or joint venture, the members are:

_____

_____

ARTICLE 2 – PREFERENCES AND INCENTIVES

2.1 **Small Business Preference** - By checking "yes" below, Bidder requests preference as a "Small Business" and further certifies under penalty of perjury, that the firm still meets the requirements of Section 1896 et. seq. Title 2, of the California Code of Regulations, and has either: 1) been approved by the Office of Small Business and Disabled Veteran Business Enterprise (DVBE) Services (OSDS) or; 2) submitted a complete application pursuant to Section 1896.14 to the OSDS by 5:00 p.m. on the bid opening date.

The Legal Name of Bidder and the Bidder's OSDS Certification must be executed in the same name-style in which bidder is licensed. A Bidder bidding jointly or as a combination of several business organizations is specially cautioned that such bidder must be jointly licensed in same form and style in which the bid is executed.

Special attention is directed to Section 1896.16 for penalties for furnishing incorrect supporting information in obtaining preference.

2.1.1 Small Business Preference Claimed? ☐ **Yes** _____ ☐ **No**
(List date filed if not yet certified)

2.2 **Non-Small Business Subcontractor Preference** - By checking "yes" below Bidder requests preference as a Non-Small Business and agrees to complete and submit Document 00 43 16-2 attached hereto, no later than forty-eight (48) hours after the time of receipt of bids (or the following business day if a weekend or state holiday). Special attention is directed to Section 1896.16 for penalties for furnishing incorrect supporting information in obtaining preference.

2.2.1 Non-Small Business Subcontractor Preference Claimed? ☐ **Yes** ☐ **No**

2.3 **Disabled Veteran Business Enterprise Bid Incentive** - By checking "yes" below, Bidder certifies and claims credit for achieving 1% or greater of DVBE Participation on this bid as is shown in Article 9 of this bid form and also requests that the corresponding DVBE Incentive be applied to this bid.

2.3.1 DVBE Incentive Claimed? ☐ **Yes** ☐ **No**

ARTICLE 3 – BONDING ASSISTANCE

In the event Bidder has received assistance in obtaining bonding for this Project, Bidder shall set forth name and nature of firm providing such assistance. Should that firm be listed as subcontractor, Bidder shall set forth the percentage of contract to be performed by that subcontractor.

_____

Firm Providing Assistance and Nature of Assistance

Subcontractor: ☐ Yes ☐ No Percentage _____

ARTICLE 4 – CERTIFICATIONS - BID DEPOSITORY AND FEDERAL COURT FINDINGS

4.1 By signing this Bid Form, Bidder certifies that in preparation of this Bid Form, no bid was received by the bidder from a bid depository, which depository (as to any portion of the work) prohibits or imposes sanctions for the obtaining by bidder, or the submission to bidder by any subcontractor or vendor or supplier of goods and services, of a bid outside the bid depository. This certification shall constitute a warranty, the falsity of which shall entitle the State to pursue any remedy authorized by law, and shall include the right, at the option of the State, of declaring any contract made as a result thereof to be void.

4.2 By signing this Bid Form, Bidder swears under penalty of perjury that representations of the bid with respect to bidder's license are true and that no more than one final un-appealable finding of contempt of court by a Federal Court has been issued against the Contractor within the immediately preceding two-year period because of the Contractor's failure to comply with an order of a Federal Court which orders the Contractor to comply with an order of the National Labor Relations Board.

4.3 By signing this Bid Form, Bidder acknowledges that in in accordance with the provisions of Section 3700 of the Labor Code, every contractor will be required to secure the payment of compensation to his employees. The Bidder agrees that they are aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and will comply with such provisions before commencing the performance of the work of this contract.

4.4 By signing this Bid Form, Bidder certifies they will not ask an applicant for onsite construction-related employment to disclose orally or in writing information concerning the conviction history of the applicant on or at the time of an initial employment application.

This section shall not apply to a position for which the person or the state is otherwise required by state or federal law to conduct a conviction history background check or to any contract position with a criminal justice agency, as that term is defined in Section 13101 of the Penal Code.

This section shall not apply to a person to the extent that he or she obtains workers from a hiring hall pursuant to a bona fide collective bargaining agreement.

ARTICLE 5 – STATEMENT OF COMPLIANCE - NONDISCRIMINATION

Bidder (hereinafter referred to as "prospective contractor" in this Statement), by signing this Bid Form, hereby certifies, unless specifically exempted, compliance with Government Code Section 12990 (a-f), and CCR, Title 2, Division 4, Chapter 5, Section 8103, in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program; as set forth in the General Conditions of the Contract for Construction. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicants for employment because of sex, race, color, ancestry, religious creed, national origin, physical disability (including HIV and AIDS), medical disability (cancer), age (over 40), marital status, and denial of family care leave.

ARTICLE 6 – QUESTIONNAIRE

6.1 In accordance with Public Contract Code, Section 10162, the Bidder shall complete the following questionnaire:

6.1.1 Has the Bidder, any officer of the Bidder, or any employee of the Bidder who has a proprietary interest in the Bidder, ever been disqualified, removed, or otherwise prevented from bidding on, or completing a Federal, State or Local government project because of a violation of law or a safety regulation?

☐ Yes ☐ No

6.1.2 Has the Bidder, any officer of the Bidder, or any employee of the Bidder who has a proprietary interest in the Bidder, ever received a safety violation or failed to file notifications to the Cal-OSHA, Federal OSHA, or EPA Agencies for employee records as required by CCR, Title 8, Section 5208 and CFR 40, Part 61?

☐ Yes ☐ No

If the answer to either 6.1.1 or 6.1.2 above is "Yes", then give the date(s) of the citation(s) or failure to make notifications, and explain the circumstances by attachment to this Bid Form.

ARTICLE 7 – NON-COLLUSION DECLARATIONTO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID

By signing this Bid Form, Bidder, being first duly sworn, deposes and says that he or she is the authorized representative of the Bidder, the party making the foregoing bid, that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and is not collusive or sham; that the Bidder has not directly or indirectly induced or solicited any other Bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any Bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the Bidder or any other Bidder, or to fix any overhead, profit, or cost element of the bid price, or that of any other Bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the Bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company

association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

ARTICLE 8 – ADDENDA

In submitting this bid, Bidder represents that Bidder has examined copies of all the Contract Documents and acknowledges receipt of the following addenda:

Addendum No.: _____ Date: _____ Addendum No.:_____ Date: _____

Addendum No.: _____ Date: _____ Addendum No.:_____ Date: _____

Addendum No.: _____ Date: _____ Addendum No.:_____ Date: _____

Failure to acknowledge on the Bid Form receipt of an addendum shall not in itself be cause for withdrawal or rejection of bids, if it can be shown that bidder did, in fact, receive such addendum prior to bid opening.

ARTICLE 9 – DVBE COMPLIANCE & PARTICIPATION SUMMARY

9.1 In accordance with Public Contract Code Section 10115, et seq., the Department of General Services has established criteria to implement the DVBE Program Goal as set forth in Document 00 22 10 of the Project Manual. Document 00 22 10, DVBE PARTICIPATION PROGRAM REQUIREMENTS cites the specific percentage of DVBE Participation required for this contract. **Failure to meet this requirement will result in a non-responsive bid.**

If DVBE Participation is a requirement for this bid, Bidder must complete Article 9.2.1 - DVBE PARTICIPATION SUMMARY. Failure to meet the full percentage of required DVBE participation will cause the bid to be deemed non-responsive and the bid will be rejected by the State. Listed DVBE vendor or subcontractor relationships should be first tier.

Any DVBE person, firm, corporation or organization committed by the bidder to fulfill DVBE Participation must: 1) be certified with the OSDS, and; 2) perform or provide a Commercially Useful Function as defined in Military and Veterans Code Section 999. Failure to comply with these requirements will deem the bid non-responsive and the bid will be rejected by the State.

If DVBE participation is set at zero percent, Bidder may still claim DVBE Incentive for voluntary DVBE Participation of 1% or greater. To have DVBE Incentive applied to this bid, Bidder must claim the Incentive in ARTICLE 2.3 - PREFERENCES & INCENTIVES and complete ARTICLE 9.2 - DVBE PARTICIPATION SUMMARY of the Bid Form.

If any DVBE subcontractor will be performing work in excess of 1/2 of 1% of the bid amount, the subcontractor **MUST** be listed under ARTICLE 9.2.1 - DVBE PARTICIPATION SUMMARY **AND** ARTICLE 10 - LIST OF SUBCONTRACTORS in accordance with Public Contract Code Section 4100, et.seq.

9.2 DVBE PARTICIPATION SUMMARY NAME OF BIDDER:_____

Completion Instructions: Capture all required and non-required first tier DVBE Participation in the space below. Identify the proposed work (services, trade or materials) to be completed by the DVBE. List the Company name, contact information, OSDS Certification Number, and the DIR Registration Number. If the Bidder is a DVBE, list only the Bidder's information as 100%; do not list additional subcontractors. Indicate the dollar amount of the work to be performed by each DVBE company and the corresponding percentage of this bid price rounded to two decimals. Add up each Dollar Amount and identify the total on the bottom row marked, TOTAL DVBE PARTICIPATION. Calculate and list the percentage of the bid price this amount represents.

Pursuant to Military and Veterans Code §999.7, the awarding department shall withhold, on a contract entered into on or after January 1, 2021, ten thousand dollars ($10,000) from the final payment, or the full final payment if less than ten thousand dollars ($10,000), until a prime contractor complies with the certification requirements of subdivision (d) of Section Military and Veterans Code §999.5. A prime contractor that fails to comply with the certification requirement shall, after notice, be allowed to cure the defect. Notwithstanding any other law, if, after at least 15 calendar days but not more than 30 calendar days from the date of notice, the prime contractor refuses to comply with the certification requirements, the awarding department shall permanently deduct ten thousand dollars ($10,000) from the final payment, or the full payment if less than ten thousand dollars ($10,000).

9.2.1 Listed hereinafter is the certified DVBE company(s) proposed to perform work if the contract is awarded to Bidder:

TYPE OF WORK PERFORMED (Service, Trade or Materials)	**NAME OF DVBE COMPANY, CONTACT PERSON AND PHONE NUMBER**	**OSDS CERTIFICATION NUMBER**	**DIR REGISTRATION NUMBER**	**DOLLAR AMOUNT OF WORK PERFORMED**	**PERCENTAGE OF BID PRICE**
			TOTAL DVBE PARTICIPATION:		

DETERMINATION OF TOTAL DVBE PARTICIPATION: Determination of total DVBE participation will be on the basis of total sum of all listed DVBE above and as verified by the State. When there is a discrepancy between the Dollar Amount and the Percentage of Bid, the higher of the two will prevail.

NAME OF BIDDER: _____

ARTICLE 10 – LIST OF PROPOSED SUBCONTRACTORS

Listed hereinafter are the **name**, **location, license number, and registration number** of all subcontractors who will be employed, and the **kind of work** which each will perform if the contract is awarded to the undersigned. I understand that under Public Contract Code Section 4100, et. seq., I must here clearly set forth the name and location of each subcontractor who will perform work or labor or render service to me in or about the construction of the work in an amount in excess of one-half of one percent (1/2 of 1%), of my total bid, and that as to any work in which I fail to do so, I agree to perform that portion myself or be subject to penalty under the act. (Note: In case more than one subcontractor is named for the same kind of work, state the portion that each will perform.) I also understand that listed subcontractors must be registered with the Department of Industrial Relations in order to be listed for and to engage in the performance of work on Public Works projects. Notwithstanding General Conditions Paragraph 1.1, the definition of a **SUBCONTRACTOR** for the purposes of the Subletting and Subcontracting law is as follows: A trade Contractor who is licensed with the Contractors' State License Board with an A, B, C or D classification, as defined pursuant to PCC Section 4113.

- Vendors or suppliers of materials only need not be listed.
- Any DVBE subcontractor performing work in excess of ½ of 1% of the bid amount **MUST** be listed below **AND** under ARTICLE 9.2.1 - DVBE PARTICIPATION SUMMARY.

Failure to list Kind of Work, Name, Location or License Number shall cause the bid to be rejected as non-responsive.

Kind of Work	Name	Location (City)	CSLB License No.	DIR Registration No.

If further space is required below, copy this page and attached hereto to be made a part of the Bid Form. Sub List Page _____of _____

Pursuant to Public Contract Code section 2010, a person that submits a bid or proposal to, or otherwise proposes to enter into or renew a contract with, a state agency with respect to any contract in the amount of $100,000 or above shall certify, under penalty of perjury, at the time the bid or proposal is submitted or the contract is renewed, all of the following:

1. CALIFORNIA CIVIL RIGHTS LAWS: For contracts executed or renewed after January 1, 2017, the contractor certifies compliance with the Unruh Civil Rights Act (Section 51 of the Civil Code) and the Fair Employment and Housing Act (Section 12960 of the Government Code); and

2. EMPLOYER DISCRIMINATORY POLICIES: For contracts executed or renewed after January 1, 2017, if a Contractor has an internal policy against a sovereign nation or peoples recognized by the United States government, the Contractor certifies that such policies are not used in violation of the Unruh Civil Rights Act (Section 51 of the Civil Code) or the Fair Employment and Housing Act (Section 12960 of the Government Code).

CERTIFICATION

I, the official named below, certify under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Proposer/Bidder Firm Name (Printed)	Federal ID Number
By (Authorized Signature)	

Printed Name and Title of Person Signing

Executed in the County of	Executed in the State of

Date Executed

NONCOLLUSION DECLARATION TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID

The undersigned declares:
I am the _____ of _____, the party making the foregoing bid.

The bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation. The bid is genuine and not collusive or sham. The bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid. The bidder has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or to refrain from bidding. The bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder. All statements contained in the bid are true. The bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof, to effectuate a collusive or sham bid, and has not paid, and will not pay, any person or entity for such purpose.

Any person executing this declaration on behalf of a bidder that is a corporation, partnership, joint venture, limited liability company, limited liability partnership, or any other entity, hereby represents that he or she has full power to execute, and does execute, this declaration on behalf of the bidder.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration is executed on _____ [date], at _____ [city], _____ [state]."

_____
Signed

END OF DOCUMENT

BIDDER'S BOND

STATE OF CALIFORNIA

DEPARTMENT OF GENERAL SERVICES

KNOW ALL MEN BY THESE PRESENTS:

That we,

_____

_____, as Principal,

and _____

_____

as Surety, are held and firmly bound unto the State of California, hereinafter called the State, in the penal sum of ten percent (10%) of the total amount of the bid of the Principal above named, submitted by said Principal to the State of California, Department of General Services, for the work described below, for the payment of which sum in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION of this obligation is such that:

WHEREAS, the Principal has submitted the above-mentioned bid to the State of California, Department of General Services, for certain construction specifically described as follows, for which bids are to be opened at _____

_____ *(Insert place where bids will be opened)* on _____ *(Insert date of bid opening)*

for _____

(Copy here the exact description of work, including location, as it appears on the proposal)

NOW, THEREFORE, If the aforesaid Principal is awarded the contract and, within the time and manner required under the specifications, after the prescribed forms are presented to him for signature, enters into a written contract, in the prescribed form, in accordance with the bid, and files the two bonds with the Department, one to guarantee faithful performance and the other to guarantee payment for labor and materials, as required by law, then this obligation shall be null and void; otherwise, it shall be and remain in full force and virtue.

In the event suit is brought upon this bond by the Obligee and judgment is recovered, the Surety shall pay all costs incurred by the Obligee in such suit, including a reasonable attorney's fee to be fixed by the court.

IN WITNESS WHEREOF, We have hereunto set our hands and seals on this _____ day of _____, 20____.

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

Name of Principal and Address for Service

By_____

Contractor Signature

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

Name of Surety and Address for Service

By_____

Attorney-in-Fact Signature

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

NOTE: Signatures of those executing for the Surety must be properly acknowledged.

CERTIFICATE OF ACKNOWLEDGMENT

STATE OF CALIFORNIA

COUNTY OF _____ ss

On this _____ day of _____ in the year of 20___ before me, a notary public in and for the county and state aforesaid, personally appeared, _____ and proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and proved to me on the basis of satisfactory evidence to be the attorney-in-fact of _____ and acknowledged to me that he/she subscribed the name of the said company thereto as surety, and his/her own name as attorney-in-fact.

(SEAL)

_____

Notary Public

DOCUMENT 00 43 16-1

LIST OF CERTIFIED SMALL BUSINESS SUBCONTRACTOR(S)

COMPLETION INSTRUCTIONS

PLEASE READ THESE INSTRUCTION CAREFULLY

IN ORDER TO GRANT A FIVE PERCENT (5%) NON-SMALL BUSINESS SUBCONTRACTOR PREFERENCE TO A NON-SMALL BUSINESS, THE BIDDER MUST COMPLETE THE CERTIFIED SMALL BUSINESS SUBCONTRACTOR SUMMARY (CSBSS) FORM 00 43 16-2. THIS FORM **MUST** BE COMPLETED BY THE NON-SMALL BUSINESS BIDDER AND RETURNED TO THE AWARDING AGENCY NO LATER THAN FORTY-EIGHT (48) HOURS AFTER THE TIME OF RECEIPT OF BIDS. IF THE BIDDER FAILS TO RETURN THE COMPLETED FORM 00 43 16-2 WITHIN 48 HOURS, THE CLAIM FOR SMALL BUSINESS PREFERENCE WILL BE DENIED.

CSBS COMPANY NAME – list the name(s) of the certified small business subcontractor(s) to be used to complete this project.

CSBS COMPANY ADDRESS – list the address(es) of the certified small business subcontractor(s) to be used to complete this project.

CSBS COMPANY TELEPHONE NUMBER – list the telephone number(s) of the certified small business subcontractor(s) to be used to complete this project.

CSBS PERCENTAGE (%) OR DOLLAR ($) AMOUNT – list the percentage(s) or dollar amount(s) that will be given to the certified small business subcontractor(s) used to complete this project.

DESCRIPTION OF WORK – identify the proposed work including services or materials to be performed by the certified small business subcontractor(s) to complete this project.

TO OBTAIN THE 5% NON-CERTIFIED SMALL BUSINESS PREFERENCE, THE LISTED SUBCONTRACTOR(S) AND/OR SUPPLIER(S) FIRM(S) MUST BE FORMALLY CERTIFIED BY THE OFFICE OF SMALL BUSINESS AND DVBE CERTIFICATION (OSDC) AS A SMALL AND/OR MICROBUSINESS. (Prime contractors should ask Subcontractor/Supplier to provide them with a copy of their OSDC certification letter)

BIDDER NAME _____ PROJECT NUMBER _____

STATE OF CALIFORNIA
CERTIFIED SMALL BUSINESS SUBCONTRACTOR(S) SUMMARY

Form date 09/28/2004

Listed hereinafter is the **name of business**, **address**, **telephone number**, **dollar amount or percentage** of all certified subcontractors who will be employed, and the **description of the work** which each will perform if the contract is awarded to this bidder.

Failure to list name of business, address, telephone number, description of work to be performed and dollar amount or percentage of work for each subcontractor may be cause for denial of the non-small business subcontractor preference.

(If further space is required for the List of Proposed Subcontractors, additional sheets showing the required information, as indicated below, shall be attached hereto and made a part of the Bid).

CERTIFIED SMALL BUSINESS SUBCONTRACTOR **(Name of Business)**	CERTIFIED SMALL BUSINESS SUBCONTRACTOR **(Address)**	CERTIFIED SMALL BUSINESS SUBCONTRACTOR **(Telephone Number)**	CERTIFIED SMALL BUSINESS SUBCONTRACTOR **($ or % Amount)**	CERTIFIED SMALL BUSINESS SUBCONTRACTOR **(Description of Work) (Service or Materials)**

STATE OF CALIFORNIA – DEPARTMENT OF FINANCE

PAYEE DATA RECORD

(Required when receiving payment from the State of California in lieu of IRS W-9 or W-7)

STD 204 (Rev. 03/2021)

Section 1 – Payee Information

NAME (This is required. Do not leave this line blank. Must match the payee's federal tax return)

BUSINESS NAME, DBA NAME or DISREGARDED SINGLE MEMBER LLC NAME (If different from above)

MAILING ADDRESS (number, street, apt. or suite no.) (See instructions on Page 2)

CITY, STATE, ZIP CODE	E-MAIL ADDRESS

Section 2 – Entity Type

Check one (1) box only that matches the entity type of the Payee listed in Section 1 above. (See instructions on page 2)

- ☐ **SOLE PROPRIETOR / INDIVIDUAL**
- ☒ **SINGLE MEMBER LLC** *Disregarded Entity owned by an Individual*
- ☐ **PARTNERSHIP**
- ☐ **ESTATE OR TRUST**

CORPORATION (see instructions on page 2)

- ☐ **MEDICAL** *(e.g., dentistry, chiropractic, etc.)*
- ☐ **LEGAL** *(e.g., attorney services)*
- ☒ **EXEMPT** *(e.g., nonprofit)*
- ☐ **ALL OTHERS**

Section 3 – Tax Identification Number

Enter your Tax Identification Number (TIN) in the appropriate box. The TIN must **match** the name given in Section 1 of this form. Do not provide more than one (1) TIN. The TIN is a 9-digit number. **Note:** Payment will not be processed without a TIN.

- For **Individuals**, enter SSN.
- If you are a **Resident Alien**, and you do not have and are not eligible to get an SSN, enter your ITIN.
- Grantor Trusts (such as a Revocable Living Trust while the grantors are alive) may not have a separate FEIN. Those trusts must enter the individual grantor's SSN.
- For **Sole Proprietor or Single Member LLC (disregarded entity), in which the sole member is an individual**, enter SSN (ITIN if applicable) or FEIN (FTB prefers SSN).
- For **Single Member LLC (disregarded entity), in which the sole member is a business entity**, enter the owner entity's FEIN. Do not use the disregarded entity's FEIN.
- For all other entities including LLC that is taxed as a corporation or partnership, estates/trusts (with FEINs), enter the entity's FEIN.

Social Security Number (SSN) or Individual Tax Identification Number (ITIN)

___ ___ ___ - ___ ___ - ___ ___ ___ ___

OR

Federal Employer Identification Number (FEIN)

___ ___ - ___ ___ ___ ___ ___ ___ ___

Section 4 – Payee Residency Status (See instructions)

- ☐ **CALIFORNIA RESIDENT** – Qualified to do business in California or maintains a permanent place of business in California.
- ☒ **CALIFORNIA NONRESIDENT** – Payments to nonresidents for services may be subject to state income tax withholding.
  - ☐ No services performed in California
  - ☐ Copy of Franchise Tax Board waiver of state withholding is attached.

Section 5 – Certification

I hereby certify under penalty of perjury that the information provided on this document is true and correct. Should my residency status change, I will promptly notify the state agency below.

NAME OF AUTHORIZED PAYEE REPRESENTATIVE	TITLE	E-MAIL ADDRESS

SIGNATURE	DATE	TELEPHONE *(Include area code)*

Section 6 – Paying State Agency

Please return completed form to:

STATE AGENCY/DEPARTMENT OFFICE	UNIT/SECTION
Department of General Services, Administrative Division	Office of Business and Acquisition Services, Contract Services Section

MAILING ADDRESS	FAX	TELEPHONE *(Include area code)*
707 Third Street, MS 508	n/a	n/a

CITY	STATE	ZIP CODE	E-MAIL ADDRESS
West Sacramento	CA	95605	n/a

STATE OF CALIFORNIA – DEPARTMENT OF FINANCE

PAYEE DATA RECORD

(Required when receiving payment from the State of California in lieu of IRS W-9 or W-7)

STD 204 (Rev. 03/2021)

GENERAL INSTRUCTIONS

Type or print the information on the Payee Data Record, STD 204 form. Sign, date, and return to the state agency/department office address shown in Section 6. Prompt return of this fully completed form will prevent delays when processing payments.

Information provided in this form will be used by California state agencies/departments to prepare Information Returns (Form 1099).
NOTE: Completion of this form is optional for Government entities, i.e. federal, state, local, and special districts.

A completed Payee Data Record, STD 204 form, is required for all payees (non-governmental entities or individuals) entering into a transaction that may lead to a payment from the state. Each state agency requires a completed, signed, and dated STD 204 on file; therefore, it is possible for you to receive this form from multiple state agencies with which you do business.

Payees who do not wish to complete the STD 204 may elect not to do business with the state. If the payee does not complete the STD 204 and the required payee data is not otherwise provided, payment may be reduced for federal and state backup withholding. Amounts reported on Information Returns (Form 1099) are in accordance with the Internal Revenue Code (IRC) and the California Revenue and Taxation Code (R&TC).

Section 1 – Payee Information

Name – Enter the name that appears on the payee's federal tax return. The name provided shall be the tax liable party and is subject to IRS TIN matching (when applicable).

- Sole Proprietor/Individual/Revocable Trusts – enter the name shown on your federal tax return.
- Single Member Limited Liability Companies (LLCs) that is disregarded as an entity separate from its owner for federal tax purposes - enter the name of the individual or business entity that is tax liable for the business in section 1. Enter the DBA, LLC name, trade, or fictitious name under Business Name.
- Note: for the State of California tax purposes, a Single Member LLC is not disregarded from its owner, even if they may be disregarded at the Federal level.
- Partnerships, Estates/Trusts, or Corporations – enter the entity name as shown on the entity's federal tax return. The name provided in Section 1 must match to the TIN provided in section 3. Enter any DBA, trade, or fictitious business names under Business Name.

Business Name – Enter the business name, DBA name, trade or fictitious name, or disregarded LLC name.

Mailing Address – The mailing address is the address where the payee will receive information returns. Use form STD 205, Payee Data Record Supplement to provide a remittance address if different from the mailing address for information returns, or make subsequent changes to the remittance address.

Section 2 – Entity Type

If the Payee in Section 1 is a(n)…	THEN Select the Box for…
Individual • Sole Proprietorship • Grantor (Revocable Living) Trust disregarded for federal tax purposes	Sole Proprietor/Individual
Limited Liability Company (LLC) owned by an individual and is disregarded for federal tax purposes	Single Member LLC-owned by an Individual
Partnerships • Limited Liability Partnerships (LLP) • and, LLC treated as a Partnership	Partnerships
Estate • Trust (other than disregarded Grantor Trust)	Estate or Trust
Corporation that is medical in nature (e.g., medical and healthcare services, physician care, nursery care, dentistry, etc. • LLC that is to be taxed like a Corporation and is medical in nature	Corporation-Medical
Corporation that is legal in nature (e.g., services of attorneys, arbitrators, notary publics involving legal or law related matters, etc.) • LLC that is to be taxed like a Corporation and is legal in nature	Corporation-Legal
Corporation that qualifies for an Exempt status, including 501(c) 3 and domestic non-profit corporations.	Corporation-Exempt
Corporation that does not meet the qualifications of any of the other corporation types listed above • LLC that is to be taxed as a Corporation and does not meet any of the other corporation types listed above	Corporation-All Other

Section 3 – Tax Identification Number

The State of California requires that all parties entering into business transactions that may lead to payment(s) from the state provide their Taxpayer Identification Number (TIN). The TIN is required by R&TC sections 18646 and 18661 to facilitate tax compliance enforcement activities and preparation of Form 1099 and other information returns as required by the IRC section 6109(a) and R&TC section 18662 and its regulations.

Section 4 – Payee Residency Status

Are you a California resident or nonresident?

- A corporation will be defined as a "resident" if it has a permanent place of business in California or is qualified through the Secretary of State to do business in California.
- A partnership is considered a resident partnership if it has a permanent place of business in California.
- An estate is a resident if the decedent was a California resident at time of death.
- A trust is a resident if at least one trustee is a California resident.
  - For individuals and sole proprietors, the term "resident" includes every individual who is in California for other than a temporary or transitory purpose and any individual domiciled in California who is absent for a temporary or transitory purpose. Generally, an individual who comes to California for a purpose that will extend over a long or indefinite period will be considered a resident. However, an individual who comes to perform a particular contract of short duration will be considered a nonresident.

For information on Nonresident Withholding, contact the Franchise Tax Board at the numbers listed below:

Withholding Services and Compliance Section: 1-888-792-4900
For hearing impaired with TDD, call: 1-800-822-6268
E-mail address: wscs.gen@ftb.ca.gov
Website: www.ftb.ca.gov

Section 5 – Certification

Provide the name, title, email address, signature, and telephone number of individual completing this form and date completed. In the event that a SSN or ITIN is provided, the individual identified as the tax liable party must certify the form. Note: the signee may differ from the tax liable party in this situation if the signee can provide a power of attorney documented for the individual.

Section 6 – Paying State Agency

This section must be completed by the state agency/department requesting the STD 204.

Privacy Statement

Section 7(b) of the Privacy Act of 1974 (Public Law 93-579) requires that any federal, state, or local governmental agency, which requests an individual to disclose their social security account number, shall inform that individual whether that disclosure is mandatory or voluntary, by which statutory or other authority such number is solicited, and what uses will be made of it. It is mandatory to furnish the information requested. Federal law requires that payment for which the requested information is not provided is subject to federal backup withholding and state law imposes noncompliance penalties of up to $20,000. You have the right to access records containing your personal information, such as your SSN. To exercise that right, please contact the business services unit or the accounts payable unit of the state agency(ies) with which you transact that business.

All questions should be referred to the requesting state agency listed on the bottom front of this form.

STATE OF CALIFORNIA – DEPARTMENT OF GENERAL SERVICES

STANDARD AGREEMENT

STD 213 (Rev. 03/2019)

AGREEMENT NUMBER	PURCHASING AUTHORITY NUMBER (if applicable)

1. This Agreement is entered into between the Contracting Agency and the Contractor named below:

CONTRACTING AGENCY NAME

Department of General Services, Real Estate Services Division, Project Management and Development Branch

CONTRACTOR NAME

2.The Term of this Agreement is:

START DATE

As Identified in the Notice to Proceed

THROUGH END DATE

XXX Calendar Days, commencing on the Start Date Identified in the Notice to Proceed

3.The maximum amount of this Agreement is: $X,XXX,XXX.XX

4. The parties agree to comply with the terms and conditions of the following exhibits, which are by this reference made a part of the Agreement.

EXHIBITS	TITLE	PAGES
Project Title	Project Title Client Address City, County, CA Project Number	
Exhibit A	Performance Bond, Payment Bond, Bid Form, and Invitation to Bid	
Exhibit B	Project Manual (except Bidding Requirements), dated XXX including the following Contract Documents: Introductory Information General Conditions of the Contract for Construction Supplementary Conditions Specifications Addenda No.	
Exhibit C	XXX Drawings, dated XXX, as listed in Document 00 01 15 of the Project Manual	

Items shown with an asterisk (*), are here by incorporated by reference and made part of this agreement as if attached hereto. These documents can be viewed at https://www.dgs.ca.gov/ols/resources

IN WITNESS WHEREOF, THIS AGREEMENT HAS BEEN EXECUTED BY THE PARTIES HERETO.

CONTRACTOR

CONTRACTOR NAME (if other than an individual, state whether a corporation, partnership, etc.)

CONTRACTOR BUSINESS ADDRESS	CITY	STATE	ZIP

PRINTED NAME OF PERSON SIGNING	TITLE

CONTRACTOR AUTHORIZED SIGNATURE	DATE SIGNED

STATE OF CALIFORNIA

CONTRACTING AGENCY NAME

CONTRACTING AGENCY ADDRESS	CITY	STATE	ZIP

PRINTED NAME OF PERSON SIGNING	TITLE

CONTRACTOR AUTHORIZED SIGNATURE	DATE SIGNED

CALIFORNIA DEPARTMENT OF GENERAL SERVICES APPROVAL	EXEMPTION, IF APPLICABLE

PERFORMANCE BOND TO ACCOMPANY CONSTRUCTION CONTRACT

KNOW ALL MEN BY THESE PRESENTS:

THAT WHEREAS, The State of California, acting by and through the Department of General Services has awarded to _____, a _____ existing under and by virtue of the laws of the State of California as Contractor, a contract for the work described as follows:

Project Name
Client Agency
Project Information
Reference Number, Project Number, Contract Number

AND WHEREAS, Said Contractor is required to furnish a bond in connection with said contract, guaranteeing the faithful performance thereof;

NOW, THEREFORE, We the undersigned Contractor and surety are held and firmly bound unto the State of California in the sum of _____ Dollars, ($000,000) to be paid to the State or its certain attorney, its successors and assigns; for which payment well and truly to be made we bind ourselves, our heirs, executors and administrators, successors and assigns, jointly and severally firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH,

That if the above bounded Contractor, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the foregoing contract and any alteration thereof made as therein provided, on his or their part to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless the State of California, its officers and agents, as therein stipulated, then this obligation shall become and be null and void; otherwise it shall be and remain in full force and virtue.

IN WITNESS WHEREOF, We have hereunto set our hands and seals on this _____ day of _____, 20_____

_____

_____
Name of Contractor and Address for Service

By_____
Contractor Signature

_____

_____

_____ (SEAL)
Name of Surety and Address for Service

By _____
Attorney-in-Fact Signature

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

CERTIFICATE OF ACKNOWLEDGMENT

STATE OF CALIFORNIA
COUNTY OF _____ ss

On this _____ day of _____ in the year of 20____ before me, a notary public in and for the county and state aforesaid, personally appeared, _____ proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and proved to me on the basis of satisfactory evidence to be the attorney-in-fact of _____ and acknowledged to me that he/she subscribed the name of the said company thereto as surety, and his/her own name as attorney-in-fact.

(SEAL)

_____
NOTARY PUBLIC

PAYMENT BOND TO ACCOMPANY CONSTRUCTION CONTRACT

(Public Contract Code Sections 7103 and 10221)

BOND NO._____

The premium on this bond is _____ for the term of Agreement Number 20-XXXX

Know All Men By These Presents:

That the State of California, acting by and through the Department of General Services, has awarded to _____ whose address for service is _____, as Principal, a contract for the work described as follows:

Project Title: _____

Project Location: _____

WHEREAS, the provisions of Public Contract Code Sections 7103 and 10221 require that the Principal file a bond in connection with said contract and this bond is executed and tendered in accordance therewith.

NOW THEREFORE, Principal and _____, a Surety Corporation organized under the laws of _____, and authorized to transact a general surety business is in the State of California, as Surety, are held and firmly bound to the People of the State of California in the penal sum of _____, for which payment we bind ourselves, our heirs, executors, administrators, successors and assigns jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH,

1. That if said Principal or its subcontractors shall fail to pay any of the persons named in Civil Code Section 9100, or amounts due under the Unemployment Insurance Code with respect to work or labor performed under the contract, or for any amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of the Principal and subcontractors pursuant to Section 13020 of the Unemployment Insurance Code, with respect to such work and labor, that the surety herein will pay for the same, otherwise this obligation is to be void. In case suit is brought upon this bond, the Surety will pay a reasonable attorney's fee to be fixed by the court.
2. This bond shall inure to the benefit of any persons named in Civil Code Section 9100 as to give a right of action to such persons or their assigned in any suit brought upon this bond.
3. The aggregate liability of the Surety hereunder, including costs and attorney fees, on all claims whatsoever shall not exceed the penal sum of the bond in accordance with the provisions of Section 996.470(a) of the Code of Civil Procedure.
4. This bond is executed by the Surety, to comply with the provisions of Public Contract Code Sections 7103, 10221 and 10222, of Chapter 5, Title 3, Part 6, Division 4 of the Civil Code and of Chapter 2, Title 14, Part 2 of the Code of Civil Procedure and said bond shall be subject to all of the terms and provisions thereof.
5. This bond may be cancelled by the Surety in accordance with the provisions of Section 996.310 et seq. of the Code of Civil Procedure.
6. This bond to become effective _____

_____ _____

(NAME OF SURETY) (ADDRESS FOR SERVICE)

I certify (or declare) under penalty of perjury under the laws of the State of California that I have executed the foregoing bond under an unrevoked power of attorney.

Executed in _____ on _____

(CITY AND STATE) (DATE)

X _____

(SIGNATURE OF ATTORNEY IN FACT)

_____

(PRINTED OR TYPED NAME OR ATTORNEY IN FACT)

STATE OF

CALIFORNIA Std. 807

(Rev. 10/2019)

Department of General Services

Change Order

Date Issued: (Type Date)

Change Order No:

ABMS Contract No:
F$ Contract No.:
Project ID: **140724**
Activity ID: **CN**
Resource Type: **CONTR**
Category: **10000**

From Division: **Real Estate Services Division**
Branch: **Project Management and Development Branch**
Address: **707 Third Street, 4th Floor**
City, State Zip: **West Sacramento, CA 95605**

Revision No.:
Date Revised:

To: (Contractor's Name:)
(Contractor's Address:)
(Contractor's City/State/Zip:)

Project:
Client Agency:
Facility Name:
Facility Location:

This Change Order is issued pursuant to the provisions of the General Conditions Article 6 of the Contract relating to **Changes in the Work** and shall not be effective until approved by the Department of General Services, REAL ESTATE SERVICES DIVISION. The State will issue the change order after the conditions have been agreed to. The contractor is directed to proceed with construction activities in such manner as to preclude the necessity for later altering the work in order to accomplish this change. This document must be completed in every detail, signed, dated and returned in **DUPLICATE** to the State's representative within **fifteen (15)** calendar days from the date of issue, as provided in the General Conditions of the Contract. Upon approval, a signed copy will be sent to the contractor as authority for proceeding with the changes (or as confirmation of previously issued instructions).

Change Order Description

Item #	Description	Amount

Total this Change Order $100,000.00

The Undersigned Contractor agrees to make this change in accordance with the printed conditions herein for
The Additive sum of $ or deductive sum ($).

This change is approved for the sum stated above and for a time extension of _____ calendar days.

This Agreement constitutes full and final settlement for all aspects of the work described herein. As part of this agreement, Contractor waives any and all rights to claim for any delay or impact costs associated with the work described herein, including, but not limited to, inefficiency, unabsorbed and extended home office overhead and extended field office overhead.

Authorized Contractor's Signature	Title	Date

Authorized State's Representative Signature	Title	Date

Distribution of Change Order:
Originals to: 1) Contractor 2) RESD Contract Unit
Copies to: 1) Project Manager 2) State Controllers Office 3) DGS Capital Outlay Account 4) State Inspector

STATE OF CALIFORNIA DEPARTMENT OF GENERAL SERVICES REAL ESTATE SERVICES DIVISION

Document 00 72 00

General Conditions of the Contract for Construction

October 2011 Edition

Table of Articles

DOCUMENT 00 72 00 - GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

ARTICLE 1 - GENERAL PROVISIONS

1.1 **DEFINITIONS:** When the following terms appear in the Contract, they shall have the following meaning:

1.1.1 Acceptance of the Work: Written acceptance of the Work by the Director of the Department of General Services, State of California, or the Director's designee.

1.1.2 Act of God: An Act of God shall include only the following occurrences or conditions and effects:

.1 Earthquakes in excess of a magnitude of 3.5 on the Richter Scale; or
.2 Tidal waves.

1.1.3 Addendum (Addenda): A document issued by the State during the bidding period which modifies, supersedes or supplements the Contract Documents.

1.1.4 Alternative: Refer to Approved Equal and Substitution.

1.1.5 Applicable Codes: Include, but are not limited to, applicable laws, statutes, regulations, rules, building and other codes, ordinances, rulings, and lawful orders of all public authorities having jurisdiction over the State, the Contractor, Subcontractors, the Project, the Work, or the execution of the Work.

1.1.6 Approved Equal: Material, equipment, or method approved by the State for use in the Work, as being acceptable as an equivalent in essential attributes to the material, equipment, or method specified in the Contract Documents.

1.1.7 Agreement: The written and executed document known as Document 00 52 00, Agreement.

1.1.8 Architect or Engineer: The State, or the State's consultant listed in the Contract Documents as the designer of record responsible for the preparation and coordination of the Drawings and technical sections of the Project Manual.

1.1.9 Beneficial Occupancy: Occupancy and use by the State of all, or part, or parts, of the Work as selected by the State, prior to Completion.

1.1.10 Bidder: Any individual, partnership, corporation, association, joint venture, or any combination thereof, submitting a Bid Form for the Work.

1.1.11 Change Order: A written order issued by the State used to determine adjustments in the Contract based on:

.1 a change in the Work,
.2 the amount of the adjustment in the Contract Sum, and
.3 the extent of the adjustment in the Contract Time.

1.1.12 Claim: An unresolved Dispute arising under or relating to the performance of the Contract which can only be filed after Acceptance of the Work and the final statement to the Contractor.

1.1.13 Completion: When the entire Work has been performed in accordance with the Contract requirements as delineated in the Contract Documents and Project Manual. Completion of the Work occurs when the State's final inspection has been made and all construction, services and deliverables have been fully executed as determined by the State's Representative, including but not limited to completion of all punch-list items and delivery of as-built drawings, operation & maintenance manuals, guaranties, warranties, spare parts, reports and certifications as noted in the Project Manual, Section 01 77 00.

1.1.14 Contract: The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified by a Change Order. The Contract Documents shall not be construed to create a contractual relationship of any kind between any persons or entities other than the State and the Contractor.

1.1.15 Contract Documents: The Contract Documents consist of the Agreement between the State and Contractor, Payment and Performance Bonds; the Conditions of the Contract, including General, Supplementary and other Conditions; Drawings, Specifications, Addenda and Change Orders.

1.1.16 Contract Sum: The Contract Sum is stated in the Agreement and, including authorized adjustments by Change Order, is the total amount payable by the State to the Contractor for performance of the Work under the Contract Documents.

1.1.17 Contract Time: The Contract Time is the period of time, from the Start Date to the date of Completion of the Work, including authorized adjustments, allotted in the Contract.

1.1.18 Contractor: The individual, partnership, corporation, association, joint venture, or any combination thereof, who has entered into a contract with the State, identified as such in the Agreement, and referred to throughout the Contract as if singular in number. The term "Contractor" means the Contractor or the Contractor's representative.

1.1.19 Day: Calendar day, unless otherwise specifically defined.

1.1.20 Department: The Department of General Services, State of California.

1.1.21 Director: The Director of the Department of General Services, State of California, or the Director's designee.

1.1.22 Dispute: A demand during performance of the Work seeking adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. A Dispute is not a Claim.

1.1.23 Drawings: The graphic and pictorial portions of the Contract Documents, illustrating the design, location and dimensions of the Work, generally including but not limited to, plans, elevations, sections, details, schedules and diagrams.

1.1.24 Emergency: A sudden, unexpected occurrence that poses a clear and imminent danger, requiring immediate action to prevent or mitigate the loss or impairment of life, health, property, or essential public services.

1.1.25 General Notes: The written instructions, provisions, conditions or other requirements appearing on the Drawings, and so identified thereon, which pertain to the performance of the Work.

1.1.26 Guarantee: The Contractor's assurance that the Project complies with the requirements of the Contract Documents.

1.1.27 Official Progress Schedule: The Contractor's baseline schedule and updates accepted by the State.

1.1.28 Or Equal: Refer to Approved Equal.

1.1.29 Owner: The State of California.

1.1.30 Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

1.1.31 Project: The total construction of which the Work performed under the Contract may be the whole or a part.

1.1.32 Project Manual: The volume(s) assembled for the Work which includes the Introductory Information, Bidding Requirements, Contracting Requirements, Specifications, and other information as may be listed in the Project Manual Table of Contents.

1.1.33 Request for Information (RFI): A written request by the Contractor submitted in a State provided format for information regarding Project specific issues.

1.1.34 Retention: A percentage of the Contract Sum held back upon completion of the Work, or any portion of the Work, to cover outstanding liabilities, contingencies, and the like, as specified in the Contract Documents.

1.1.35 Samples: Physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

1.1.36 Schedule of Values: A document furnished by the Contractor to the State reflecting the portions of the Contract sum allotted for the various parts of the Work, and used as the basis for reviewing the Contractor's applications for payment request.

1.1.37 Shop Drawings: Drawings, diagrams, schedules, and other data specially issued for the Work by the Contractor or a Subcontractor, Sub-subcontractor, and material suppliers to illustrate some portion of the Work.

1.1.38 Specifications: That portion of the Contract Documents consisting of the written requirements for materials, standards, equipment, construction systems, and standards of workmanship for the Work, and performance of related services.

1.1.39 State: The State of California acting through the Department of General Services.

1.1.40 State Construction Supervisor/Inspector: The person(s) authorized by the State to provide inspection services, field coordination and quality control during construction.

1.1.41 State Contract Act: The act which is set forth in the California Public Contract Code, Section 10100, et seq.

1.1.42 State's Representative: Person(s) authorized by the State to act on behalf of the State for the Project.

1.1.43 Subcontractor: An individual, partnership, corporation, association, joint venture, or any combination thereof, who has a direct contract with the Contractor to perform work or labor or render service in or about the Work. The term "Subcontractor" is referred to as if singular in number and means a Subcontractor or a representative of the Subcontractor. The term "Subcontractor" shall not include those who supply materials only or a separate contractor or subcontractors of a separate contractor.

1.1.44 Sub-subcontractor: A person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the work. The term "Sub-subcontractor" is referred to as if singular in number and means a Sub-subcontractor or a representative of the Sub-subcontractor.

1.1.45 Not Used

1.1.46 Substitution: A material and/or process offered by the Contractor in lieu of the specified material and/or process, and accepted by the State in writing as being equivalent (equal) to the specified material and/or process.

1.1.47 Warranty: A Contractor's, manufacturer's or material supplier's assurance that products and services provided meet the requirements of the Contract Documents.

1.1.48 Work: Construction, services and deliverables required by the Contract Documents and Project Manual, including labor, materials, equipment, services, and documents provided or to be provided by the Contractor to fulfill the Contractor’s obligations under the Contract, including but not limited to requirements such as; completion of punch-list items, as-built drawings, operation & maintenance manuals, guaranties, warranties, spare parts, reports, and certifications.

1.2 EXECUTION, CORRELATION AND INTENT

1.2.1 The Contract will not be binding on the State until appropriately endorsed by the State's legal Representative, in accordance with Public Contract Code, Section 10220.

1.2.2 Execution of the Contract by the Contractor is a representation that the Contractor is familiar with the methodology under which the work is to be performed and has correlated personal observations with requirements of the Contract Documents.

1.2.3 The intent of the Contract Documents is to include items necessary for completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

1.2.4 Organization of the Specifications into Groups, Divisions, subgroups, Sections and Articles, and arrangement of Drawings shall not be the basis that Contractor utilizes in dividing the Work among Subcontractors, nor in establishing the extent of work to be performed by any trade.

1.2.5 When standards of the Federal Government, trade societies, or trade associations are referred to in the Contract Documents by specific date of issue, these shall be considered as part of the Contract Documents. When such references do not bear date of issue, current published edition at the date of the first Invitation to Bid shall be considered as part of the Contract Documents.

1.2.6 Unless otherwise stated in the Contract Documents, words and terms which have well-known or commonly accepted technical or construction industry meanings shall be used in the Contract Documents in accordance with such recognized meanings.

1.2.7 Every part of the Work shall be accomplished in workmanship-like manner by workers, laborers, or mechanics specially skilled in the class of work required. Any person the State may deem incompetent or disorderly shall be promptly removed from the Project by the Contractor upon written notice from the State, and shall not be re-employed on this Project.

1.3 **USE OF THE STATE'S DRAWINGS, PROJECT MANUAL AND OTHER DOCUMENTS:** The Drawings, Project Manual and other documents issued by the State, and copies furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects, nor for additions to this Project outside the scope of the Work without the specific written consent of the State. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Project Manual and other documents issued by the State appropriate to, and for use in, the execution of their work under the requirements of the Contract Documents.

1.4 **CAPITALIZATION**

1.4.1 Terms capitalized in the General Conditions of the Contract for Construction include those which are:

.1 Specifically defined; or
.2 Titles of numbered Articles; or
.3 References to Paragraphs, Subparagraphs and Clauses; or
.4 Titles of other documents.

1.5 **CONFLICTS IN THE CONTRACT DOCUMENTS**

1.5.1 In the event of conflict in the Contract Documents, the following priorities shall govern:

.1 Addenda shall govern over other Sections of the Contract Documents to the extent specifically noted; subsequent Addenda shall govern over prior Addenda only to the extent specified.
.2 The General Conditions of the Contract for Construction shall govern over Drawings and Specifications except for specific modifications stated in the Supplementary Conditions, and except for Addenda.
.3 In case of conflict between the Drawings and the Specifications, the Specifications shall govern unless the requirement(s) in the Drawings is/are more stringent and/or of higher quality and/or of higher quantity.
.4 In the case of conflict within the Drawings, the following shall govern:
    1) Schedules, when identified as such, shall govern over all other portions of the Drawings.
    2) Specific notes shall govern over other notes and all other portions of the Drawings, except schedules described in the preceding Clause.
    3) Larger scale Drawings shall govern over smaller scale Drawings.
    4) Detail Drawings shall govern over standard plates bound within the Project Manual.
    5) Figured or numerical dimensions shall govern over dimensions obtained by scaling.

1.5.2 Omissions: If the Contract Documents are not complete as to any minor detail or required construction system or with regard to the manner of combining or installing of parts, materials, or equipment, but there exists accepted trade standard for good and workmanlike construction, such detail shall be deemed to have been implied by the requirements of the Contract Documents in accordance with such standard.

.1 "Minor Detail" shall include the concept of substantially identical components, where price of each such component is small even though aggregate cost or importance is substantial, and shall include a single component which is incidental, even though its cost or importance may be substantial. Quality and quantity of parts or material so supplied shall conform to trade standards and be compatible with type, composition, strength, size and profile of parts or materials otherwise set forth in the Contract Documents.

1.6 REQUESTS FOR INFORMATION, CLARIFICATION OR ADDITIONAL INSTRUCTIONS

1.6.1 Requests for Information (RFI): Should the Contractor discover conflicts, omissions, or errors in the Contract Documents, or have any questions concerning interpretation or clarification of Contract Documents, the Contractor shall immediately submit to the State in writing an RFI that complies with the following requirements:

.1 All RFIs, whether by the Contractor, a Subcontractor or supplier at any tier, shall be submitted by the Contractor to the State.
.2 RFIs shall be numbered sequentially and be presented in the format provided by the State.
.3 The Contractor shall clearly and concisely set forth the single issue for which interpretation or clarification is sought, indicate Specification Section number, article and subarticle numbers, and Contract Drawing number, and detail, or other item involved, and state why a response is required from the State.
.4 The Contractor shall set forth its own interpretation or understanding of the requirements, along with reasons why it has reached such an understanding in each RFI.
.5 RFIs shall be submitted in a timely manner in order that they may be adequately researched and answered before the response affects any critical activity of the Work.
.6 The State will review all RFIs to determine whether they are truly RFIs within the meaning of the term as defined in Paragraphs 1.1.33 and 1.6.1. RFI's which are determined to be not within the meaning of the term and/or RFIs where answers can readily be found in the Drawings and Project Manuals shall be deemed to be superfluous and the cost for reviewing these RFIs will be back-charged to the Contractor.
.7 Responses to RFIs will be made within 14 days unless the State notifies the Contractor in writing that a response will take longer. The 14 days will begin when the RFI is received and dated by the State. Should the State respond sooner, the Contractor shall not assume that a new timeline has been established. Delays in the progress of the Work due to late submittal of RFIs by the Contractor are solely the responsibility of the Contractor.
.8 Responses from the State will not change any requirement of the Contract unless so noted by the State in the response to the RFI.
.9 Should the Contractor believe that a response to an RFI causes a change to the requirements of the Contract, the Contractor shall, before proceeding, give written notice to the State, indicating that the Contractor considers the State's response to the RFI to be a Change Order. An RFI will not be considered to be automatically a notice for a Change Order. The Contractor shall give separate written notice within 7 days of receipt of the State's response to the RFI. If the Contractor fails to give notice within 7 days or prior to commencement of the change, the Contractor shall forfeit the right to seek additional time or cost under Article 6.

1.6.2 Additional Detailed Instructions: The State may furnish additional detailed written and/or graphic instructions to further explain the work, and such instructions shall be a part of the Contract requirements. Should additional detailed instructions, in the opinion of the Contractor, constitute work in excess of the scope of the Work, the Contractor shall submit written notice to the State within 14 days following receipt of such instructions, and in any event prior to commencement of the work thereon. The State will then consider the notice; and, if in the State's judgment it is justified, the State's instructions will be revised or the extra work authorized in accordance with the provisions of Article 6.

ARTICLE 2 - ADMINISTRATION OF THE CONTRACT

2.1 INFORMATION AND/OR SERVICES REQUIRED OF THE STATE

2.1.1 Information and/or services under the State's control shall be furnished by the State within a mutually agreed upon response time so as to avoid delay in the orderly progress of the Work.

2.1.2 The Contractor will be furnished Drawings and Project Manuals as specified in the Contract Documents.

2.2 ADMINISTRATION OF THE CONTRACT

2.2.1 The State will provide administration of the Contract as described in the Contract Documents during construction, until final payment is due and during the correction period described in Paragraph 12.2 and throughout the guarantee period.

2.2.2 The State will visit the Project site appropriate to the stage of construction to become familiar with the progress and quality of the completed work and to determine if the Work is in accordance with the Contract Documents.

2.2.3 Unless so specified in the Contract Documents, the State will not have control over construction means, methods, techniques, sequences or procedures, or safety precautions and programs in connection with the Work. The State will not be responsible for the Contractor's failure to carry out the Work in accordance with the requirements of the Contract Documents. The State will not be responsible for acts, errors, or omissions of the Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or of any other persons performing portions of the Work.

2.2.4 Communications Facilitating Contract Administration: Communications by and with the State's consultants shall be through the State. Communications by and with Subcontractors**,** Sub-subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the State.

2.2.5 If the State observes work that appears to not comply with the requirements of the Contract Documents, the State will have the authority to reject the Work. Whenever the State considers it necessary or advisable for implementation of the intent of the Contract Documents, the State will require additional inspection or testing of the Work, in accordance with Subparagraphs 3.13.2 and 3.13.3, whether or not such work is fabricated, installed or completed.

2.2.6 The State will review and take action upon the Contractor's submitted Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of submittals is not conducted for the purpose of determining the accuracy and completeness of other details, such as dimensions and quantities, nor for substantiating instructions for installation or performance of equipment or systems, which remain the responsibility of the Contractor.

2.2.7 Substitutions and Approved Equals: Alternative material(s), article(s), or equipment that are of equal quality and of required characteristics for the purpose intended may be proposed by the Contractor. The State will examine proposed alternatives for compliance with the Contract Documents. The proposed material(s), article(s), or equipment, will be reviewed for comparative quality, suitability, and performance against the product(s) specified in the Contract Documents. Refer to Subparagraph 3.12.10, for Substitution procedures. If Contractor’s substitution is accepted, the Contractor shall be responsible for the costs of any changes resulting from the substitution, including, but not limited to redesign costs of the Project.

2.2.8 The State will conduct inspections to determine the Contractor’s compliance with the Contract Documents and the date of Completion; will receive, for review and record, written warranties and related documents required by the Contract Documents and assembled by the Contractor; and will issue a final Payment Authorization upon compliance with the requirements of the Contract Documents and Acceptance of the Work.

2.3 BREACHES, DEFAULTS AND TERMINATION FOR CAUSE

2.3.1 If the Director deems that the Contractor has failed to supply an adequate working force, or material of proper quality, or has failed to comply with Public Contract Code Section 10262, or has failed in any other respect to prosecute the Work with the diligence and force specified by the Contract, the Director may:

.1 after written notice of at least 5 days to the Contractor, specifying the defaults to be remedied, provide any such labor or materials and deduct the cost from any money due or to become due to the Contractor under the Contract; or
.2 if the Director considers that the failure is sufficient ground for such action, the Director may give written notice of at least 5 days to the Contractor and the Contractor's sureties, that if the defaults are not remedied, the Contractor's control over the Work will be terminated.

2.3.2 Should the State exercise its rights to terminate as noted in Subparagraph 2.3.1, the State may, without prejudice to any other rights or remedies of the State and subject to any prior rights of the Surety:

.1 terminate employment of the Contractor;
.2 take possession of the Project site, materials, equipment, tools, appliances, and construction equipment and machinery owned by the Contractor;
.3 accept assignment of Subcontractor Agreements pursuant to Paragraph 4.4; and/or
.4 finish the Work by whatever method(s) the State may deem expeditious and appropriate.

2.3.3 When the State terminates the Contract for reasons provided in Subparagraph 2.3.1, the Contractor shall not be entitled to receive any further payment until Completion of the Work. If the costs incurred by the State because of termination under Subparagraph 2.3.1 exceed the unpaid balance, the Contractor shall pay the difference to the State.

2.4 TERMINATION FOR THE STATE'S CONVENIENCE

2.4.1 The State reserves the right to terminate this Contract or any part thereof, due to an Act of God or for its sole convenience. In the event of such termination, the Contractor shall immediately stop hereunder and shall immediately cause its Subcontractors, Sub-subcontractors and material suppliers at any tier, to immediately stop work, leaving the site in a safe and secured condition. The Contractor shall not be paid for any work performed or costs incurred after the termination date that could have been avoided.

2.4.2 The Contractor shall be paid in accordance with the provisions of Article 8; except that the amount due the Contractor shall be based upon the State's final estimate of the Work completed, or acceptable materials furnished but not used, to the date of suspension of the Work, less any amounts required to be withheld pursuant to Article 8, and less any prior payment(s) made to, or on the account of the Contractor.

2.5 SUSPENSION BY THE STATE FOR CONVENIENCE

2.5.1 The State may, by written notice, order the Contractor to suspend, delay or interrupt the Work, in whole or in part, for such period of time as the State may determine.

2.5.2 An adjustment may be claimed by the Contractor in accordance with Article 6 and Article 7 for changes in the Work, caused by a suspension, delay or interruption. No adjustment will be made to the extent:

.1 that Contractor’s performance of the Work, is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
.2 that an equitable adjustment is made or denied under another provision of the Contract.

ARTICLE 3 - CONTRACTOR

3.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY THE CONTRACTOR

3.1.1 The Contractor shall carefully study and compare the Contract Documents with each other and shall report to the State, in writing, any errors, inconsistencies or omissions discovered. If the Contractor performs any work knowing it involves a recognized error, inconsistency or omission in the Contract Documents, without such notice to the State the Contractor shall assume responsibility for such performance and shall bear the cost for correction.

3.1.2 The Contractor shall take field measurements and verify field conditions and shall compare such field measurements, conditions and other related information known to the Contractor with the Contract Documents before proceeding.

3.1.3 The Contractor shall promptly, and before such conditions are disturbed, notify the State in writing of:

.1 subsurface or latent physical conditions at the site differing materially from those indicated, or
.2 unknown physical conditions at the site of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract.
.3 Hazardous materials.

3.1.4 The State will promptly investigate the conditions, and if the State finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the Work, whether or not changed as a result of such conditions, a Change Order will be issued in accordance with Article 6.

3.2 SUPERVISION AND CONSTRUCTION PROCEDURES

3.2.1 The Contractor shall supervise and direct the Work. The Contractor shall be responsible for, and have control over, construction means, methods, techniques, sequences, procedures, safety precautions and programs in connection with the Work, and for coordinating the Work under the Contract; unless otherwise noted or specified in the Contract Documents.

3.2.2 The Contractor shall be responsible to the State for acts and omissions of the Contractor's employees, Subcontractors, Sub-subcontractors or material suppliers and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

.1 Subcontractor Responsibility: The Contractor shall be responsible for the actions or inaction of Subcontractors, Sub-subcontractors or material suppliers, at all tiers, regardless of whether they are a Disabled Veterans Business Enterprise (DVBE) firm or are stipulated suppliers or sole sourced. No claim, request for equitable adjustment or Change Order request shall be submitted to the State for any action of any Subcontractor, Sub-subcontractor or material supplier, at any tier, unless the Contractor can demonstrate that the State is the proximate cause of the change or delay alleged in such request. The State will not accept any responsibility or liability for any action or inaction of any Subcontractor, Sub-subcontractor or material supplier, at any tier, except to the extent that the State is the proximate cause of the change or delay.

3.2.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents, either by activities or duties of the State, the State's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.2.4 The Contractor shall be responsible for inspections of portions of the Work already completed under the Contract to determine that such portions are in proper condition to receive subsequent work. If the Contractor determines that some work performed on the Project does not comply with the requirements of the Contract Documents, the Contractor shall repair or replace such defective work at the Contractor's sole expense.

3.2.5 Until Acceptance of the Work, the Contractor shall have the charge and care thereof, and shall bear risk of injury or damage to any part of the Work by action of the elements (except for an Act of God, or natural disaster as proclaimed by the State or Federal Government), or from any other reason except for such damages as are directly caused by acts of the Federal or State Government and the public enemy, except as provided in Paragraph 8.5.

3.3 LABOR AND MATERIALS

3.3.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. Materials, articles and equipment furnished by the Contractor for incorporation into the Work shall be new unless otherwise specified in the Contract Documents.

3.3.2 Hours of Labor: Workers are limited and restricted to 8 hours during any one calendar day, and 40 hours during any one calendar week except that pursuant to Labor Code Section 1815, any work performed in excess of 8 hours per day and 40 hours during any one week, shall be permitted upon compensation for hours worked in excess of 8 hours per day at not less than 1-1/2 times the basic rate of pay. The Contractor shall pay the State $25 as a penalty for each worker for each calendar day worked in violation of the above limitations and restrictions.

3.3.3 Prevailing Wage: The Contractor shall comply with Labor Code, Section 1774 and 1775. Pursuant to Section 1774, the Contractor and any subcontractors, regardless of tier, shall pay not less than the specified prevailing wage rates to all workers employed in the execution of the Contract. In accordance with Section 1775, the Contractor and any subcontractor under the Contractor shall forfeit to the State not more than $50 for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rates for the work or craft, in which the worker is employed for any work executed under the Contract by the Contractor or by any subcontractor in violation of the provisions of the Labor Code; and, in particular, Labor Code, Sections 1770 to 1780, inclusive. In addition to such forfeiture, the difference between such stipulated prevailing wage rates and the amount paid to each worker for each day, or portion thereof, shall be paid to each underpaid worker by the Contractor or subcontractor. This provision shall not apply to properly registered apprentices.

.1 Pursuant to Labor Code, Section 1770, the Director of the Department of Industrial Relations has ascertained the general prevailing rate of per diem wages and a general prevailing rate for legal holiday and overtime work for each craft required for execution of the Contract. The Contractor shall obtain copies of the prevailing rate of per diem wages from the Department of Industrial Relations, Division of Labor Statistics & Research, PO Box 420603, San Francisco, CA 94142-0603, (415) 703-4780; or wage rates may be accessed on the internet at http://www.dir.ca.gov/DLSR/statistics_research.html.The Contractor is responsible to read, understand and comply with all the guidelines, including the fine print in the prevailing wage determinations; and shall post a copy of the prevailing wage rates, specific to the Project, at the Project site.

.2 Wage rates set forth are the minimum that may be paid by the Contractor. Nothing herein shall be construed as preventing the Contractor from paying more than the minimum rates set. No extra compensation will be allowed by the State due to the inability of the Contractor to hire labor at minimum rates, nor for necessity for payment by the Contractor of subsistence, travel time, overtime, or other added compensations, all of which possibilities are elements to be considered and ascertained to the Contractor's own satisfaction in preparing the Bid Form.

.3 If it becomes necessary to employ crafts other than those listed in the General Prevailing Wage Rate booklet, the Contractor shall contact the Division of Labor Statistics and Research as noted above. The rates thus determined shall be applicable as minimum for the contract and incorporated in the bid. When the wage determination shows an expiration date (noted by a double asterisk**), to expire during the term of the contract, the Contractor must call or write the DIR to obtain the new rates and incorporate them in the bid to be applicable for the term of the contract.

.4 The Contractor and each subcontractor, regardless of tier, shall keep an accurate payroll record showing the names, addresses, social security numbers, work classifications, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by the Contractor and/or subcontractor in connection with the Work. Payroll records shall be certified and shall be on forms provided by the Division of Labor Standards Enforcement, or shall contain the same information as those forms. The Contractor's and subcontractor's certified payroll records for each employee shall be submitted with each payment request, covering the period of the payment request.

3.3.4 Travel and Subsistence Payments: The Contractor shall pay travel and subsistence payments to persons required to execute the Work as such travel and subsistence payments are defined in applicable collective bargaining agreements filed with the Department of Industrial Relations, pursuant to Labor Code, Sections 1773.1 and 1773.9.

3.3.5 Apprentices: Properly registered apprentices may be employed in the execution of the Work. Every apprentice shall be paid the standard wage paid to apprentices under the regulations of the craft or trade at which the apprentice is employed, and shall be employed only at the work of the craft or trade to which the apprentice is registered. The Contractor and each Subcontractor shall comply with the requirements of Labor Code, Section 1777.5, and any related regulations regarding the employment of registered apprentices.

3.4 NONDISCRIMINATION CLAUSE

3.4.1 Definitions: As they pertain to the Standard California Nondiscrimination Construction Contract Specifications:

.1 Administrator: The Administrator, Office of Compliance Programs (OCP), California Department of Fair Employment and Housing (DFEH), or any person to whom the Administrator delegates authority.

.2 Minority includes:

1) Black (all persons having primary origins in any of the Black racial groups of Africa, but not of Hispanic origin); or
2) Hispanic (all persons of primary culture or origin in Mexico, Puerto Rico, Cuba, Central or South America, or other Spanish derived culture or origin regardless of race); or
3) Asian/Pacific Islander (all persons having primary origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent or the Pacific Islands); or
4) American Indian/Alaskan Native (all persons having primary origins in any of the original peoples of North America and who maintain culture identification through tribal affiliation or community recognition).

3.4.2 Whenever the Contractor or any Subcontractor subcontracts a portion of the Work, it shall physically include in each subcontract of $5,000 or more, the Nondiscrimination Clause in the Contract directly or through incorporation by reference. Any subcontract for work involving a construction trade shall also include the Standard California Construction Contract Specifications, either directly or through incorporation by reference.

3.4.3 The Contractor shall implement the specific nondiscrimination standards provided in Clauses 3.4.6.1 through 3.4.6.5.

3.4.4 Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities and/or women shall excuse the Contractor's obligations under these specifications, Government Code, Section 12990, or the regulations promulgated pursuant thereto.

3.4.5 In order for the nonworking training hours of apprentices and trainees to be counted, such apprentices and trainees shall be employed by the Contractor during the training period, and the Contractor shall have made a commitment to employ the apprentices and trainees upon the completion of their training, subject to the availability of employment opportunities. Trainees shall be trained pursuant to training programs approved by the U.S. Department of Labor or the California Department of Industrial Relations.

3.4.6 The Contractor shall take specific actions to implement the Contractor's nondiscrimination program. The evaluation of the Contractor's compliance with these specifications shall be based upon the Contractor's effort to achieve maximum results from the Contractor's actions. The Contractor shall be able to demonstrate fully the Contractor's efforts under Steps .1 through .5 below:

.1 Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites and at all facilities at which the Contractor's employees are assigned to work. The Contractor, whenever possible, shall assign two or more women to each construction project. The Contractor shall specifically ensure that all leadpersons, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligations to maintain such a working environment, with specific attention to minority and/or female individuals working at such sites or in such facilities.

.2 Provide written notification within 7 days to the Director of DFEH when the union(s) with which the Contractor has a collective bargaining agreement(s) has not referred to the Contractor a minority person and/or woman sent by the Contractor, or when the Contractor has other information that the union(s) referral process has impeded the Contractor's efforts to meet the Contractor's obligations.

.3 Disseminate the Contractor's equal employment opportunity policy by providing notice of the policy to unions and training, recruitment and outreach programs and requesting their cooperation in assisting the Contractor to meet the Contractor's obligations; and by posting the company policy on bulletin boards accessible to all employees at each location where construction work is performed.

.4 Ensure all personnel making management and employment decisions regarding hiring, assignment, layoff, termination, conditions of work, training, rates of pay or other employment decisions, including all supervisory personnel, superintendents, general leadpersons, on-site leadpersons, etc., are aware of the Contractor's equal employment opportunity policy and obligations, and discharge their responsibilities accordingly.

.5 Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the equal employment opportunity policy and the Contractor's obligations under these specifications are being carried out.

3.4.7 Contractors are encouraged to participate in voluntary associations which assist in fulfilling their equal employment opportunity obligations. The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of the Contractor's obligations under these specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work-force participation, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. It is the Contractor's obligation to comply.

3.4.8 The Contractor is required to provide equal employment opportunity for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of the Fair Employment and Housing Act (Government Code, Section 12990 et seq.) if a particular group is employed in a substantially disparate manner.

3.4.9 Establishment and implementation of a bona fide affirmative action plan pursuant to Section 8104(b) of Title 2, California Code of Regulations (CCR), shall create a rebuttable presumption that the Contractor is in compliance with the requirements of Government Code, Section 12990, and its implementing regulations.

3.4.10 The Contractor shall not use the nondiscrimination standards to discriminate, harass or allow harassment against any person because of race, color, religion, sex, national origin, ancestry, physical disability (including HIV and AIDS), mental disability, medical condition (cancer), marital status, or age over 40, denial of family and denial of family care leave.

3.4.11 The Contractor shall not enter into any subcontract with any person or firm decertified from State contracts pursuant to Government Code, Section 12990.

3.4.12 The Contractor shall carry out such sanctions and penalties for violation of these specifications and the Nondiscrimination Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Government Code, Section 12990 and its implementing regulations by the awarding agency. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Government Code, Section 12990.

3.4.13 The Contractor shall designate a responsible official to monitor all employment-related activity to ensure that the company's equal employment opportunity policy is being carried out, to submit reports relating to the provisions herein as may be required by OCP, and to keep records. Records shall at least include for each employee the name, address, telephone number, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice

trainee, helper or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work is performed. Records shall be maintained in any easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, the Contractor shall not be required to maintain separate records.

3.5 GUARANTEE

3.5.1 The Contractor unconditionally guarantees the Work will be completed in accordance with the requirements of the Contract Documents, and will remain free of defects in workmanship and materials for a period of 1 year from the date of Completion of the Work of the Project, unless a longer guarantee period is specifically called for in the Contract Documents. The Contractor shall repair or replace work, or adjacent work, or both, that may have been damaged or displaced, which was not in accordance with the requirements of the Contract Documents, or that may be defective in its workmanship or material within the guarantee period specified in the Contract Documents, without any expense whatsoever to the State; ordinary wear and tear and abuse excepted.

3.5.2 The Contractor further agrees, within 14 days after being notified in writing by the State, of work not in accordance with the requirements of the Contract Documents or defects in the Work, that the Contractor shall commence and execute, with due diligence, work necessary to fulfill the terms of the guarantee. If the State finds that the Contractor fails to perform the work under the guarantee, the State will proceed to have the work completed at the Contractor's expense and the Contractor will pay costs of the work upon demand. The State will be entitled to all costs, including attorney's fees necessarily incurred upon the Contractor's refusal to pay the above costs.

3.5.3 Notwithstanding the foregoing Subparagraph, in the event of an emergency constituting an immediate hazard to health or safety of State employees, property, or licensees, the State may undertake, at the Contractor's expense and without prior notice, work necessary to correct such hazardous condition(s) when it is caused by work of the Contractor not being in accordance with the requirements of the Contract Documents.

3.6 **TAXES:** The Contractor shall pay all applicable taxes for the Work, or portions thereof provided by the Contractor, which were legally enacted as of the bid date, whether or not yet effective or merely scheduled to go into effect.

3.7 PERMITS, FEES AND NOTICES

3.7.1 The Contractor shall secure and pay for required permits, governmental fees, licenses and inspections necessary to complete the Work, unless otherwise provided in the Contract Documents.

3.7.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on the performance of the Work.

3.7.3 If the Contractor observes that portions of the Contract Documents are at variance with applicable laws, statutes, ordinances, building codes, and rules and regulations, the Contractor shall promptly notify the State in writing. If the Contractor performs work known to be contrary, or should have known to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without prior notice to the State, the Contractor shall assume full responsibility for the Work and shall bear the attributable costs.

3.7.4 The Contractor is not subject to municipal, county, or district laws, rules, or regulations pertaining to building permits or regulating the design or construction of buildings upon State property, except as specified in the Contract Documents.

3.7.5 The Contractor may be subject to federal, state, municipal, county, local or district laws, rules, or regulations pertaining to off-site work, such as utility connections, fire protection systems and encroachment upon federal, state, private, city or county property, including, but not limited to storm water pollution prevention plans.

3.7.6 All construction work shall comply with the California Code of Regulations, Title 24, California Building Standards Code (CBSC), and other Applicable Codes, current edition, as of the bid date or as specified in the Specifications.

3.8 **ALLOWANCES:** The Contractor shall include in the Contract Sum, Allowances in accordance with the requirements of the Specifications, Division 01.

3.9 SUPERINTENDENT

3.9.1 The Contractor shall employ a competent Superintendent and assistants who shall be in attendance at theProject site during performance of the Work. The Superintendent, or the Contractor’s duly appointed representative, shall be the person in charge of

the construction of the Work and shall represent the Contractor. Communications given to the Superintendent shall be as binding as if given directly to the Contractor. All communications shall be confirmed in writing by the Contractor. Should the State deem the Superintendent to be incompetent, the State has the authority to request the Contractor to replace this person.

3.9.2 Should the Contractor decide to replace the Superintendent, the Contractor shall notify the State in writing, no fewer than 14 calendar days prior to the replacement. The Contractor shall submit the name and resume of the new Superintendent with the letter.

3.9.3 At any other time when the Superintendent is absent from the Project site because no Work is being performed, the Superintendent shall nevertheless keep the State advised of the Superintendent's whereabouts so that the Superintendent may readily be reached and available for consultation at the Project site at any time.

3.10 CONTRACTOR'S PROGRESS SCHEDULE

3.10.1 Within the time frame specified in the specifications and prior to the first payment request, the Contractor shall submit to the State a Progress Schedule, including submittal schedules, prepared in accordance with the Specifications, Division 01. The Progress Schedule shall show the order in which the Contractor proposes to execute the Work, dates on which the Contractor will start each major subdivision of the Work, and projected dates of completion of each such subdivision in accordance with the requirements of the Contract Documents. The Contractor shall submit adjusted Progress Schedules, including submittal schedules, to reflect changed conditions in accordance with the requirements of the Contract Documents with each payment request.

3.10.2 The Contractor shall, unless otherwise specified in the Contract Documents, or directed by the State in writing, show in the schedule that physical construction of the Work will start within 10 calendar days of the start date stipulated in the Notice to Proceed, and show execution to Completion, in accordance with the specified schedule, subject to adjustment in accordance with the requirements of the Contract Documents.

3.10.3 The Contractor shall provide an adequate work force, materials of proper quality, and equipment to properly execute the Work and to ensure completion of each part in accordance with the Progress Schedule and within the Contract Time specified.

3.10.4 The Contractor shall submit to the State a Schedule of Values consistent with the Progress Schedule and Article 8. The Schedule of Values will be used as a basis for payment in accordance with Article 8.

3.10.5 The State's review and acceptance of the Progress Schedule is for compliance with the requirements of the Contract Documents only. Review and acceptance by the State of the Progress Schedule does not mean approval and does not relieve the Contractor of any of the Contractor's responsibility for the accuracy or feasibility of the Progress Schedule, or of the Contractor's ability to meet the interim Project milestone dates and the date of Completion. The State's review and acceptance does not expressly or impliedly warrant, acknowledge or admit the reasonableness of the logic, durations, manpower or equipment loading of the Progress Schedule.

3.11 DOCUMENTS AND SAMPLES AT THE PROJECT SITE

3.11.1 The Contractor shall maintain at the Project site one record copy of the Drawings, Project Manual, Addenda, Change Orders and other modifications, in good order and marked currently to record changes and selections made during construction; and in addition, Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the State and shall be delivered to the State upon completion of the Work.

3.11.2 Daily Records Clause: The Contractor shall prepare and maintain daily inspection records to document the progress of the Work on a daily basis. Daily Records shall include a daily accounting of labor and equipment on the site for the Contractor and Subcontractors, at any tier. Daily Records shall make a clear distinction between work being performed under Change Order, base scope work, and/or disputed work. Daily Records shall be copied and provided to the State at the end of every week, unless otherwise agreed to in writing.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES (SUBMITTALS)

3.12.1 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate those portions of the work for which submittals are required and the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the State is subject to the limitations of Subparagraph 2.2.6.

3.12.2 The Contractor shall review, approve and submit to the State Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents within the number of days set forth in the Specifications, Division 01; except finishes which shall be submitted in a sequence so as to cause no delay in the progress of the Work or in the activities of the State or separate

contractors. Submittals that are not required by the Contract Documents may be returned to the Contractor without action.

3.12.3 The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been reviewed by the State. Such work shall be in accordance with reviewed submittals.

3.12.4 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and related field construction criteria, and has checked and coordinated the information contained within the submittal(s) with the requirements of the Contract Documents.

3.12.5 The Contractor shall not be relieved of the responsibility for any deviation from the requirements of the Contract Documents by the State's review of submittals unless the Contractor has specifically informed the State, in writing, or as directed by the State, of such deviation at the time of submittal, and the State has given written consent to the specific deviation. The State's review shall not relieve the Contractor of responsibility for errors or omissions in submittals. Any resulting cost increase due to such a deviation shall be the sole responsibility of the Contractor.

3.12.6 The Contractor shall respond per requirements of the Contract Documents, in writing or on resubmitted submittals, to revisions other than those requested by the State on previous submittals. After the second resubmittal of a specific item, that is still not accepted, the Contractor will be charged all costs of submittal review. The charges will be deducted from the Contract Sum.

3.12.7 Informational submittals on which the State is not expected to take action, may be identified in the Contract Documents.

3.12.8 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the State will be entitled to rely upon the accuracy and completeness of such calculations and certifications.

3.12.9 When descriptive catalog designations, including manufacturer's name, product brand name, or model number(s) are referred to in the Contract Documents, such designations shall be considered as being those found in industry publications of current issue at date of first Invitation to Bid.

3.12.10 Substitutions and Approved Equals: Alternative material(s), article(s), or equipment that are of equal quality and of required characteristics for the purpose intended may be proposed by the Contractor for use in the Work, provided the Contractor complies with the Specifications, Division 01, and the following requirements:

.1 The Contractor shall submit a proposal for the alternative material(s), article(s), or equipment, in writing, within 35 days after Contract start date stated in the Notice to Proceed. In exceptional cases where the best interests of the State so require, the State may give written consent to a submittal or resubmittal received after expiration of the time limit designated.

.2 The proposal will not be considered unless the submittal is accompanied by complete information and descriptive data necessary to determine equality of offered material(s), article(s), or equipment. Samples shall be provided when requested by the State. Burden of proof as to comparative quality, suitability, and performance of offered material(s), article(s), or equipment shall be upon the Contractor. The State will be the sole judge as to such matters. In the event the State rejects the use of such alternative(s) submitted, then one of the particular products originally specified in the Contract Documents shall be furnished.

.3 If mechanical, electrical, structural, or other changes are required for installation, fit of alternative materials, articles, or equipment, or because of deviations from Contract Drawings and Specifications, such changes shall not be made without consent of the State, and shall be made without additional cost to the State.

3.13 TESTS AND INSPECTIONS

3.13.1 The Contractor shall at all times permit the State, its agents, officers, and employees to visit the Project site and inspect the Work, including shops where work is in preparation. This obligation shall include maintaining proper facilities and safe access for such inspection. Including, but not limited to providing lifts, ladders, scaffolds, platforms and paths of travel. When the Contract Documents require a portion of the Work to be tested, such portion of work shall not be covered up until inspected and approved by the State. The Contractor shall be solely responsible for notifying the State where and when the work is ready for inspection and testing. Should any work be covered without the required testing and approval, such work shall be uncovered and recovered at the Contractor's expense. Whenever the Contractor intends to perform work on Saturday, Sunday, or a legal holiday, the Contractor shall give written notice to the State of such intention at least 48 hours prior to performing the Work, so that the State may make necessary arrangements.

3.13.2 If the State determines that portions of the Work require additional testing, inspection or approval not included in the Contract Documents, the State will instruct the Contractor, in writing, to make arrangements for additional testing, inspection or

approval by an entity acceptable to the State, and the Contractor shall give 48 hours written notice to the State of where and when tests and inspections will be conducted so that the State may observe the procedures. The State will bear the costs except as provided in Subparagraph 3.13.3.

3.13.3 If procedures for testing, inspection or approval under Subparagraphs 3.13.1 and 3.13.2 reveal failure of a portion(s) of the Work to comply with the Contract Documents, the Contractor shall bear all costs made necessary by such failure(s) including those of repeated procedures and compensation for the State's services and expenses.

3.13.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and delivered to the State within 14 days after each test.

3.14 **USE OF PROJECT SITE**

3.14.1 The Contractor shall confine operations at the Project site to areas permitted by law, ordinances, permits and the Contract Documents.

3.14.2 The Contractor shall perform no operations of any nature on or beyond the limits of Work or premises, except as such operations are authorized in the Contract Documents, or authorized by the State.

3.14.3 The Contractor shall ensure the limits of Work to be free of graffiti or other similar defacements during the time of the Contract; if such defacement occurs, then the Contractor shall properly remove, repair, or correct the affected area(s), or as otherwise directed by the State. The Contractor shall protect exposed surfaces within the limits of Work, with anti-graffiti coatings, and maintain such protection continuously effective during the time of the Contract.

3.14.4 Prohibitions: Pursuant to Subparagraph 3.2.2., the use of alcohol and tobacco products, and the use or possession of weapons, or illegal controlled substances by the Contractor, or others under the Contractor's control, on State property is not allowed. Residing on site in temporary facilities by the Contractor, or others under the Contractor's control, is not allowed unless otherwise specified in the Specifications, Division 01.

3.15 **CUTTING AND PATCHING**

3.15.1 The Contractor shall be responsible for cutting, fitting or patching as required to complete the Work.

3.15.2 The Contractor shall not damage nor endanger the Work by cutting, patching or otherwise altering the construction, and shall not cut nor otherwise alter the construction without prior written consent of the State.

3.16 **CLEANING UP**

3.16.1 The Contractor shall keep the Project site and surrounding areas free from waste materials and/or rubbish caused by operations under the Contract and at other times when directed by the State. At all times while finish work is being accomplished, floors shall be kept clean, free of dust, construction debris and trash. Upon completion of the Work, the Contractor shall remove from the Project site the Contractor's tools, construction equipment, machinery, and any waste materials not previously disposed of, leaving the Project site thoroughly clean, and ready for the State's final inspection.

3.16.2 If the Contractor fails to clean up as provided in the Contract Documents, the State may do so and charge the cost thereof to the Contractor.

3.17 **ACCESS TO WORK:** The Contractor shall provide the State continuous and safe access to the Work. Including, but not limited to providing lifts, ladders, scaffolds, platforms and paths of travel.

3.18 **ROYALTIES AND PATENTS:** The Contractor shall pay royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and hold the State harmless.

3.19 **INDEMNIFICATION**

3.19.1 Duty To Defend: To the fullest extent permitted by law, the Contractor shall defend the State and any officer or employee of the State from and against suits filed against the State alleging claims, (including costs of attorneys fees) by reason of liability imposed by law and claims, including but not limited to, claims of personal injury, death, damage to property and loss of use thereof, or any claims arising out of the Contractor's performance of the Contract, or damages of other relief based on allegations of the failure of the Contractor, or the Contractor's Subcontractors to properly perform their obligations under the Contract, of the Contractor's violations of any legal duties, even if the allegations of any suit are groundless, false or fraudulent, and the Contractor

may make such investigation and settlement of any suit as the Contractor deems expedient. This duty to defend is separate and independent from the Contractor's duty to indemnify and hold harmless the State from such claims. Any failure to fulfill this obligation shall be a default of the Contractor's performance obligations under the Contract.

3.19.2 Duty to Indemnify: To the fullest extent permitted by the law, the Contractor shall hold harmless and indemnify the State and any officer or employee of the State from and against claims, losses and expenses (including costs of attorneys fees) by reason of liability imposed by law for claims, including but not limited to, claims of personal injury, death, damage to property and loss of use thereof, or any claims arising out of the Contractor's performance of the Contract, or damages or other relief based on allegations of the failure of the Contractor, or the Contractor's Subcontractors to properly perform their obligations under the Contract, or the Contractor's violations of any legal duties. Any failure to fulfill this obligation shall be a default of the Contractor's performance obligations under the Contract.

3.20 **AIR POLLUTION:** The Contractor and Subcontractors shall comply with State and/or local air pollution control rules, regulations, ordinances, and statutes that apply to work performed under the Contract. If there is a conflict between the State and local air pollution control rules, regulations, ordinances and statutes, the most stringent shall govern.

3.21 **CERTIFICATION BY CONTRACTOR OF RECYCLED CONTENT:** The Contractor shall certify in writing, under penalty of perjury, to the State, the minimum, if not exact, percentage of recycled content, both postconsumer material and secondary material, as defined in Public Contract Code Sections 12153 and 12200 and 12209, in materials, goods, or supplies offered or products used in the performance of the Contract, regardless of whether the product meets the required recycled percentage as defined in Sections 12153 and 12200 and 12209. The Contractor may certify that the product contains zero recycled content.

3.22 **UNFAIR BUSINESS PRACTICES:** The Contractor agrees and will require the Subcontractors and suppliers to agree to assign to the State all rights, title, and interest in and to all causes of action they may have under Section 4 of the Clayton Act (15 U.S.C. Section 15), or under the Cartwright Act (commencing with Section 16700 of the Business and Professions Code), arising from the purchase of goods, services or materials, pursuant to the Contract Documents or subcontract thereunder. An assignment made by the Contractor, and additional assignments made by Subcontractors and suppliers, shall be deemed to have been made and will become effective at the time the State tenders final payment to the Contractor, without further acknowledgment of the parties.

3.23 **CHILD SUPPORT COMPLIANCE ACT:** For any contract in excess of $100,000, the Contractor acknowledges in accordance with Public Contract Code Section 7110, that: (a) the Contractor recognizes the importance of child and family support obligations and shall fully comply with all applicable state and federal laws relating to child and family support enforcement, including, but not limited to, disclosure of information and compliance with earnings assignment orders, as provided in Chapter 8 (commencing with Section 5200) of Part 5 of Division 9 of the Family Code; and (b) the Contractor, to the best of its knowledge is fully complying with the earnings assignment orders of all employees and is providing the names of all new employees to the New Hire Registry maintained by the California Employment Development Department.

3.24 **NOT USED**

3.25 **CONTRACTOR REQUIRED NOTIFICATION OF CHANGES:** The Contractor shall notify the State's Representative in writing of any change to Contractor's name, status, or information including but not limited to:

1. Name
    a. An amendment is required to change the Contractor's name as listed on this Agreement. Upon receipt of Contractor's notification and legal documentation of the name change, the State will process the amendment. Payment of invoices presented with a new name cannot be paid prior to approval of said amendment.
    b. The State shall not be liable for penalties or interest on payments which are delayed due to Contractor's change of name and subsequent amendment processing.
2. Address/Location
3. Federal Employer Identification Number (FEIN)
4. Type of Organization or Legal Status – including:
    a. Corporate
    b. Partnership
    c. Individual/Sole-Ownership
    d. Joint Venture
    e. Limited Liability Company
    f. DBA
5. Ownership
6. Officers or Key Personnel
7. License
8. Other (Bankruptcy, Etc.)

Contractor shall immediately provide an updated Standard Form 204 (IRS/FTB form) to the Contracts Management & Procurement Services Section within five (5) calendar days of any such relevant change.

The State shall not be liable for penalties or interest on payments which are delayed do to Contractor's lack of proper or timely notice and documentation of a relevant change in status which impacts the State's ability to pay.

Contractor shall submit the firm's status change in writing including the Contract Number, Project Title and all necessary backup and legal documentation to support the status change to:

The State Department of General Services
Real Estate Services Division
Contracts Management & Procurement Services Section
707 Third Street, Suite 2-350
West Sacramento, CA 95605

ARTICLE 4 - SUBCONTRACTORS

4.1 SUBLETTING AND SUBCONTRACTING

4.1.1 The Contractor shall adhere to the rules governing subcontracting as set forth in the Subletting and Subcontracting Fair Practices Act, commencing with Public Contract Code, Section 4100. Subcontractor substitutions shall be in accordance with provisions of the Subletting and Subcontracting Fair Practices Act, beginning with Public Contract Code, Section 4100. Violations of this Act by the Contractor may subject the Contractor to penalties and disciplinary action as provided by the Subletting and Subcontracting Fair Practices Act.

4.1.2 The Contractor shall be responsible for the Work. Persons engaged in the Work of the Project are the responsibility and under the control of the Contractor. The Contractor shall give personal attention to fulfillment of the Contract and shall keep the Work under the Contractor's control. When any Subcontractor fails to execute a portion of the Work in a manner satisfactory to the State, the Contractor shall remove such Subcontractor immediately upon written request notice from the State, and the Subcontractor shall not again be employed on the Project. Although Specification Sections of the Contract Documents may be arranged according to various trades or general grouping of work, the Contractor is not obligated to sublet work in any manner. The State will not entertain requests to arbitrate disputes among Subcontractors or between the Contractor and Subcontractor(s) concerning responsibility for performing any part of the Work.

4.1.3 The State may not permit a contractor or subcontractor who is ineligible to bid or work on, or be awarded, a public works project pursuant to Sections 1777.1 or 1777.7 of the Labor Code to bid on, be awarded, or perform work as a subcontractor on a public works project.

.1 Any contract on a public works project entered into between a contractor and a debarred subcontractor is void as a matter of law. A debarred subcontractor may not receive any public money for performing work as a subcontractor on a public works contract, and any public money that may have been paid to a debarred subcontractor by a contractor on the project shall be returned to the awarding body. The Contractor shall be responsible for the payment of wages to workers of a debarred subcontractor who has been allowed to work on the Project.

4.2 SUBCONTRACTUAL RELATIONS

4.2.1 The Contractor shall make available to each proposed Subcontractor, prior to the execution of a Subcontractor Agreement, copies of the Contract Documents to which the Subcontractor will be bound. Upon written request of the Subcontractor, the Contractor shall identify to the Subcontractor the terms and conditions of the proposed Subcontractor Agreement which may or may not be at variance with the Contract. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors. The Contractor shall, by Subcontractor Agreement, require each Subcontractor, to the extent of the work to be performed by the Subcontractor:

.1 To be bound to the Contractor by terms of the Contract.
.2 To assume toward the Contractor the obligations and responsibilities which the Contractor, by the Contract, assumes toward the State.
.3 To preserve and protect the rights of the State under the Contract Documents with respect to the work to be performed by the Subcontractor.
.4 To be allowed, unless specifically provided otherwise in the Subcontractor Agreement, the benefits of rights, remedies and redress against the Contractor that the Contractor, by the Contract, has against the State.
.5 To enter into similar agreements with Sub-subcontractors.

4.2.2 Subcontractor Payments: The Contractor shall pay the Contractor's Subcontractors for work performed no later than 10 days after receipt of each progress payment. If there is a good faith dispute over all or any portion of the amount due a Subcontractor on a progress payment, the Contractor may withhold no more than 150 percent of the disputed amount. This provision shall apply to Sub-subcontractors also. A violation of these requirements invokes the payment and penalty provisions of Public Contract Code, Section 10262 and Section 10262.5.

4.3 **DISABLED VETERAN BUSINESS ENTERPRISE PROGRAM:** Pursuant to Public Contract Code (PCC) Section 10115 et. seq., the Contractor shall use, employ and utilize Disabled Veteran Business Enterprise (DVBE) subcontractors, sub-subcontractors or material suppliers who were listed in their bid documents for DVBE Program participation, to the full extent of the amount of money and/or percentage of commitment manifested in the bid documents. If the Contractor wishes to substitute any listed DVBE subcontractors, sub-subcontractors or material suppliers for just and legal cause, the Contractor shall follow the dictates of PCC Sections 4107 and 10115.12b, as well as Military and Veterans Code (M&VC) Section 999.5(e) and California Code of Regulations, Title 2, Section 1896.64. The DVBE may only be replaced by another DVBE and shall obtain the written authorization of the State prior to any such substitutions. The Contractor shall not unilaterally substitute a listed DVBE subcontractor, sub-subcontractor or material supplier. Failure of Contractor to seek substitution and adhere to the DVBE participation requirement identified in the bid may be cause for contract termination, recovery of damages under rights and remedies due to the State, and penalties as outlined in M&VC Section 999.9; PCC Sections 4110 and PCC Section 10115.10.

4.4 **CONTRACT ASSIGNMENTS:** Performance of the Contract may not be assigned except upon written consent of the State. Consent will not be given to an assignment which would relieve the Contractor or the Contractor's Surety of their responsibilities under the Contract.

ARTICLE 5 - CONSTRUCTION BY THE STATE OR BY SEPARATE CONTRACTORS

5.1 STATE'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

5.1.1 The State reserves the right to perform work or operations related to the Project with the State's own work force, and to award separate contracts in connection with other portions of the Project, and other construction or operations on the Project site or adjacent to the Project. The Contractor shall at all times conduct the Work so as to impose no hardship on the State or others engaged in work on the Project, nor to cause any unreasonable delay or hindrance to the Project.

5.1.2 When separate contracts are awarded for different portions of the Project, "the Contractor" in the Contract Documents in each case shall mean the contractor who executes each separate contract. Each contractor is the intended third part beneficiary of other contracts for the Project.

5.1.3 The Contractor shall not cause unnecessary hindrance or delay to another contractor working on or near the Project. If the performance of any contract for the Project is likely to be interfered with by the simultaneous execution of some other separate contract or contracts, the State will decide which contractor may proceed.

5.1.4 Costs caused by defective or ill-timed work shall be borne solely by the responsible contractor.

5.2 MUTUAL RESPONSIBILITY

5.2.1 The Contractor shall cooperate fully with the State and separate contractors with regard to the execution of their work as follows:

.1 The Contractor shall cooperate fully with the State and all separate contractors with regard to introduction and storage of their materials and equipment.

.2 The Contractor shall coordinate with the State and separate contractors with regard to construction scheduling and sequence of operations, subject to approval of the State.

.3 Each contractor shall monitor the schedule and progress of each other contractor whose work affects its work, and shall provide timely notice to the State of potential problems of interface so that the State can mitigate the problem.

.4 The Contractor shall properly connect the Work to the work of the State or the separate contractors.

.5 The Contractor shall inspect the work of the State or other contractors affecting the Work and promptly report to the State in writing irregularities or defects in the separate work, which renders it unsuitable for reception or connection of the Work.

.6 Failure of the Contractor to inspect and report shall constitute acceptance of the other work as fit and proper to receive the Work, except as to defects which may develop in the other work after execution of the Contractor’s Work.

5.2.2 Claims Between Separate Contractors:

.1 Should the Contractor cause damage to the work or property of any separate contractor on the Project, the Contractor shall, upon due notice, settle with such other contractor by agreement, mediation or arbitration, if they will so settle.

.2 If such separate contractor sues the State or initiates an arbitration proceeding on account of any damage alleged to have been so sustained, the State will notify the Contractor who shall defend such proceedings at the Contractor's sole expense.

.3 The Contractor shall pay or satisfy any judgement or award against the State, arising therefrom. In addition, the Contractor shall pay the State for attorney's fees, court, arbitration or mediation costs and additional administrative, professional, consultant, inspection, testing and other service costs which the State has incurred.

5.2.3 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to any completed or partially completed construction or to any property of the State or separate contractors as provided in Subparagraph 10.1.6.

5.2.4 Cutting and Patching Under Separate Contracts: The Contractor shall be responsible for any cutting, fitting and patching that may be required to complete the Work, except as otherwise specifically provided for in the Contract Documents. The Contractor shall not endanger any work of the State or of any other contractor by cutting, excavating, or otherwise altering any work, except with the written consent of the State.

5.3 **STATE'S RIGHT TO CLEAN UP:** If a dispute arises among the Contractor, separate contractors and/or the State as to the responsibility under their respective contracts for maintaining the Project site and surrounding areas free from waste materials and rubbish as described in Paragraph 3.16, the State may clean up and allocate the costs among those responsible.

ARTICLE 6 - CHANGES IN THE WORK

6.1 GENERAL

6.1.1 The State may order changes, including but not limited to, revisions to the Contract Documents, performance of extra work, and the elimination of work, without invalidating the Contract. Orders for such changes will be in writing. Changes shall not affect the obligations of the sureties on the contract bonds nor require their consent. Contract Time and Contract Sum will be adjusted, by written Change Order for changes which materially increase or decrease the time or cost or performance.

.1 Proposed Change Order: The Contractor will be issued a written proposed Change Order by the State describing the intended changes to the Work.

.2 Timeline: Within 14 days the Contractor shall submit to the State the Contractor's proposed cost estimate to be added or deducted from the Contract Sum due to the change, authenticated in full by completely detailed estimates and other authenticators of the cost by the Contractor, Subcontractors, Sub-subcontractors, vendors or material suppliers, and any adjustments of time of Completion of the entire Work that is directly attributable to the State's proposed Change Order.

.3 Agreement: If an agreement is reached as to the adjustment in compensation for performance of changed Work, but an agreement is not reached as to the adjustment of Time for such Work, then the Contractor shall proceed with the Work at the agreed cost, reserving to the Contractor the right to further pursue the Contractor's claim for adjustment of time in accordance with Paragraphs 7.4 and 9.1.

.4 Failure to Submit Cost Estimate: If the Contractor fails to submit the cost estimate within the 14 days timeline, or there is failure to agree to the Cost, then the State shall have the right to issue an order in writing to the Contractor to commence Work immediately, and the Contract Sum shall be changed in accordance with the State's estimate of cost, unless, within 14 days following completion of the added Work or with written notice to delete the Work, the Contractor submits to the State written proof that the State's estimate is in error.

6.1.2 The Contractor, when ordered by the State, shall proceed with changes before agreement is reached on adjustment, if any, in compensation or time for performance, and shall furnish to the State records as specified in Clause 6.2.1.3. If the Contractor fails to provide such records, the State's records will be used for the purpose of adjustment, if any, in Contract Time and Contract Sum.

.1 Contractor may make payment requests for such work.

6.1.3 The Contractor will forfeit compensation for cost and /or time for proceeding with changes to the Work without written authorization from the State. The Contractor shall notify the State, in writing, and request an evaluation whenever it appears a change is necessary. This written notice shall be made within 24 hours of such discovery. If the State concurs with the Contractor's request for a change to the Work, the State will follow the procedures under Article 6. Delays as a result of these requests will be the

responsibility of the Contractor.

6.2 **CHANGE ORDER**

6.2.1 Methods used in determining adjustments to the Contract Sum shall be based on one of the following methods:

.1 By mutual acceptance of a lump sum increase or decrease in costs. Upon the State's written request, the Contractor shall furnish a detailed estimate of increase or decrease in costs, together with cost breakdowns and other support data within the time specified in such request. The Contractor shall be responsible for any additional costs caused by the Contractor's failure to provide the estimate within the time specified.

.2 By the State, on the basis of the State's estimate of increase or decrease in the costs.

.3 By the State, whether or not negotiations are initiated as provided in Clause 6.2.1.1, by actual and necessary costs, as determined by the State, on the basis of records. Beginning with the first day and at the end of each day, the Contractor shall furnish to the State detailed hourly records for labor, construction equipment, and services; and itemized records of materials and equipment used that day in performance of the changes. Such records shall be on a form acceptable to the State. Such records shall be signed by the Contractor and, when agreed to by the State, will become the basis for compensation for the changed work. Such agreement shall not preclude subsequent adjustment based upon later audit by the State.

.4 By unit prices stated in the Contract Documents, or subsequently agreed upon.

.5 By a manner agreed upon by the State and the Contractor.

6.2.2 Allowable Costs: The only costs which will be allowed due to changes in the Work shall be computed in the following manner:

.1 Labor: Compensation for labor shall include the applicable payroll cost for labor, including first level supervision providing physical construction labor directly engaged in performance of the changes. Others, who may be involved in the preparation of the change order, including, but not limited to supervisors, superintendent, engineers, or estimators, shall be considered as overhead costs under Clause 6.2.2.4. Payroll cost for labor shall be the General Prevailing Wage Rates applicable for this project and in the locality for performance of the changes. In addition to the published rates, only social security, worker compensation, state and federal taxes shall be included in the total payroll cost. Other costs shall be considered as mark-ups under Clause 6.2.2.4. Use of a classification which would increase labor costs will not be permitted.

.2 Materials and Equipment: Compensation for materials and equipment shall include the necessary costs for materials and equipment directly required for performance of the changes. Cost of materials and equipment may include costs of transportation and delivery. If discounts by suppliers are available to the Contractor, they shall be credited to the State. If materials and equipment are obtained from a supply or source owned by, or in part, by the Contractor, payment therefore will not exceed current wholesale prices for such materials and equipment. If, in the opinion of the State, the cost of materials and equipment is excessive, or if the Contractor fails to furnish satisfactory evidence of costs from supplier, the cost of materials and equipment shall be the lowest current wholesale price at which similar materials and equipment are available in quantities required. The State reserves the right to furnish materials and equipment required for performance of the changes, and the Contractor shall have no claim for costs or mark-ups on such materials and equipment.

.3 Construction Equipment:

.1 Compensation for construction equipment shall include the necessary costs for use of construction equipment directly required for performance of the changes. Any use for less than 30 minutes shall be considered one-half hour. No costs will be allowed for time while construction equipment is inoperative, idle, or on stand-by, for any reason, unless such times have been approved in advance by the State. Rental time for construction equipment moved by its own power shall include the time required to move construction equipment to the Work site from the nearest available source for rental of such equipment, and time required to return such equipment to the source. If construction equipment is not moved by its own power, loading and transportation costs will be paid in lieu of such rental time. Neither moving time nor loading and transportation costs will be allowed if the construction equipment is used for any work other than the changes. No allowance will be made for individual pieces of construction equipment and tools having a replacement value of $500 or less. No construction equipment costs will be recognized in excess of rental rates established by distributors or equipment rental agencies in the locality for performance of the changes.

.2 Unless otherwise approved by the State, the allowable rate for use of construction equipment shall constitute full compensation to the Contractor for cost of fuel, power, oil, lubrication, supplies, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, labor except for construction equipment operators and any and all costs to the Contractor incidental to the use

of such construction equipment.

.4 Mark-Ups for Added Work:

.1 General: The following allowance for mark-ups for performance of the changes shall constitute full compensation for additional field and home office overhead, profit, insurance, taxes (excluding sales taxes for materials incorporated into the project), and bonds, and other costs not covered under Clauses 6.2.2.1 through 6.2.2.3.

.2 Contractor: When work is added, the Contractor may claim mark-up in addition to authorized allowable costs, a reasonable sum as compensation for the items identified in 6.2.2.4.1 above, subject to proof of entitlement based on actual job costs, actual job experience, the Contractor's bidding data, and industry custom and practice. Under no circumstance can this sum exceed the following percentages:

.1	Contractor Labor	:	21 percent, includes bond cost.
.2	Contractor Materials and Equipment	:	16 percent, includes bond cost.
.3	Subcontractor Work	:	6 percent of Subcontractor's costs, includes bond cost.

.1 Calculations of the Contractor's allowable 6 percent mark-up of the Subcontractor's Work shall not include the Subcontractor's allowable mark-up. Compounding of mark-up is not allowed.

.3 Subcontractors: When work is added, the Subcontractor may claim mark-up in addition to authorized allowable costs, a reasonable sum as compensation for the items identified in 6.2.2.4.1 above, subject to proof of entitlement based on actual job costs, actual job experience, the Subcontractor's bidding data, and industry custom and practice. Under no circumstance can this sum exceed the following percentages:

.1	Subcontractor Labor	:	20 percent
.2	Subcontractor Materials and Equipment	:	15 percent

.3 The aggregate mark-ups for all Subcontract tiers shall not exceed 20 percent for labor and 15 percent for materials and equipment. Compounding of mark-up is not allowed.

.5 For Deleted Work: When the State is entitled to a credit for deleted work, the credit shall include direct labor, materials, and supervision plus overhead of the Contractor or Subcontractor, as applicable for the deleted work. Deleted overhead shall be computed as no less than 5 percent of the direct labor, materials, and supervision, and should reflect the actual savings to the Contractor resulting from the deletion based upon actual job prices for the work at issue, actual job experience, the Contractor's bidding data for the project and industry custom and practice. For example, if a $10,000 item of work is deleted, the credit to the State would be no less than $10,500.

.6 For Combination of Added and Deleted Work: For Change Orders that involve both added and deleted work, the Contract Sum will be adjusted based on the following computation: Cost before mark-ups of added and deleted work shall each be separately estimated. If a difference between costs results in an increase to the Contract Sum, a mark-up for added work shall be applied to the difference. If a difference in costs results in a decrease, then the 5 percent credit to the State for deleted overhead set forth above shall be applied to the difference.

.7 General Limitations: Costs to the Contractor for changes which exceed market values prevailing at the time of the change will not be allowed unless the Contractor establishes that all reasonable means for performance of the changes at prevailing market values have been investigated and the excess cost could not be avoided. Notwithstanding actual charges to the Contractor on work performed or furnished by others, no mark-ups will be allowed in excess of those specified in Clause 6.2.2.4 above.

6.2.3 Cost Disallowance: Costs which will not be allowed or paid in Change Orders or Claim settlements under this Contract include, but are not limited to, interest cost of any type other than those mandated by statute; Claim preparation or filing costs; legal expenses; the costs of preparing or reviewing proposed Change Orders or Change Order proposals concerning Change Orders which are not issued by the State; lost revenues; lost profits; lost income or earnings; rescheduling costs; costs of idled equipment when such equipment is not yet at the site or has not yet been employed on the Work; lost earnings or interest on unpaid retainage; claims consulting costs; the costs of corporate officers or staff visiting the site or participating in meetings with the State; any compensation due to the fluctuation of foreign currency conversions or exchange rates; or loss of other business.

6.3 **ACCEPTANCE OF CHANGE ORDERS:** The Contractor's written acceptance of a Change Order shall constitute final and binding agreement to the provisions thereof and a waiver of Claims in connection therewith, whether direct, indirect, or consequential in nature.

6.4 **EFFECT ON SURETIES:** Alterations, extensions of time, extra and additional work, and other changes authorized by the Contract Documents may be made without securing consent of Surety(s) on Contract Bonds.

ARTICLE 7 - TIME

7.1 NOTICE TO PROCEED

7.1.1 The Contractor will be notified of the Contract start date as stated in the Notice to Proceed. Notwithstanding other provisions of the Contract, the State will not be obligated to accept or to pay for work furnished by the Contractor prior to the start date stated in the Notice to Proceed whether or not the State has knowledge of the furnishing of such work. The Contractor shall not be allowed on the site of the Work until the Contractor's Contract bonds and certificates of insurance comply with requirements of the Contract.

7.1.2 Work under the Contract shall be conducted in accordance with Paragraph 3.10. The Contractor shall not begin any Work until authorized in writing by the State.

7.2 **CONTRACT TIME:** The Contract Time is the period set forth in Document 00 73 00, Supplementary Conditions. The start and completion dates will be stated in a Notice to Proceed. It is essential that the Project be completed within the time fixed for Completion in Document 00 73 00 or liquidated damages will be assessed for delay. All portions of the Work shall be completed and shall be ready for full use by the State on, or prior to, the date of Completion.

7.2.1 Time is of the essence in this Contract.

7.3 **LIQUIDATED DAMAGES:** For every day that the Work remains unfinished after the time fixed for Completion in the Contract Documents, as modified by any approved extension of time, damage will be sustained by the State. Because of the difficulty in computing actual material loss and disadvantages to the State, it is determined in advance that the Contractor will pay the State the amount of damages set forth in the Agreement, as representing a reasonable forecast of actual damages which the State will suffer by failure of Contractor to complete the Work within the time fixed for Completion in the Contract. Execution of the Agreement shall constitute acknowledgment by the Contractor that the Contractor agrees that the State will actually suffer damages in the amount fixed for every Day during which Completion of the Work is avoidably delayed beyond the time fixed for Completion in the Contract.

7.4 TIME EXTENSIONS

7.4.1 Request for Time Extension: In the event the Contractor requests an extension of Contract Time for unavoidable delay, the Contractor shall furnish such justification and supporting evidence as the State may deem necessary for the determination as to whether the Contractor is entitled to an extension of Contract Time. The Contractor shall submit justification in writing no later than 7 days after the initial occurrence of any delay. The justification shall be based on the Official Progress Schedule as updated at the time of occurrence of the delay or execution of work related to any changes to the scope of the Work. The justification shall include, but is not limited to the following information:

.1 Duration to perform activity(ies) relating to changes in the Work and resources (manpower, equipment, material, etc.) required to perform these activities within the stated duration.

.2 Logical ties to the Official Progress Schedule for proposed changes or delay showing activity(ies) in the schedule start or completion dates are affected by the change or delay.

7.4.2 The State, upon receipt of such justification and supporting evidence, shall make its finding of fact. The State's decision shall be final and conclusive and the State will advise the Contractor in writing of such decision. If the State finds that the Contractor is entitled to an extension of Contract Time, the State's determination as to the total number of extension days shall be based upon the latest updated version of the Official Progress Schedule. Such data will be included in the next monthly updating of the schedule.

7.4.3 Time Extensions: For delays that the State agrees are unavoidable, and are Justified in accordance with Subparagraph 7.5.2, the Contractor shall, pursuant to the Contractor's application, be allowed an extension of time beyond the Contract Time. During such extension of time, neither extra compensation for engineering and inspection nor liquidated damages will be charged to the Contractor. Time extensions shall be granted only for delays or changes that extend the Completion date, based on the latest accepted updated version of the Official Progress Schedule. Time extensions for delays and changes shall not exceed one day for each day that the Contract Completion date of the Official Progress Schedule is extended by this change or delay.

7.5 DELAYS IN COMPLETION OF THE WORK

7.5.1 Notice of Delays: Whenever the Contractor foresees delay in the continuance and Completion of the Work, or immediately upon the occurrence of any delay which the Contractor regards as unavoidable, the Contractor shall notify the State in writing, in a separate notice of the delay. The Contractor's notice shall include the probability of the occurrences of such delay and its cause in

order that the State may take immediate steps to prevent the occurrence or continuance of the delay. If the delay cannot be prevented, the State will determine whether the delay is unavoidable and to what extent continuance and Completion of the Work is anticipated to be delayed.

.1 The Contractor shall make no claim for delay not called to the attention of the State in writing, at the time of its occurrence.

.2 Delay in the continuance of parts of the Work that does not prevent or delay the continuance of other parts of the Work or the Completion of the whole Work within the Contract Time shall be deemed to constitute neither avoidable delays nor unavoidable delays, within the meaning of the Contract. Such delay will be considered Unjustified and no extension to the Contract Time and/or additional compensation will be granted.

7.5.2 Justified Delay: Justified Delay in the continuance or Completion of the Work shall include delays which result from causes beyond the control of the Contractor and which could not have been avoided by the exercise of due care and diligence on the part of the Contractor or the Contractor's Subcontractors. Delay in Completion of the Work due to Contract modifications ordered by the State and unforeseeable delays in continuance or completion of the work of other contractors employed by the State may be considered Justified Delays insofar as they interfere with the Contractor's Completion of the Work within the Contract Time. Delays due to normal weather conditions which prevent the Contractor from proceeding with the controlling item on the Official Progress Schedule will not be regarded as a Justified Delay.

.1 Justified Delay will result in an extension beyond the Contract Time in accordance with Paragraph 7.4.

.2 Justified Delay that includes Contract modifications ordered by the State may entitle the Contractor to extra compensation in accordance with the provisions of Article 6.

.3 Delay that results from causes beyond the control of the State and is determined by the State to be the Contractor's responsibility shall be considered Unjustified and will result in no extension in the Contract Time or extra compensation. The State's decision shall be final and conclusive.

.4 The State will determine the net difference between overlapping or concurrent Justified Delays and Unjustified Delays and whether the Contractor is entitled to any extension in the Contract Time and/or extra compensation. The State's decision shall be final and conclusive.

7.5.3 Weather Delays: If weather conditions are the basis for delays in the continuance or completion of the Work, such delay shall be documented by 5 year climatological data obtained by the Contractor, from the nearest nationally recognized reporting station to the Work site, substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction. The State will not be responsible for additional costs of the Contractor caused by weather delays, including, but not limited to, costs of extended overhead.

7.6 ACCELERATION

7.6.1 The State reserves the right to accelerate the Work of the Contract. In the event that the State directs acceleration, such directive will be only in written form. The Contractor shall keep cost and other Project records related to the acceleration directive separately from normal Project costs and records, and shall provide a written record of acceleration cost to the State on a daily basis.

7.6.2 In the event that the Contractor believes that some action or inaction on the part of the State constitutes an acceleration directive, the Contractor shall immediately notify the State in writing that the Contractor considers the actions an acceleration directive. This written notification shall detail the circumstances of the acceleration directive. The Contractor shall not accelerate work efforts until the State responds to the written notification. If acceleration is then directed or required by the State, cost records referred to above shall be maintained by the Contractor and provided to the State on a daily basis.

7.6.3 In order to recover additional costs due to acceleration, the Contractor shall document that additional expenses were incurred and paid by the Contractor. Labor costs recoverable will be only overtime or shift premium costs or the cost of additional laborers brought to the site to accomplish the accelerated work effort. Equipment costs recoverable will be only the cost of added equipment mobilized to the site to accomplish the accelerated work effort.

ARTICLE 8 - PAYMENTS AND COMPLETION

8.1 **SCHEDULE OF VALUES**: Before the first payment request, the Contractor shall submit to the State a Schedule of Values allocated to portions of the Work, included with the Contractor's Progress Schedule, and supported by such data to substantiate the accuracy as the State may require. This Schedule of Values, unless objected to by the State, shall be used as a basis for progress payments.

8.2 **TIMELINESS OF PAYMENTS**

8.2.1 Upon receipt of a payment request by the designated State's Representative with updated Progress Schedule from the Contractor, the State will review same to determine if it is a proper payment request based on the approved Schedule of Values. Any payment request determined by the State not to be suitable for payment shall be modified and processed in accordance with the State's assessment or returned to the Contractor for resubmittal. The reason(s) the payment request was deemed unsuitable shall be stated in writing.

8.2.2 Actual payment request submittal date shall be established by the State. Thereafter, the payment request submittal date will be monthly on the same date.

8.2.3 The State will make progress payments pursuant to Public Contract Code, Section 10261.5.

8.3 **RETENTIONS**

8.3.1 Upon submittal and receipt of a monthly payment request in accordance with Paragraph 8.2 above, the following shall apply:

.1 The Contractor's payment request shall include the total amount of Work completed to date, including materials as verified by the State, furnished and delivered on the Project site, not used, or in a secure off-site facility, pursuant to Public Contract Code, Section 10261. All materials included in the Contractor's payment requests furnished and delivered on the Project site, not used, and /or in a secure off-site facility shall be used exclusively for the Project. It shall be the sole responsibility of the Contractor to maintain, protect and secure such materials.

.2 The State shall retain not less than 5 percent of the estimated value of Work completed.

8.3.2 Securities in Lieu of Retention: At the request and expense of the Contractor, and in accordance with Public Contract Code, Section 10263, the Contractor may provide securities in lieu of retention.

8.4 **ASSIGNMENT OF CONTRACT FUNDS:** The Contractor may assign moneys due or to become due under the Contract, through an amendment to the Contract. Any assignment of moneys earned by the Contractor shall be subject to proper retention in favor of the State and to deductions provided for in the Contract. Moneys withheld, whether assigned or not, are subject to being used by the State to the extent permitted by law, for the Completion of the Work in the event that the Contractor is in default of the Contract.

8.5 **OCCUPANCY BY THE STATE PRIOR TO COMPLETION OF THE WORK**

8.5.1 The State reserves the right to occupy all or any part of the Project prior to Completion of the Work, upon written notice. Such occupancy or use is herein referred to as Beneficial Occupancy. In this event, the Contractor shall be relieved of responsibility to the State for liability arising out of such occupancy by the State. Nevertheless, the Builder's Risk Coverage must remain in effect, with either a "consent to occupy" endorsement or a waiver of occupancy endorsement, with no right of recovery against the State.

8.5.2 The State's Beneficial Occupancy does not constitute Completion of the Work or Acceptance of the Work by the State, or any portion of the Work, nor will it relieve the Contractor of responsibility for correcting defective Work or materials found at any time before Acceptance of the Work, as set forth in Article 12 or during the Guarantee period as set forth in Paragraph 3.5, or after the State's acceptance, as set forth in Subparagraph 8.6.1. However, when the Project includes separate buildings, and one or more of the buildings is entirely occupied by the State, then upon written request by the Contractor and by written consent from the State, the Guarantee period will commence to run from the date of the State's occupancy of such building or buildings.

8.6 **ACCEPTANCE OF THE WORK AND FINAL PAYMENT**

8.6.1 When the Contractor considers the Work complete, the Contractor shall request a final inspection in writing to be conducted by the State.

.1 The Contractor shall request this final inspection only when all Work, including deficient items identified on previous inspections, have been completed and deliverables delivered as noted in the Project Manual, Section 01 77 00.

.2 The State Representative shall conduct a final inspection within 14 days of receipt of a written request from the Contractor for final inspection.

.3 If, after the inspection, the State Representative determines that the Work is complete, the State Representative will establish a date for Completion of the Work. The State Representative will then recommend to the Director of the Department of General Services, or the Director's designee, to accept the Work within 60 days from the

date of Completion of the Work.

.4 Upon Acceptance of the Work by the Director:
   a) The Retention held by the State will be released, and
   b) The Contractor will be relieved of the duty of maintaining and protecting the Work.

.5 If the State determines that the Work is not complete, the Contractor will be notified in writing of deficiencies. After correcting all deficiencies the Contractor shall again initiate the procedures for final inspection as set forth above. If the process of re-inspection and correction of deficiencies goes beyond the Contract Time, the Contractor shall be assessed liquidated damages.

.6 Determination by the State that the Work is complete or Acceptance of the Work will not bar any Claim against the Contractor pursuant to Paragraph 3.5.

8.6.2 Upon Acceptance of the Work, the State will submit a final statement to the Contractor:

.1 The final statement shall take into account the Contract Sum as adjusted by any Change Orders, amounts already paid to the Contractor, sums to be withheld for incomplete Work, liquidated damages, stop notices, and for any other cause under the Contract.

.2 A warrant in the amount of the sum due the Contractor, if any, will be issued.

.3 If the Contractor owes any amount to the State, the final statement shall serve as an invoice to the Contractor.

8.6.3 The Contractor is required to pay Subcontractors from which a Retention has been withheld within 7 days of receipt from the State of Retention proceeds.

8.6.4 The Contractor has 30 days after receipt of the final statement to file a Claim with the State.

.1 All Claims shall comply with the requirements of Subparagraph 9.1.2.

.2 Failure to file a Claim within the 30 day period constitutes a failure to diligently pursue and exhaust the required administrative procedures set forth in the Contract. Such failure shall constitute waiver of additional rights to compensation under the Contract or the right to request Equitable Adjustment.

.3 If the Contractor does not file a Claim within the 30 day period, the final warrant made by the State will become a complete and final settlement between the State and the Contractor.

8.7 **INTEREST:** Payments due and unpaid under the Contract shall earn interest pursuant to Public Contract Code, Sections 7107 and 10261.5.

ARTICLE 9 - DISPUTES AND CLAIMS

9.1 DISPUTE AND CLAIM PROCEDURES

9.1.1 Dispute as to Contract Requirements: When the Contractor and the State fail to agree whether or not any work is within the scope of Contract requirements, the Contractor shall immediately perform such work upon receipt of a written notice to do so by the State. Within 14 days after receipt of such notice to perform disputed work, the Contractor may submit a written protest to the State, specifying in detail the Contract requirements that were exceeded, and approximate change in cost resulting so that the State will have notice of a potential Claim. Failure to submit a protest within the specified period shall constitute a waiver of any and all rights to an adjustment in Contract Sum and Contract Time due to such work, and the Contractor thereafter shall not be entitled to adjustment of Contract Sum or Contract Time. For any such work that is found to exceed Contract requirements, there shall be an adjustment in Contract Sum and Contract Time on same basis as any other change in the Work.

.1 The Contractor shall provide supporting data and shall provide and maintain records of costs attributable to Disputes in similar manner as for Change Orders in Article 6.

.2 The State's Representative and the Contractor's Superintendent will make every reasonable effort to resolve the Dispute prior to proceeding to the next step.

.3 Either the State or the Contractor may call a special meeting for the purpose of resolving the Dispute. Such a meeting will be held within 7 days of written request thereof.

.4 If the Dispute as to the Contract Documents has not been resolved, the Contractor shall, within 14 days after the special meeting, take one or more of the following actions:
   .1 submit additional supporting data requested by the State;
   .2 modify the initial Dispute; or
   .3 notify the State that the initial Dispute stands as is.

.5 If the Dispute has not been resolved within 7 days after the Contractor's action in response to Clause 9.1.1.4, another meeting may be scheduled, at the State's option, with senior management personnel of the State and the Contractor. The purpose of this meeting is to resolve the Dispute prior to proceeding to the action under

Subparagraph 9.1.2.

9.1.2 Claim Submission and Documentation: If a Dispute has not been resolved at the time of the State's final statement, the Contractor shall submit within 30 days a Claim along with detailed documentation required by Subparagraph 9.1.1 for the State's consideration.

.1 The Contractor shall furnish 3 certified copies of the required Claim documentation. The Claim documentation shall be complete when furnished. The evaluation of the Contractor's Claim will be based upon State records and the Claim documents furnished by the Contractor.

.2 Claim documentation shall conform to generally accepted accounting principles and shall be in the following format:

- .1 General Introduction
- .2 General Background Discussion
- .3 Issues
  - .1 Index of Issues (listed numerically)
  - .2 For each issue
    - .1 Background
    - .2 Chronology
    - .3 Contractor's position (reason for State's potential liability)
    - .4 Supporting documentation of merit or entitlement
    - .5 Supporting documentation of damages
    - .6 Begin each issue on a new page
- .4 All critical path method (CPM) schedules, both as-planned, monthly updates, schedule revisions, and as-built along with the computer disks of all schedules related to the Claim.
- .5 Productivity exhibits (if appropriate)
- .6 Summary of Issues and Damages

.3 Supporting documentation of merit for each issue shall be cited by reference, photocopies, or explanation. Supporting documentation may include, but shall not be limited to, General Conditions; General Requirements; technical Specifications; Drawings; correspondence; conference notes; Shop Drawings and submittals; Shop Drawing logs; survey books; inspection reports; delivery schedules; test reports; daily reports; subcontracts; fragmentary critical path method (CPM) schedules or time impact analyses; photographs; technical reports; requests for information; field instructions; and all other related records necessary to support the Contractor's Claim.

.4 Supporting documentation of damages for each issue shall be cited, photocopied, or explained. Supporting documentation may include, but shall not be limited to, documents related to the preparation and submission of the bid; certified, detailed labor records, including labor distribution reports; material and equipment procurement records; construction equipment ownership costs records or rental records; Subcontractor or vendor files and cost records; service cost records; purchase orders; invoices; Project as-planned and as-built cost records; general ledger records; variance reports; accounting adjustment records; and any other accounting materials necessary to support the Contractor's Claim.

.5 Each copy of the Claim documentation shall be certified by a responsible officer of the Contractor in accordance with the requirements of the Contract Documents.

.6 Should the Contractor be unable to support any part of the Claim, and it is determined that such inability is attributable to falsity of such certification or misrepresentation of fact or fraud on the part of the Contractor, the Contractor shall be liable to the State as provided for under California Government Code, Section 12650 et seq., known as the False Claims Act.

.7 The State will render a written decision to the Contractor relative to the Claim. The State's written decision shall be final and binding on the party(ies) but subject to arbitration. The State may withhold from the final payment an amount not to exceed 150 percent of the disputed amount. If there is a Surety and there appears to be a possibility of a Contractor's default, the State may, but is not obligated to, notify the Surety and request the Surety's assistance in resolving the controversy.

.8 All issue items to be included in the Complaint in Arbitration shall be a part of the Claim submitted with the required documentation under this Subparagraph 9.1.2. Issues not included in the Claim under Subparagraph 9.1.2 shall not be considered.

9.1.3 Arbitration: Any Claim filed in compliance with Subparagraph 9.1.2 not resolved by the above procedures shall be resolved by arbitration in accordance with the provisions of Public Contract Code Section 10240 et seq., and Title 1, California Code of Regulations, Section 1300 et seq., unless the State and the Contractor agree in writing to waive arbitration and proceed to litigation. Either party may initiate arbitration by filing a Complaint in Arbitration with the Office of Administrative Hearings in

Sacramento, California, in compliance with the requirements of Public Contract Code Section 10240, et seq., and Title 1, California Code of Regulations, Section 1300 et seq. Arbitration shall be conducted in Sacramento, California.

9.2 AUDIT AND ACCESS TO RECORDS

9.2.1 The Contractor shall maintain books, records, documents, and other evidence directly pertinent to the performance of the Work under this Contract, in accordance with generally accepted accounting principles and practices consistently applied. The Contractor shall also maintain all financial information and data used by the Contractor in the preparation or support of any cost submission, including the Contractor's original bid required for this Contract, or any Change Order, Claim, or other request for equitable adjustment, and a copy of the cost summary or information submitted to the State. The State's Representative shall have access upon 24 hours advance written notice, at all times during normal business hours, to such books, records, documents, financial information, and all other evidence for the purpose of inspection, audit, and copying. The Contractor shall, at no cost to the State, provide proper facilities for such access, inspection and copying purposes.

9.2.2 The Contractor agrees to make the provisions of Paragraph 9.2 applicable to this Contract, and Change Orders, Claims, or other requests for Equitable Adjustment affecting the Contract Time or Contract Sum. The Contractor agrees to include the provisions of Paragraph 9.2 in subcontracts and sub-subcontracts or purchase orders, at any tier, and make Paragraph 9.2 applicable to subcontracts, at any tier, in excess of $10,000, and to make the provisions of Paragraph 9.2 applicable to Change Orders, Claims, and other requests for Equitable Adjustment related to Project performance.

9.2.3 Audits conducted under Paragraph 9.2 shall be in accordance with general accepted auditing standards and established procedures and guidelines of the reviewing or audit agency.

9.2.4 The Contractor agrees to the disclosure of all information and reports resulting from access to records under the provisions of Paragraph 9.2, to the State, and other affected agencies.

9.2.5 Records under the provisions of Paragraph 9.2 shall be maintained and made available during the performance of the Work under this Contract until 3 years past final payment, and until final settlement of all Disputes, Claims, or litigation, whichever occurs later. In addition, those records which relate to any portion of this Contract, to any Change Order, to any Dispute, to any litigation, to the settlement of any Claim arising out of such performance, or to the cost or items to which an audit exception has been taken, shall be maintained and made available until final payment or final resolution of such Dispute, litigation, Claim, or exception, whichever occurs later.

9.2.6 The right of access provisions of Paragraph 9.2 applies to financial records pertaining to this Contract and Change Orders and Claims. In addition, this right of access applies to records pertaining to all contracts, Change Orders, and Contract Amendments:

.1 To the extent the records pertain directly to Contract performance;
.2 If there is any indication that fraud, gross abuse, or corrupt practices may be involved;
.3 If the Contract is terminated for default or convenience.

9.2.7 Access to records is not limited to the required retention periods. The authorized State Representatives shall have access to records at any reasonable time for as long as the records are maintained.

9.2.8 Further, the Contractor agrees to include a similar right of the State to audit records and interview staff in any subcontract related to performance of this Agreement, in regards to the Disabled Veterans Business Enterprise (DVBE) Program.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY OF PERSONS AND PROPERTY

10.1.1 The Contractor shall initiate, maintain and supervise safety precautions and programs in connection with the performance of the Work.

10.1.2 The Contractor shall take precautions for safety and provide protection to prevent damage, injury or loss to:

.1 Employees working under the Contract and other persons who may be affected thereby;
.2 The Work and materials and equipment to be incorporated therein, whether in storage on or off the Project site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
.3 Other property at the Project site, or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities, except as otherwise noted or specified.

10.1.3 The Contractor shall comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on the safety of persons or property, or their protection from damage, injury or loss.

10.1.4 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying the State, other Owners (other than the State) and users of adjacent sites and utilities.

10.1.5 The Contractor shall comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities regarding the storage and/or use of explosives or other hazardous materials or equipment necessary for execution of Work. The Contractor shall employ properly qualified personnel for supervision of same.

10.1.6 The Contractor shall remedy damage and loss to property referred to in Clauses 10.1.2.2 and 10.1.2.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Clauses 10.1.2.2 and 10.1.2.3. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.19.

10.1.7 The Contractor shall not permit any part of the Work or Project site to be loaded so as to endanger its safety.

10.1.8 When conditions of the Work, in the judgment of the State, present risk of injury or death to persons or property damage, the State, may direct the Contractor, at the Contractor's sole expense, to close down the Work and not commence work again until dangerous conditions are eliminated.

10.1.9 The Contractor, at the Contractor's own cost, shall rebuild, repair, restore and make good damages to any portion of the Work affected by such causes before Acceptance of the Work.

10.2 **EMERGENCIES:** In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's sole discretion, to prevent any threatened damage, injury or loss. Additional compensation or extension of Contract Time claimed by the Contractor because of an emergency will be reviewed as provided in Article 6.

10.3 **DRUG-FREE WORKPLACE**

10.3.1 By signing the Agreement, the Contractor certifies, under penalty of perjury under the laws of the State of California, that the Contractor will comply with the requirements of the Drug-Free Workplace Act of 1990 (Government Code, Section 8350 et seq.), and will provide a drug-free workplace by taking the following actions:

.1 Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations.

.2 Establish a Drug-Free Awareness Program to inform employees about:

.1 The dangers of drug abuse in the workplace;

.2 The person's or company's policy of maintaining a drug-free workplace;

.3 Any available counseling, rehabilitation, and employee assistance programs; and,

.4 penalties that may be imposed upon employees for drug abuse violations.

.3 Provide, as required by Government Code, Section 8355(c), that every employee who works under the Contract will:

.1 receive a copy of the company's drug-free workplace policy statement; and

.2 agree to abide by the terms of the company's statement as a condition of employment.

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTOR'S INSURANCE

11.1.1 General Insurance Requirements:

.1 Contractor shall procure and maintain insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder and the results of that work by the Contractor, its agents, representatives, employees or subcontractors.

.1 Contractor shall furnish the State with original certificates and endorsements effecting coverage required by this clause. All certificates and endorsements are to be received and approved by the State before work commences.

.2 The State reserves the right to require complete, certified copies of all required insurance policies, including endorsements affecting the coverage required by these specifications at any time.

.2 Insurance Companies shall be acceptable to Department of General Services (DGS) and Office of Risk and Insurance Management (ORIM). Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A-VI. Exception may be made for the State Compensation Insurance Fund. If self-insured, review of financial information may be required.

.3 Except as otherwise provided for Builders Risk/Installation Floater under Clause 11.1.2.4, all coverage shall be in force until the Acceptance of the Work by the Director of DGS. If the insurance expires, the Contractor shall immediately provide a new current certificate or be declared in breach of Contract. The State reserves the right to withhold all progress and retention payments until the breach is cured to the satisfaction of the State. Renewal insurance certificates must be tendered to the State prior to or exactly at the expiration of the previous insurance certificate. There shall be no gap in insurance coverage. This renewed insurance shall be in accordance with the terms of the Contract.

.4 Insurance policies shall contain a provision that coverage will not be cancelled without 30 days prior written notice to the State.

.5 The Contractor shall be responsible for any deductible or self-insured retention contained within the insurance.

.6 In the event the Contractor fails to keep in effect at all times the specified insurance coverage, the State may, in addition to the remedies noted in Article 11.1.1.3 above and any other remedies it may have, remove the Contractor from the work site and/or may terminate this Contract upon the occurrence of such event, subject to the provisions of this Contract. In the event, the State elects to remove the Contractor from the work site, the Contractor will not be entitled to additional days or compensation.

.7 Any insurance required to be carried shall be primary.

.8 Minimum Scope of Insurance - Coverage shall be at least as broad as:

.1 Insurance Services Office Commercial General Liability coverage (occurrence Form CG 0001). The insurance Certificate shall show the GL form number.

.2 Insurance Services Office Form Number CA 0001 covering Automobile Liability, "any auto", or "scheduled, hired and nonowned".

.9 The State reserves the right to require the Contractor to provide the subcontractors' insurance certificates and policies, when so directed by the State.

11.1.2 Insurance Requirements: The Contractor shall furnish to the State evidence of the required insurance as follows:

.1 Commercial General Liability: The Contractor shall maintain commercial general liability with limits of not less than $5,000,000 per occurrence for bodily injury and property damage liability combined. If Commercial General Liability insurance or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit. If the aggregate applies "per project or location", it shall so state on the certificate. The policy shall include coverage for liabilities arising out of premises, operations, independent contractors, products, completed operations, personal and advertising injury, and liability assumed under an insured contract. This insurance shall apply separately to each insured against whom claim is made or suit is brought subject to the Contractor's limit of liability. The policy shall include the Department of General Services and the State of California, its officers, agents, and employees, as additional insureds, but only insofar as the operations under the Contract are concerned.

.1 Additional Insured coverage shall be provided in the form of an insured endorsement (CG 20 10 11 85 r equivalent) to the contractor's insurance policy. The endorsement must be attached to the certificate.

.2 Deductibles and Self-Insured Retentions (for Commercial General Liability): Any deductibles or self-insured retentions must be declared to and approved by the State. At the option of the State, either: the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the State of California and the Department of General Services, its officers, agents, employees and servants or the Contractor shall provide a financial guarantee satisfactory to the State guaranteeing payment of losses and related investigations, claim administration, and defense expenses.

.2 Automobile Liability: The Contractor shall maintain motor vehicle liability with limits of not less than $1,000,000 per accident for bodily injury and property damage. The State is to be covered as additional insured with respect to liability arising out of automobiles owned, leased, hired or borrowed by or on behalf of the contractor.

.3 Workers' Compensation: The Contractor shall maintain statutory workers' compensation and employer's liability coverage for all its employees who will be engaged in the performance of the Contract, including special coverage extensions where applicable as required by the State of California. The Workers' Compensation policy shall be endorsed with a waiver of subrogation in favor of the State for all work performed by the contractor, its employees, agents and subcontractors. Except for State Fund, all subrogation waiver endorsements shall be on a separate form attached to the certificate. The Contractor shall maintain Employer's Liability coverage of $1,000,000 per accident for bodily injury or disease.

.4 Builders Risk/Installation Floater: The Contractor shall maintain in force, at its own expense, Builders Risk/Installation Floater covering the Contractor's labor, materials, and equipment to be used for completion of the Work performed under this Contract against all risks of direct physical loss, excluding earthquake and flood, for an amount equal to the full amount of the Contract Sum.

.1 The Contractor agrees as a provision of the contract to waive all rights of recovery against the State.

.2 The State of California, Department of General Services shall be a named insured or additional insured under the policy.

.3 The policy shall have a loss payable clause in favor of the State of California, Department of General Services.

.4 The requirement for maintaining the Builders Risk/Installation Floater shall be in full force at all times during the entire duration of the Contract Time without any gaps, delays or breaks in coverage. This includes Beneficial Occupancy and authorized adjustment for time extensions. Coverage shall be maintained until Completion of the Work, except for delivery of as-built drawings, operation and maintenance manuals, guarantees, warranties, spare parts, reports and certifications as noted in the Closeout Procedures section of the Project Manual and as determined by the State's Representative in writing.

11.1.3 Neither the State, nor any officer or employee of the State, shall be liable for any loss or damage that may happen to the Work, or any part thereof; nor to any of the materials or other items used or employed in performing the Work; nor for injury to any person or persons, either workers or the public, for damage to property from any cause which might have been prevented by the Contractor, or the Contractor's employees or agents, against all of which injuries or damages the Contractor shall properly guard. The Contractor shall indemnify and hold harmless the State, and all officers and employees of the State, from all suits, actions or claims brought for, or on account of injuries or damages received or sustained by any person or persons, by or from the Contractor, the Contractor's employees or agents, in construction of the Work, or by or in consequence of the Contractor's failure to properly guard the same, or by or as a result of any act or omission of the Contractor, the Contractor's employees or agents. In addition to any remedy authorized by law, moneys due the Contractor under the Contract, as considered necessary by the State, may be retained until disposition has been made of such suits, actions, or claims for damages; however, this provision shall not be construed as precluding the State from enforcing any right of offset the State may have to any such moneys.

11.2 **NO PERSONAL LIABILITY:** Neither the State, nor any other officer or employee of the State will be personally responsible for liabilities arising under the Contract.

11.3 **PERFORMANCE BOND AND PAYMENT BOND**

11.3.1 The Contractor shall furnish bonds, each in the amount of 100 percent of the Contract Sum, covering faithful performance of the Contract and payment of obligations arising thereunder, as stipulated in the bidding requirements or as specifically required in the Contract Documents.

11.3.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bond(s) or permit a copy to be made.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

12.1 UNCOVERING AND CORRECTION OF WORK

12.1.1 If a portion of the Work is covered prior to the State's review, it shall, if requested in writing by the State, be uncovered for the State's observation and replaced at the Contractor's expense without change in the Contract Time.

12.1.2 The Contractor shall notify the State 2 working days prior to covering any work.

12.2 CORRECTION OF WORK

12.2.1 The Contractor shall promptly correct work rejected by the State or Work failing to conform to the requirements of the Contract Documents, whether or not fabricated, installed or completed. The Contractor shall bear the costs of correcting such rejected work, including additional testing and inspections required and compensation for the State's services and expenses made necessary thereby.

12.2.2 Notwithstanding Paragraph 3.5, in the event of an emergency constituting an immediate hazard to the health or safety of any persons or property, the State may undertake, at the Contractor's expense and without prior notice, work necessary to correct such hazardous condition(s) arising from work performed by the Contractor that is not in conformance with the requirements of the Contract Documents.

12.2.3 The Contractor shall remove from the Project site portions of the Work that are not in accordance with the requirements of the Contract Documents, and are neither corrected by the Contractor nor accepted by the State.

12.2.4 If the Contractor fails to correct nonconforming work, as per Paragraph 3.5, the State may correct the nonconforming work in accordance with Paragraph 2.3. If the Contractor does not proceed with correction of such nonconforming work, within such time fixed by written notice from the State, the State may remove and store the salvable materials articles and/or equipment at the Contractor's expense. If the Contractor does not pay all costs of such removal and storage within 14 days after written notice, the State may, upon 14 additional calendar days written notice, sell such materials articles and/or equipment at an auction or private sale, and shall account for the proceeds thereof, after deducting costs and damages that would have been borne by the Contractor, including compensation for the State's services and expenses made necessary thereby. If the proceeds of a sale do not cover all costs that the Contractor would have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the State.

12.2.5 The Contractor shall bear the cost of correcting destroyed or damaged Work executed by the State or separate contractors, whether fully completed or partially completed, which is caused by the Contractor's correction or removal of Work that is not in accordance with requirements of the Contract Documents.

12.2.6 Nothing contained in this Paragraph 12.2 shall be construed to establish a period of limitation with respect to other obligations that the Contractor might have in the Contract Documents. Establishment of the time period of 1 year, as described in Subparagraph 3.5.1, relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with requirements of the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

12.3 **ACCEPTANCE OF NONCONFORMING WORK:** If the State prefers to accept any or all of the Work that is not in accordance with requirements of the Contract Documents, the State may do so instead of requiring its correction and/or removal, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment to the Contractor has been made.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.1 **GOVERNING LAW:** The Contract shall be governed by the law of the State of California.

13.2 **SUCCESSORS AND ASSIGNS:** The Contract binds the Contractor, the Contractor's partners, successors, assigns and legal representatives to the State in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations in the Contract Documents.

13.3 **WRITTEN NOTICE:** Written notice shall be deemed to have been duly served if delivered in person to the individual; or a member of the firm or entity; or to an officer of the corporation for which it was intended; or if delivered to or sent by US mail to the last business address known to the party giving notice.

13.4 **CONTRACTOR'S USE OF COMPUTER SOFTWARE:** The Contractor, by signing the Agreement, certifies that it has appropriate systems and controls in place to ensure that State funds will not be used in the performance of the Contract for the acquisition, operation or maintenance of computer software in violation of copyright laws.

13.5 **INDEPENDENT CONTRACTOR:** Contractor, and the agents, subcontractors, and employees of the Contractor, in the performance of this Contract, shall act in an independent capacity and not as officers or employees or agents of the State.

13.6 **UNENFORCEABLE PROVISIONS:** In the event that any provision of this Contract is unenforceable or held to be unenforceable, then the parties agree that all other provisions of this Contract have force and effect and shall not be affected thereby.

13.7 **EXPATRIATE CORPORATIONS:** Contractor herby declares that it is not an expatriate corporation or subsidiary of an expatriate corporation within the meaning of Public Contract Code Section 10286 and 10286.1, and is eligible to contract with the State.

13.8 **DOMESTIC PARTNERS:** For Contracts executed or amended after July 1, 2004, the Contractor may elect to offer domestic partner benefits to the Contractor's employees in accordance with Public Contract Code Section 10295.3. However, the Contractor cannot require an employee to cover the costs of providing any benefits which have otherwise been provided to all employees regardless of marital or domestic partner status.

13.9 **AIR OR WATER POLLUTION VIOLATION:** Under the State laws, the Contractor shall not be: (1) in violation of any order or resolution not subject to review promulgated by the State Air Resources Board or an air pollution control district; (2) subject to cease and desist order not subject to review issued pursuant to Section 13301 of the Water Code for violation of waste discharge requirements or discharge prohibitions; or (3) finally determined to be in violation of provisions of federal law relating to air or water pollution.

13.10 **CERTIFICATION BY CONTRACTOR OF DISABLED VETERAN BUSINESS ENTERPRISE/SMALL BUSINESS PARTICIPATION**

13.10.1 If, for this agreement, the Contractor made a commitment to achieve disabled veteran business enterprise (DVBE) participation, the Contractor must certify in writing to the State, the total amount the Contractor received under the contract, the name and address of the DVBE firms that participated in the performance of the contract, the amount each DVBE received from the Contractor, that all payments have been made to the DVBE and the actual percentage of DVBE participation achieved. Additionally, if for this agreement, the Contractor made a commitment to achieve 25% Small Business participation, the Contractor must certify in writing to the State, the actual percentage of Small Business participation that was achieved. The Contractor is instructed to comply with the procedures stated in CLOSEOUT PROCEDURES, Section 01 77 00. This certification shall be completed pursuant to Section 999.5 of the Military and Veterans Code (M&VC) and Section 14841 of the Government Code. A person or entity that knowingly provides false information shall be subject to a civil penalty for each violation.

END OF DOCUMENT

DOCUMENT 00 73 00
SUPPLEMENTARY CONDITIONS

Requirements included herein supplement DOCUMENT 00 72 00 - GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION.

1. ARTICLE 1 – GENERAL PROVISIONS

Paragraph 1.1, DEFINITIONS

Add the following definition:

Construction Manager: A consultant firm, Cumming Group, had been retained for this Project by the State to assist the Department of General Services.

Hazardous Materials: These materials include but are not limited to products and materials containing: Asbestos, Lead, PCB's, Petroleum fuels and lubricants (including chemical additives), oxidizers, corrosives, solvents, acids and carcinogens.

2. ARTICLE 2 – ADMINISTRATION OF THE CONTRACT

Paragraph 2.6, RUSSIAN SANCTION ORDERS

Add the following Subparagraph 2.6

2.6 On March 4, 2022, Governor Gavin Newsom issued Executive Order (EO) N-6-22 regarding Economic Sanctions against Russia and Russian entities and individuals. "Economic Sanctions" refers to sanctions imposed by the U.S. government in response to Russia's actions in Ukraine, as well as any sanctions imposed under state law. The EO directs state agencies to terminate contracts with, and to refrain from entering any new contracts with, individuals or entities that are determined to be a target of Economic Sanctions. Accordingly, should the State determine Contractor is a target of Economic Sanctions or is conducting prohibited transactions with sanctioned individuals or entities, that shall be grounds for termination of this agreement. The State shall provide Contractor advance written notice of such termination, allowing Contractor at least 30 calendar days to provide a written response. Termination shall be at the sole discretion of the State.

3. ARTICLE 3 – CONTRACTOR

Paragraph 3.2, SUPERVISION AND CONSTRUCTION PROCEDURES

Delete Subparagraph 3.2.5 in its entirety and replace it with new Subparagraph 3.2.5 as follows:

3.2.5 Until Acceptance of the Work, the Contractor shall have the charge and care thereof, and shall bear risk of injury or damage to any part of the Work by action on the elements (except for an Act of God, or natural disaster as proclaimed by the State or Federal Government provided that the loss does not involve Contractor negligence and if the Work damaged is built in accordance with the Contract and applicable building standards), or from any other reason except for such damages as are directly caused by acts of the Federal or State Government and the public enemy, except as provided in Paragraph 8.5.

Paragraph 3.3, LABOR AND MATERIALS

Delete Subparagraph 3.3.3 in its entirety and replace it with new Subparagraph 3.3.3 as follows:

3.3.3. Prevailing Wage: The Contractor shall comply with Labor Code Sections 1774 and

1775. Pursuant to Section 1774, the Contractor and every subcontractor, regardless of tier, shall pay not less than the specified prevailing wage rates to all workers employed in the execution of the Contract. In accordance with Section 1775, the Contractor shall forfeit to the State up to $200 for each day, or portion thereof, for each worker paid less than the prevailing wage rates for the work or craft in which the worker is employed for any work executed under the Contract by the Contractor or by any subcontractor, regardless of tier, in violation of the provisions of the Labor Code; and, in particular, Labor Code Sections 1770 to 1780, inclusive. In addition to such forfeiture, the difference between such stipulated prevailing wage rates and the amount paid to each worker for each day, or portion thereof, shall be paid to each underpaid worker by the Contractor. This provision shall not apply to properly registered apprentices.

.1 Pursuant to Labor Code, Section 1770, the Director of the Department of Industrial Relations has ascertained the general prevailing rate of per diem wages and a general prevailing rate for legal holiday and overtime work for each craft required for execution of the Contract. The Contractor shall obtain copies of the prevailing rate of per diem wages from the Department of Industrial Relations, Division of Labor Statistics & Research, PO Box 420603, San Francisco, CA 94142-0603, (415) 703-4780; or wage rates may be accessed on the internet at Prevailing Wage Requirements. The Contractor is responsible to read, understand and comply with all the guidelines, including the fine print in the prevailing wage determinations; and shall post a copy of the prevailing wage rates, specific to the Project, at the Project site.

.2 Wage rates set forth are the minimum that may be paid by the Contractor. Nothing herein shall be construed as preventing the Contractor from paying more than the minimum rates set. No extra compensation will be allowed by the State due to the inability of the Contractor to hire labor at minimum rates, nor for necessity for payment by the Contractor of subsistence, travel time, overtime, or other added compensations, all of which possibilities are elements to be considered and ascertained to the Contractor's own satisfaction in preparing the Bid Form

.3 If it becomes necessary to employ crafts other than those listed in the General Prevailing Wage Rate booklet, the Contractor shall contact the Division of Labor Statistics and Research as noted above. The rates thus determined shall be applicable as minimum for the contract and incorporated in the bid. When the wage determination shows an expiration date (noted by a double asterisk**), to expire during the term of the contract, the Contractor must call or write the DIR to obtain the new rates and incorporate them in the bid to be applicable for the term of the contract.

.4 The Contractor and each subcontractor, regardless of tier, shall keep an accurate payroll record showing the names, addresses, social security numbers, work classifications, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by the Contractor and/or subcontractor in connection with the Work. Payroll records shall be certified and shall be on forms provided by the Division of Labor Standards Enforcement, or shall contain the same information as those forms. The Contractor's and subcontractor's certified payroll records for each employee shall be submitted with each payment request, covering the period of the payment request unless requested otherwise by the Labor Commissioner of the Department of Industrial Relations pursuant to Labor Code Section 1771.4(c)(2)(b) monthly payrolls should be sent directly to the Department of Industrial Relations in the current prescribed electronic format. Refer to Certified Payroll Reporting for access to the electronic Certified Payroll (eCRP) Application.

.5 Labor Compliance Monitoring and Enforcement: This project is subject to monitoring and enforcement by the Department of Industrial Relations (DIR), Compliance Monitoring Unit. All Contractors and subcontractors, regardless of tier, shall be required to comply with the Monitoring and Enforcement Program, including, but not limited to, contractor registration, submittal of electronic certified payroll reports directly to the DIR and cooperation with on-site monitoring by DIR personnel.

Paragraph 3.13, TESTS AND INSPECTIONS

Delete Subparagraph 3.13.1 in its entirety and replace with the following Subparagraph 3.13.1.

3.13.1 The Contractor shall at all times permit the State, its agents, officers, and employees to visit the Project site and inspect the Work, including shops where the work is in preparation. This obligation shall include maintaining proper facilities and safe access for such inspection. Including, but not limited to providing lifts, ladders, scaffolds, platforms and paths of travel. When the Contract Documents require a portion of the Work to be tested, such portion of the work shall not be covered up until inspected and approved by the State. The Contractor shall be solely responsible for notifying the State where and when the work is ready for inspection and testing and shall give written notice no fewer than two business days prior to the time of inspection. For inspections that require the State Fire Marshal's (SFM) presence, the Contractor shall provide the State's Inspector of Record (IOR) written notice where and when the work is ready for inspection no fewer than three business days prior to the time of inspection.

Should any work be covered without the required testing and approval, such work shall be uncovered and recovered at the Contractor's expense.

Delete Subparagraph 3.13.2 in its entirety and replace with the following Subparagraph 3.13.2.

3.13.2 If the State determines that portions of the Work require additional testing, inspection or approval not included in the Contract Documents, the State will instruct the Contractor, in writing, to make arrangements for additional testing, inspection or approval by an entity acceptable to the State, and the Contractor shall give written notice to the State of where and when tests and inspections will be conducted no fewer than two business days prior to the time of the additional testing, inspection or approval so that the State may observe the procedures. For inspections that require the State Fire Marshal's (SFM) presence, the State's Inspector of Record (IOR) will make the necessary arrangements with the SFM. The Contractor shall provide ~~a~~ written notice no fewer than three business days prior to the time of inspection.

The State will bear the costs except as provided in Subparagraph 3.13.3.

Paragraph 3.25, CONTRACTOR REQUIRED NOTIFICATION OF CHANGES

Delete Paragraph 3.25 in its entirety and replace with the following Paragraph 3.25

3.25 CONTRACTOR REQUIRED NOTIFICATION OF CHANGES: The Contractor shall notify the State's Representative in writing of any change to Contractor's name, status, or information including but not limited to:

1. Name
   a. An amendment is required to change the Contractor's name as listed on this Agreement. Upon receipt of Contractor's notification and legal documentation of the name change, the State will process the amendment. Payment of invoices presented with a new name cannot be paid prior to approval of said amendment.
   b. The State shall not be liable for penalties or interest on payments which are delayed due to Contractor's change of name and subsequent amendment processing.
2. Address/Location
3. Federal Employer Identification Number (FEIN)
4. Type of Organization or Legal Status – including:
   a. Corporate
   b. Partnership
   c. Individual/Sole-Ownership

d. Joint Venture
e. Limited Liability Company
f. DBA

5. Ownership
6. Officers or Key Personnel
7. License
8. Other (Bankruptcy, Etc.)

Contractor shall immediately provide an updated Standard Form 204 (IRS/FTB form) to the Architectural, Construction and Engineering Contracts Section within five (5) calendar days of any such relevant change.

The State shall not be liable for penalties or interest on payments which are delayed due to Contractor's lack of proper or timely notice and documentation of a relevant change in status which impacts the State's ability to pay.

Contractor shall submit the firm's status change in writing including the Contract Number, Project Title and all necessary backup and legal documentation to support the status change to:

The State Department of General Services, Administration Division
Office of Business and Acquisition Services, Contracts Services Section
707 Third Street, Suite 2-300
West Sacramento, CA 95605-2811

Paragraph 3.4, NONDISCRIMINATION CLAUSE

Delete Paragraph 3.4 in its entirety and replace with the following:

3.4.1. During the performance of this contract, the recipient, contractor, and its subcontractors shall not deny the contract's benefits to any person on the basis of race, religious creed, color, national origin, ancestry, physical disability, mental disability, medical condition, genetic information, marital status, sex, gender, gender identity, gender expression, age, sexual orientation, or military and veteran status, nor shall they discriminate unlawfully against any employee or applicant for employment because of race, religious creed, color, national origin, ancestry, physical disability, mental disability, medical condition, genetic information, marital status, sex, gender, gender identity, gender expression, age, sexual orientation, or military and veteran status. Contractor shall insure that the evaluation and treatment of employees and applicants for employment are free of such discrimination.

3.4.2. Contractor shall comply with the provisions of the Fair Employment and Housing Act (Gov. Code, § 12900 et seq.), the regulations promulgated thereunder (Cal. Code Regs., tit. 2, § 11000 et seq.), the provisions of Article 9.5, Chapter 1, Part 1, Division 3, Title 2 of the Government Code (Gov. Code, §§ 11135-11139.5), and the regulations or standards adopted by the awarding state agency to implement such article.

3.4.3. Contractor or recipient shall permit access by representatives of the Department of Fair Employment and Housing (DEFH) and the awarding state agency upon reasonable notice at any time during the normal business hours, but in no case less than 24 hours' notice, to such of its books, records, accounts, and all other sources of information and its facilities as said Department or Agency shall require to ascertain compliance with this clause.

3.4.4. Recipient, contractor and its subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement.

3.4.5. The contractor shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the contract.

3.4.6 STANDARD CALIFORNIA NONDISCRIMINATION CONSTRUCTION CONTRACT SPECIFICATIONS (GOV. CODE SECTION 12990)

These specifications are applicable to all state contractors and subcontractors having a construction contract or subcontract of $5,000 or more.

.1 As used in the specifications:

a. “Act” means the Fair Employment and Housing Act.

b. “Administrator” means Administrator, Office of Compliance Programs, California Department of Fair Employment and Housing, or any person to whom the Administrator delegates authority;

.2 Whenever the contractor or any subcontractor subcontracts a portion of the work, it shall include in each subcontract of $5,000 or more the nondiscrimination clause in this contract directly or through incorporation by reference. Any subcontract for work involving a construction trade shall also include the Standard California Construction Contract Specifications, either directly or through incorporation by reference.

.3 The contractor shall implement the specific nondiscrimination standards provided in paragraphs 6(a) through (e) of these specifications.

.4 Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the contractor has a collective bargaining agreement, to refer members of any group protected by the Act shall excuse the contractor's obligations under these specifications, Government Code section 12990, or the regulations promulgated pursuant thereto .5. In order for the nonworking training hours of apprentices and trainees to be counted, such apprentices and trainees must be employed by the contractor during the training period, and the contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor or the California Department of Industrial Relations.

.5 In order for the nonworking training hours of apprentices and trainees to be counted, such apprentices and trainees must be employed by the contractor during the training period, and the contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to

training programs approved by the U.S. Department of Labor or the California Department of Industrial Relations.

.6 The contractor shall take specific actions to implement its nondiscrimination program. The evaluation of the contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The contractor must be able to demonstrate fully its efforts under steps a. through e. below:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and at all facilities at which the contractor's employees are assigned to work. The contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the contractor's obligations to maintain such a working environment.

b. Provide written notification within (7) seven days to the director of the DFEH when the referral process of the union or unions with which the contractor has a collective bargaining agreement has impeded the contractor's efforts to meet its obligations.

c. Disseminate the contractor's equal employment opportunity policy by providing notice of the policy to unions and training, recruitment and outreach programs and requesting their cooperation in assisting the contractor to meet its obligations; and by posting the company policy on bulletin boards accessible to all employees at each location where construction work is performed.

d. Ensure all personnel making management and employment decisions regarding hiring, assignment, layoff, termination, conditions of work, training, rates of pay or other employment decisions, including all supervisory personnel, superintendents, general foremen, on-site foremen, etc., are aware of the contractor's equal employment opportunity policy and obligations, and discharge their responsibilities accordingly.

e. Ensure that seniority practices, job classifications, work assignments, and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the equal employment opportunity policy and the contractor's obligations under these specifications are being carried out.

.7 Contractors are encouraged to participate in voluntary associations that assist in fulfilling their equal employment opportunity obligations. The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on equal employment opportunity in the industry, ensures that the concrete benefits of the program are reflected in the contractor's workforce participation, and can provide access to documentation that

demonstrates the effectiveness of actions taken on behalf of the contractor. The obligation to comply, however, is the contractor's.

.8 The contractor is required to provide equal employment opportunity for all persons. Consequently, the contractor may be in violation of the Fair Employment and Housing Act (Government Code section 12990 et seq.) if a particular group is employed in a substantially disparate manner.

.9 The contractor shall not use the nondiscrimination standards to discriminate against any person because race, religious creed, color, national origin, ancestry, physical disability, mental disability, medical condition, genetic information, marital status, sex, gender, gender identity, gender expression, age, sexual orientation, or military and veteran status.

.10 The contractor shall not enter into any subcontract with any person or firm decertified from state contracts pursuant to Government Code section 12990.

.11 The contractor shall carry out such sanctions and penalties for violation of these specifications and the nondiscrimination clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Government Code section 12990 and its implementing regulations by the awarding agency. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Government Code section 12990.

.12 The contractor shall designate a responsible official to monitor all employment related activity to ensure that the company equal employment opportunity policy is being carried out, to submit reports relating to the provisions hereof as may be required by OCP and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, status, (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in any easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

4. ARTICLE 4 – SUBCONTRACTORS

Paragraph 4.2, SUBCONTRACTUAL RELATIONS

Delete Paragraph 4.2.2 and replace it with the following Paragraph 4.2.2:

4.2.2 Subcontractor Payments: Subcontractors and Sub-subcontractors shall be paid for work performed in accordance with Public Contract Code Sections 10262 and 10262.5.

Delete Paragraph 4.3 and replace it with the following Paragraph 4.3

4.3 DISABLED VETERAN BUSINESS ENTERPRISE PROGRAM: Pursuant to Public Contract Code (PCC) Section 10115 et. seq., the Contractor shall use, employ and utilize Disabled Veteran Business Enterprise (DVBE) subcontractors, sub-subcontractors or material

suppliers who were listed in their bid documents for DVBE Program participation, to the full extent of the amount of money and/or percentage of commitment manifested in the bid documents. If the Contractor wishes to substitute any listed DVBE subcontractors, sub-subcontractors or material suppliers for just and legal cause, the Contractor shall follow the dictates of PCC Sections 4107 and 10115.12b, as well as Military and Veterans Code (M&VC) Section 999.5(e) and California Code of Regulations, Title 2, Section 1896.64. The DVBE may only be replaced by another DVBE and shall obtain the written authorization of the State prior to any such substitutions. The Contractor shall not unilaterally substitute a listed DVBE subcontractor, sub-subcontractor or material supplier. Failure of Contractor to seek substitution and adhere to the DVBE participation requirement identified in the bid may be cause for contract termination, recovery of damages under rights and remedies due to the State, and penalties as outlined in M&VC Section 999.9; PCC Sections 4110 and PCC Section 10115.10.

5. ARTICLE 7 – TIME

Paragraph 7.2, CONTRACT TIME

Delete Subparagraph 7.2.1 and replace it with the following Subparagraph 7.2.1:

7.2.1 Time is of the Essence in this Contract. The Contractor shall complete all the Work of the Contract within the Contract Time of:

FIVE HUNDRED AND FIFTEEN (515)

calendar days, starting on the Start Date stipulated in the Notice to Proceed, which the Contractor will receive not less than 5 days in advance.

Add the following Subparagraph 7.2.2:

7.2.2 City of Delano Work: Within the Contract Time specified in Subparagraph 7.2.1, Contractor shall complete the DMV Delano Off-Site Improvement Plans work in accordance with the following schedule; commencing on same date as the entire Contract:

.1 Complete submittals for work on City of Delano Property within the following number of calendar days: FOURTEEN (14)

.2 Allow the following number of calendar days for the State's review and acceptance of City of Delano Property submittals: FOURTEEN (14)

.3 Complete City of Delano Property work within the following number of working days: THIRTY (30)

Paragraph 7.3, LIQUIDATED DAMAGES

Add the following Subparagraphs 7.3.1 and 7.3.2:

7.3.1 The Contractor shall pay to the State the sum of $3900 per day for each and every calendar day delay in finishing of Work under this Contract beyond the Contract time.

7.3.2 If the Contractor is more than 14 calendar days behind schedule at any point during the Contract Time, based on the latest updated Official Progress Schedule, the State will withhold $3900 per day for each and every day that the Contractor is behind schedule from the monthly payment for that month. If the Contractor recoups all or a portion of the delay

during the next pay period, the amount withheld will be reduced accordingly.

6. ARTICLE 8 – PAYMENTS AND COMPLETION

Paragraph 8.2, TIMELINESS OF PAYMENTS

Delete Paragraph 8.2.3 and replace it with following Paragraph 8.2.3:

8.2.3 The State will make progress payments pursuant to Public Contract Code, Sections 10261 and 10261.5.

Paragraph 8.3, RETENTIONS

Delete Subparagraph 8.3.1.2 and replace it with the following Subparagraph 8.3.1.2:

.2 The State shall retain 5 percent of the estimated value of Work completed.

Paragraph 8.5, OCCUPANCY BY THE STATE PRIOR TO COMPLETION OF THE WORK

Delete Paragraph 8.5.1 and replace it with the following:

8.5.1 The State reserves the right to occupy all or any part of the Project prior to Completion of the Work, upon written notice. Such occupancy or use is herein referred to as Beneficial Occupancy. In this event, the Contractor shall be relieved of responsibility to the State for liability arising out of such occupancy by the State.

7. ARTICLE 11 – INSURANCE AND BONDS

Paragraph 11.1, CONTRACTOR'S INSURANCE

Delete Paragraph 11.1 and replace it with the following 11.1:

11.1 CONTRACTOR'S INSURANCE

11.1.1 General Insurance Requirements:

.1 Contractor shall procure and maintain insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder and the results of that work by the Contractor, its agents, representatives, employees or subcontractors.

.1 Contractor shall furnish the State with certificates and endorsements effecting coverage required by this clause. All certificates and endorsements are to be received and approved by the State before work commences.

.2 The State reserves the right to require complete, certified copies of all required insurance policies, including endorsements affecting the coverage required by these specifications at any time.

.2 Insurance Companies shall be acceptable to Department of General Services (DGS) and Office of Risk and Insurance Management (ORIM). Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A-VII, unless otherwise acceptable to DGS, Office of Risk and Insurance Management. Exception may be made for the State Compensation Insurance Fund. If self-insured, review of financial information may be required.

.3 Except as otherwise provided for Builders Risk/Installation Floater under Clause 11.1.2.4, all coverage shall be in force until the Acceptance of the Work by the Director of DGS. If the

insurance expires, the Contractor shall immediately provide a new current certificate or be declared in breach of Contract. The State reserves the right to withhold all progress and retention payments until the breach is cured to the satisfaction of the State. Renewal insurance certificates must be tendered to the State prior to or exactly at the expiration of the previous insurance certificate. There shall be no gap in insurance coverage. This renewed insurance shall be in accordance with the terms of the Contract.

.4 Contractor is responsible to notify the State a minimum of five (5) business days before the effective date of any cancellation, non-renewal or material change that affects required insurance coverage.

.5 Unless otherwise stated in the contract, the Contractor shall be responsible for any premium deductible or self-insured retention contained within the insurance.

.6 All insurance policies required by this contract must allow the State to pay and/or act as the contractor's agent in satisfying any self-insured retention (SIR). The choice to pay and/or act as the contractor's agent in satisfying any SIR is at the State's discretion.

.7 In the event the Contractor fails to keep in effect at all times the specified insurance coverage, the State may, in addition to the remedies noted in Article 11.1.1.3 above and any other remedies it may have, remove the Contractor from the work site and/or may terminate this Contract upon the occurrence of such event, subject to the provisions of this Contract.

In the event, the State elects to remove the Contractor from the work site, the Contractor will not be entitled to additional days or compensation.

.8 Any insurance required to be carried shall be primary and not excess or contributory, to any other insurance carried by the State.

.9 Any required endorsement requested by the State must be submitted with all requested certificates of insurance and not substituted by referring to such coverage on the certificate of insurance.

.10 Minimum Scope of Insurance - Coverage shall be at least as broad as:

.1 Insurance Services Office Commercial General Liability coverage (occurrence Form CG 0001). .2 Insurance Services Office Form Number CA 0001 covering Automobile Liability, "any auto", or "all owned, hired and non-owned".

.11 All coverage and limits available to the contractor shall also be available and applicable to the State.

.12 Contractor shall procure and maintain insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees, or subcontractors.

.13 With the exception of Builders Risk/Installation Floater, Contractor shall require and verify that all subcontractors maintain insurance coverage and limits meeting or exceeding all the requirements stated herein. Contractor shall ensure that the Department of General Services and the State of California, its officers, agents, and employees, as additional insured on insurance required from subcontractors but only insofar as the operations under the Contract are concerned. For Commercial General Liability coverage subcontractors shall provide coverage with a form at least as broad as CG 20 38 04 13. The State reserves the right to require the Contractor to provide the subcontractors' insurance certificates and policies, when so directed by the State.

11.1.2 Insurance Requirements: The Contractor shall furnish to the State evidence of the required insurance as follows:

.1 Commercial General Liability: The Contractor shall maintain commercial general liability with limits of not less than $5,000,000 per occurrence for bodily injury and property damage liability combined. If Commercial General Liability insurance or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit. If the aggregate applies "per project or location", it shall so state on the certificate. The policy

shall include coverage for liabilities arising out of premises, operations, independent contractors, products, completed operations, personal and advertising injury, and liability assumed under an insured contract. This insurance shall apply separately to each insured against whom claim is made or suit is brought subject to the Contractor's limit of liability. The policy shall include the Department of General Services and the State of California, its officers, agents, and employees, as additional insureds, but only insofar as the operations under the Contract are concerned.

.1 Additional Insured coverage shall be provided in the form of an insured endorsement as broad as the (CG 20 10 11 85) to the contractor's insurance policy. All coverage and limits available to the named insured shall be available and applicable to the additional insured. The endorsement must be attached to the certificate.

.2 Deductibles and Self-Insured Retentions (for Commercial General Liability): Any deductibles or self-insured retentions must be declared to and approved by the State. At the option of the State, either: the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the State of California and the Department of General Services, its officers, agents, employees and servants or the Contractor shall provide a financial guarantee satisfactory to the State guaranteeing payment of losses and related investigations, claim administration, and defense expenses.

.2 Automobile Liability: The Contractor shall maintain motor vehicle liability with limits of not less than $1,000,000 per accident for bodily injury and property damage. The State is to be covered as additional insured with respect to liability arising out of automobiles owned, leased, hired or borrowed by or on behalf of the contractor. The policy shall include the Department of General Services and The State of California, its officers, agents, and employees, as additional insureds, but only insofar as the operations under the Contract are concerned. All coverage and limits available to the named insured shall also be available and applicable to the additional insured.

.3 Workers' Compensation: The Contractor shall maintain statutory workers' compensation and employer's liability coverage for all its employees who will be engaged in the performance of the Contract, including special coverage extensions where applicable as required by the State of California. The Workers' Compensation policy shall be endorsed with a waiver of subrogation in favor of the State for all work performed by the contractor, its employees, agents and subcontractors. Except for State Fund certificates, all subrogation waiver endorsements shall be submitted on a separate form. The Contractor shall maintain Employer's Liability coverage of $1,000,000 per accident for bodily injury or disease.

.4 Builders Risk/Installation Floater: The State shall insure all Work while in the course of construction, reconstruction, remodeling or alteration, including materials incorporated in the Work, against physical loss or damage resulting from the perils normally insured under an All Risk Builders Risk/Installation Floater policy, including, but not limited to theft, fire and vandalism. The State will self-insure against Acts of God and natural disasters proclaimed by the State or Federal Government. The State will issue to the Contractor a "Summary of Coverage" provided under this Clause 11.1.2.4 Summary of Coverage and Certificate of Insurance will be provided to contractor as part of the executed contract.

.1 Contractor shall be responsible for paying a deductible not to exceed $50,000 for water damage and $25,000 for all other perils per occurrence in the event of loss.

.2 The proceeds under the Builder's Risk/Installation Floater Insurance procured by the State will be payable to the State and Contractor as their respective interests, from time to time, may appear.

.3 State's Builders Risk/Installation Floater Insurance shall provide limited coverage for materials in transit and materials stored off-site, and full coverage for materials at the Project site; however, the Contractor is responsible for reviewing the "Summary of Coverage" and reporting values that exceed the limits provided within the Summary of Coverage. Notification to the State does not provide coverage. Value increases must be approved by the insurance carrier and contractor must

have a Certificate of Insurance issued by the insurance carrier showing the increased values. Lacking confirmation from the State's insurance carrier that additional coverage was procured, Contractor will be responsible for damages in excess of the coverage limits provided within the Summary of Coverage.

.4 Nothing in this Clause 11.1.2.4 shall be construed to relieve the Contractor of Contractor's responsibilities referred to under Clause 11.1.1 and Clause 11.1.2.

.5 Insurance policies referred to in this Clause 11.1.2.4 shall provide the following:

.1 That the policies are primary and do not participate with nor are excess over any other valid collectible insurance carried by the Contractor.

.2 That the Insurer waives the right of subrogation against the Contractor.

END OF DOCUMENT

STATE OF CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REAL ESTATE SERVICES DIVISION
PROJECT MANAGEMENT AND DEVELOPMENT BRANCH

Date: July 26, 2023 **DOCUMENT 00 91 13**

ADDENDUM No. 1 TO THE CONTRACT DOCUMENTS

Bid Due Date – August 29, 2023

DMV DELANO AREA OFFICE REPLACEMENT
DEPARTMENT OF MOTOR VEHICLES
DELANO, KERN COUNTY, CALIFORNIA

PROJECT NO. 140724

ACKNOWLEDGE RECEIPT OF THIS ADDENDUM ON BID FORM AND REVISE THE CONTRACT DOCUMENTS AS FOLLOWS:

SUBJECT:	REFERENCE DOCUMENTS:
Bid Package Addendum	REFER TO REVISED "ADDENDUM 01" PLAN SHEETS FOR BELOW ITEMS; REFER TO ATTACHED ADI DOCUMENTS FOR RELEVANT RFI RESPONSES REGARDING SCOPE AND REVISIONS LISTED WITH ADI REFERENCES.

Description:

DMV Delano Off-Site Improvement Plans:

Storm Drain:

1. All storm drain piping and storm drain manholes shown on drawings titled "DMV Delano Off-Site Improvement Plans" dated 09/21/2021 have been installed and accepted by City of Delano. Trench backfill has only been accepted from pipe bedding to 1 foot above pipe bedding.
   Excavate entire length of storm drain trench backfill to 1 foot above top of pipe bedding (keep in place 1 foot of existing compacted backfill) re-place material, and recompact backfill material to meet Detail 2/ST 5.03 (City of Delano Standard Plate St21B). Import satisfactory soil as needed to meet proposed grades.
2. Raise storm drain manholes to proposed RIM elevations.

Sanitary Sewer:

1. Approximately 100 linear feet of sanitary sewer pipe was installed by previous contractor. This length of pipe did not pass City of Delano acceptance testing. Contractor is to remove all existing installed sanitary sewer pipe, and re-install per drawings. Piping removed may be re-used at the contractor's option.

General:

1. Construct all other off-site improvements per drawings titled "DMV Delano Off-Site Improvement Plans" dated 09/21/2021.

Specification Section 31 20 00 – EARTH MOVING

1. Updated specification 31 20 00 EARTH MOVING to incorporate requirements of Geotechnical Engineering Investigations Update Report prepared by Moore Twining Associates (included as Reference Document as part of Bid Documents). Replace specification 31 20 00 – EARTH MOVING in its entirety.

Specification Section 33 42 00 - STORMWATER CONVEYANCE

1. Clarified requirement in Part 2.01B for watertight joints for HDPE piping. Replace specification 33 42 00 – STORMWATER CONVEYANCE in its entirety.

Geotechnical Engineering Investigations Update Report prepared by Moore Twining Associates, Inc. dated May 26, 2023 (FOR REFERENCE ONLY)

California Department of Motor Vehicles – DMV (On-site Plans – CIVIL PLAN SHEETS)

(RED TEXT REFERS TO ISSUED ADI DOCUMENTS ATTACHED)

1. T0.2 – Replaced Fire Flow test with test performed on February 9, 2023. Replace sheet with sheet attached. (ADI 004)
2. T0.4 – Added new sheet T0.4 – UL Details. Sheet includes pipe/conduit and duct penetration details for all Communication Room Penetrations. (ADI 005)
3. V1.01 – Added new sheet TOPOGRAPHIC SURVEY.
4. C0.01 – Updated site benchmark to reflect topographic survey (sheet V1.01), replaced Fire Flow test with test performed on February 9, 2023, added new sheet C1.00 to sheet index, and added note 10 for pipe wrap for corrosion protection. Replace sheet with sheet attached. (Supersedes ADI 004)
5. C1.00 – Added new sheet EXISTING CONDITIONS AND DEMOLITION PLAN.
6. C1.05 - Updated site benchmark to reflect topographic survey (sheet V1.01), added limits of over-excavation, added existing topo (sheet V1.01) as screed background, added new sheet note 9, and new note for subgrade preparation of trash enclosure footings. Replace sheet with sheet attached.
7. C1.06 – Replaced single 8-inch diameter fire riser with two (2) 4-inch diameter risers. One 4” for fire department connection, One 4” that transitions from the site 8” at the proposed tee. Added note 5 for pipe wrap for corrosion protection. Replace sheet with sheet attached. (Supersedes ADI 004)
8. C1.07 – Replaced single 8-inch diameter fire riser with two (2) 4-inch diameter risers. One 4” for fire department connection, One 4” that transitions from the site 8” at the proposed tee. Added keynote 12 to refer to structural detail for parallel pipe separation requirements at concrete footings. Replace sheet with sheet attached. (ADI 004)
9. C1.08 - Added new sheet note 7 and reference to note at pipe connection to off-site stub-outs. Replace sheet with sheet attached.
10. C2.01 - Added new sheet note 1 and reference to note at pipe connection to off-site stub-outs. Updated existing grade on profile. Replace sheet with sheet attached.
11. C2.02 - Updated existing grade on profile. Replace sheet with sheet attached.
12. C2.03 - Added new sheet note 1 and reference to note at pipe connection to off-site stub-outs. Updated existing grade on profile. Replace sheet with sheet attached.
13. C2.04 - Updated existing grade on profile. Replace sheet with sheet attached.
14. C2.05 - Updated existing grade on profile. Replace sheet with sheet attached.
15. C2.06 - Updated existing grade on profile. Replace sheet with sheet attached.
16. C4.02 - Updated site benchmark to reflect topographic survey (sheet V1.01), added limits of over-excavation, added existing topo (sheet V1.01) as screed background, added new sheet note 8, and new note for subgrade preparation of trash enclosure footings. Replace sheet with sheet attached.
17. C4.03 - Updated site benchmark to reflect topographic survey (sheet V1.01), added existing topo (sheet V1.01) as screed background. Replace sheet with sheet attached.
18. C5.02 – Updated size of bollard to ensure fit into proposed sleeve. Replace sheet with sheet attached.
19. C5.05 – Detail 2, replaced fire riser from 8” diameter to 4” diameter. Detail 4, updated label to reflect connection to fire riser room and changed material for underground pipe from 4” DIP to 4” C900 PVC. Replace sheet with sheet attached. (ADI 004)

20. C5.06 – Detail 1, Updated pipe bedding above pipe, clarified gradation of crushed rock, and compaction requirements. Replace sheet with sheet attached.
21. C5.08 – Detail 1, updated trench width to meet requirements of ASTM D2321. Replace sheet with sheet attached.
22. C5.09 – Detail 1, updated thickness of thickened edge based on Geotechnical Engineering Investigations Update Report prepared by Moore Twining Associates (included as Reference Document as part of Bid Documents). Replace sheet with sheet attached.

California Department of Motor Vehicles – DMV (On-site Plans – MECHANICAL/PLUMBING/ELECTRICAL/LOW VOLTAGE/FIRE ALARM PLAN SHEETS)

(RED TEXT REFERS TO ISSUED ADI DOCUMENTS ATTACHED)

1. M1.01 – Added symbol for required volume dampers. Requirement for volume dampers are identified in specification 23 33 00, 3.01D, drawings were updated to show locations. Also updated:
   - Corrected incorrect air terminal tagging. Overall quantity identified in schedule M6.01 remains unchanged.
   - Rerouted duct work and refrigerant lines in First Aid/Lactation, Communication Room, and Materials Storage to be served directly from Corridor.
   - Added Transfer Grilles
   - Added FSD-1 for Communication Room
   - Updated Communication Room background to show fire rated walls.
   -Updated routing of EF-1 to match location shown on M1.05
   Replace sheet with sheet attached. (Supersedes ADI 005)
2. M1.04 – Updated location of EF-1 to match location shown on M1.05. Replace sheet with sheet attached.
3. M3.02 - Corrected incorrect air terminal tagging. Overall quantity identified in schedule M6.01 remains unchanged. Replace sheet with sheet attached. (ADI 005)
4. M5.01 – Added detail of Fire and Smoke Damper. Replace sheet with sheet attached. (ADI 005)
5. M5.02 - Included seismic bracing requirement for VRF Evaporator. Replace sheet with sheet attached. (ADI 005)
6. M6.01 – Added Schedule for Fire & Smoke Dampers. Added two more transfer grilles. Replace sheet with sheet attached. (ADI 005)
7. E0.01 – Added symbol for Emergency Power Off (EPO) Button. Replace sheet with sheet attached. (ADI 005)
8. E1.01 – Updated Keynote 4 conduit quantity to match off-site electrical SCE plans. Replace sheet with sheet attached.
9. E1.02 – Added power for FSDs, general note, and updated circuitry. Replace sheet with sheet attached. (ADI 005)
10. E2.01 – Updated lighting circuitry. Replace sheet with sheet attached. (ADI 005)
11. E4.01 – Added EPO Switch and updated circuitry. Replace sheet with sheet attached. (ADI 005)
12. E5.01 – Updated One line diagram and Keynote 1. Replace sheet with sheet attached. (Supersedes ADI 005)
13. E6.02 – Added FSD and updated panels for VRF Evaporator and ERV. Replace sheet with sheet attached. (ADI 005)
14. E6.03 – Updated Panel Schedules and added new Panel 2T1. Replace sheet with sheet attached. (ADI 005)
15. LV1.02 – Added requirement for fire sealed sleeves. Replace sheet with sheet attached. (ADI 005)
16. LV4.01 – Updated communication wall backgrounds, moved 4 sleeves on the plan south wall to plan west wall. Added requirement for fire sealed sleeves. Replace sheet with sheet attached. (ADI 005)
17. F1.01 – Updated General Note 19 and Hydraulic Graph to reflect Fire Flow test performed on February 9,2023. Replace sheet with sheet attached. (ADI 004)
18. F3.01 – Replaced single 8-inch diameter fire riser with two (2) 4-inch diameter risers. Replace sheet with sheet attached. (ADI 004)

California Department of Motor Vehicles – DMV (STRUCTURAL PLAN SHEETS)

(RED TEXT REFERS TO ISSUED ADI DOCUMENTS ATTACHED)

1. S0.1, Foundation Note #1: Change Soils Report to #E53623.01 by Moore Twining Associates, Inc dated 5/26/23.
2. S2.1 Foundation Plan Note #4: change line 1 to read "Site preparation and building pad construction to be done in accordance with project specifications".
3. S2.1 Foundation Plan Note #5 and note on plan: change "crushed rock" to "Un-recycled Class 2 Aggregate base".
4. S2.1 Foundation Plan footing elevation mark at grids H and 3: change top of footing elevation to "2'-0" TOF".
5. S5.1: Delete Detail 14/S5.1.
6. S2.2 – Add (8) C8 members between joists at low roof per attached drawing. (ADI 001)
7. S2.3 – Add detail references at grid F and G on grid line 2; Add C5x6.7 blocking above W12x26 between Grids G an H south of Grid 2 and just north of grid 3 along with welding notation; Add Detail reference 9/A5.6 at column at Grid 3/F; Add Detail Reference 10/A5.6 at Grid 3/G; Add detail reference 9/S5.6 at columns at Grids 2/B and 3/B; Add (14) C8 blocking between 2- joist bays East of grid B between Grids 2, and 3; Add C12 x20.7 ledgers along grid line 2 between grids A & B and between grid lines F&G, and along grid line 3 between grids A&B and between grids F&G. (ADI 001)
8. S3.3 – At Detail D clarified C5 location (shown in floor plan); At Detail E clarified C12 location added at framing plan; At Detail clarified C12 location added at framing plan. (ADI 001)
9. S3.4 -At Detail A clarified location of C12 x 20.7 (added at framing plan) and added attachment notes and detail 9/S5.6 reference.; At Detail B clarified C12 location (added at framing plan) (ADI 001)
10. S4.1 – At Elevation 2, Between Grids A&B and between grids F&G add reference to C12 (added at framing plan) (ADI 001)
11. S4.2 – At Elevation 1, Between Grids A&B and between grids F&G add reference to C12 and a reference to detail 9/A5.6 (added at framing plan)
12. S5.6 – Revised details 9, and 10 (ADI 001)

California Department of Motor Vehicles – DMV (ARCHITECTURAL PLAN SHEETS)

(RED TEXT REFERS TO ISSUED ADI DOCUMENTS ATTACHED)

1. T0.0 – Revised Drawing Index to include new sheets. (ADI 005)
2. T0.3 – Added new sheet to include CBC prescriptive code rating of CMU walls and UL assemblies for 1-hour wall construction, rated wall attachment to CMU, top of wall detail and through-penetration firestop systems. (ADI 005)
3. T0.4 – Added new sheet T0.4 – UL Details. Sheet includes pipe/conduit and duct penetration details for all Communication Room Penetrations. (ADI 005)
4. A1.00 – REVISED Floor Plan showing rated walls. (ADI 005)
5. A6.00 – revised Door Schedule to include rating of Comm Room door. (ADI 005)
6. A7.50 – At Keynotes, Add: "29 COUTERTOP SUPPORT. SEE DETAIL 12/A8.40; At Elevation 2 Add callout for keynote 29 identifying support post at corner of writing counter west of the exit door; At Elevation 5 Add keynote 29 callout to added support post east end of solid surface counter.; At Elevation 6 added keynote 29 callout at support posts at east and west ends of Start Here counter and Camera Counters. (ADI 001)
7. A8.00 – added information to wall types 3 & 5 regarding fire rating identification. (ADI 005)

The Work shall be carried out in accordance with these supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. **Proceeding with Work in accordance with these instructions indicates acceptance without change in the Contract Amount or Contract Duration.** It is the Contractor's responsibility to inform subcontractors, vendors and staff of these remarks to the design and/or construction.

Signed: _____ Date: _____

Name
State of California, DGS, RESD, PMDB
707 Third St., Suite 04-105
West Sacramento, CA 95605

Tel: Fax:

cc:

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
3. Excavating and backfilling for buildings and structures.
4. Base course for concrete slabs-on-grade.
5. Base course for concrete walks and pavements.
6. Base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Division 01 "Photographic Documentation" for recording preexcavation and earth-moving progress.
2. Section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping, and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 32 90 00 "Landscaping" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.03 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subgrade and hot-mix asphalt paving, concrete slab on grade, or site walkways.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

F. Engineered Fill: Soil materials per section 2.01 used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D1586.

H. Structures: Buildings, footings, foundations, slabs, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subgrade: Bottom surface of an excavation or the top surface of a fill or backfill immediately below base, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.
b. Coordination of Work with utility locator service.
c. Extent of trenching by hand or with air spade.
d. Field quality control.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Controlled low-strength material, including design mixture.
2. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Warning Tape: 12 inches (300 mm) long; of each color.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports to be Provided by Contractor: For each imported borrow soil material proposed for fill and backfill as follows. See also testing requirements for Satisfactory Soils for imported borrow in Part 2.

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D1557.
3. Plasticity Index
4. Expansion Index (ASTM D4829)
5. R-Value
6. Sulfates
7. Minimum Resistivity
8. Certification from contractor that borrow soils are clean fill and do not contain any environmental contaminates regulated by local, state, or federal agencies having jurisdiction.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.07 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Division 01 "Temporary Facilities and Controls" and Section 31 10 00 "Site Clearing" are in place.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide import borrow soil materials meeting the requirements of Satisfactory Soils when sufficient Engineered Fill soil materials are not available from onsite excavations.

B. Satisfactory Soils: Soil Classification Groups, SC, ML, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Plasticity Index: Less than 15
2. Expansion Index: Less than 25
3. R-value: Minimum 20
4. Sulfates: <0.05% by weight
5. Minimum Resistivity: > 2,000 ohm-cm
6. Written certification signed by contractor indicating that import soils are clean fill and do not contain any environmental contaminates regulated by local, state, or federal agencies having jurisdiction. Include supporting environmental test data based on accepted industry standards considering the current and past uses of the land at the borrow source.

C. Unsatisfactory Soils: Soil Classification Groups GC, GW, GP, GM, SW, SP, CL, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained between optimum moisture and 3 percent above optimum moisture content at time of compaction.
2. Unsatisfactory soils also include materials that do not meet the requirements for Satisfactory Soils.

D. Base Course: Class 2 Aggregate Base Course per California Department of Transportation (CALTRANS) standard specifications. Material utilized below building slabs shall be free of recycled content.

E. Engineered Fill:

On-site soils free of organics (less than 3 percent by weight), have an expansion index of less than 25, do not contain particles larger than 3 inches in dimension, and are free of debris.

Import soils meeting the requirements of Satisfactory Soils

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; meeting the gradation requirements for “bases” in ASTM D2940/D2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.

H. Sand: ASTM C33/C33M; fine aggregate.

2.02 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C150/C150M, Type II.
2. Fly Ash: ASTM C618, Class C or F.
3. Normal-Weight Aggregate: ASTM C33/C33M, 3/8-inch (10-mm) nominal maximum aggregate size.
4. Water: ASTM C94/C94M.
5. Air-Entraining Admixture: ASTM C260/C260M.

B. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C495/C495M.

2.03 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clear and grub site per section 31 10 00

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

C. Protect and maintain erosion and sedimentation controls during earth-moving operations.

D. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Engineer. The Contract Sum will be adjusted for rock excavation according

to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

3.05 EXCAVATION FOR STRUCTURES

A. After stripping, the building pad area shown on the plans shall be over-excavated to an elevation of 298 feet, and to a depth of at least 1.5 feet below bottom of all footings, whichever requires the deeper excavation. Slot cutting only below foundations will not be allowed. The over-excavation limits shall be as shown on the plan and include the entire building footprint, all foundations, and adjacent walkways, a minimum of 5 feet horizontally beyond the edges of the foundations, and a minimum of 5 feet beyond all walkways adjacent to the building, whichever is greater. After excavation of the near surface soils to the depths recommended above, Engineer shall be requested to verify that the exposed soils are consistent with the anticipated conditions, and verification from the Contractor's surveyor shall be provided that the horizontal and vertical over-excavation limits required for the project have been achieved. After these conditions are satisfied, the exposed bottom shall be proofrolled to identify potential soft, or unstable areas. Where soft or unstable soils are identified during proofrolling, the contractor shall conduct remedial preparation to achieve stability in accordance with the project specifications to the satisfaction of the geotechnical engineer. Upon approval of the proofrolling, the bottom of the excavations shall be scarified to a minimum depth of 8 inches, moisture conditioned or aerated to optimum moisture content and three (3) percent above optimum moisture content and compacted as engineered fill followed by placement of engineered fill to pad grade. If unstable soil conditions persist, stabilization shall be conducted in accordance with the project specifications.

B. Extra care shall be taken to ensure that the horizontal and vertical extent of the excavation and compaction for the building pad preparation conform to the site preparation recommendations presented herein. The Contractor shall verify in writing to the Owner that the horizontal and vertical over-excavation limits were completed in conformance with the project plans, and the project specifications. The verification shall include an as-built plan created with survey data from a licensed surveyor hired by the Contractor showing the elevation of the bottom of the excavation and the horizontal extent of the excavation.

C. Proofrolling of the excavation bottom for the building pad, prepared subgrade, and aggregate base sections shall be conducted using a rubber-tired vehicle weighing at least 25 tons, with the tires inflated to the manufacturer's operating pressure. The entirety of the areas shall be proofrolled, with each succeeding pass offset by not greater than one tire width. A representative of the qualified geotechnical engineer shall be scheduled by the Contractor to observe the proof rolling activities. If depressions more than one-

half (½) inch occur, the Contractor shall perform remedial grading to achieve this requirement.

D. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm).

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. Maintain moisture conditions of exposed soils to prevent desiccation cracking in dry periods, and to prevent instability in wet periods.
2. Excavation for Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. After stripping, pavement areas, exterior concrete flatwork and areas to receive fill outside the limits of the building pad preparation shall be scarified to a depth of 12 inches, moisture conditioned, compacted as engineered fill and the areas shall then be filled to design subgrade with engineered fill. Proof roll the finished subgrade to verify stability prior to placement of base course. The horizontal extent of the preparation shall include all pavement and flatwork areas and a minimum of three (3) feet beyond the edges of the flatwork and pavement.

3.07 EXCAVATION FOR LIGHTLY LOADED FOOTINGS FOR SCREEN WALLS, SITE WALLS AND PLANTER WALLS

A. After stripping, miscellaneous lightly loaded foundations such as trash enclosure walls, planter walls, site walls, etc. shall be over-excavated to a minimum of 1 foot below preconstruction site grade, and to a depth of 1 foot below the bottom of the foundation, whichever is deeper. The zone of excavation shall extend a minimum of three (3) feet horizontally beyond the limits of the foundation.

3.08 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated on plans.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

3.09 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proofroll the excavation bottom for the building pad, prepared subgrade, and aggregate base sections using a rubber-tired vehicle weighing at least 25 tons, with the tires inflated to the manufacturer’s operating pressure. The entirety of the areas shall be proofrolled, with each succeeding pass offset by not greater than one tire width. A representative of the qualified geotechnical engineer shall be scheduled by the Contractor to observe the proof rolling activities. If depressions more than one-half (½) inch occur, the Contractor shall perform remedial grading to achieve this requirement.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.10 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 6-inch thick, concrete-base slab support for piping or conduit less than 24 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 6 inches of concrete before backfilling or placing roadway base course. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."

E. Backfill voids with clean sand or grout while removing shoring and bracing. Submit grout mix for Engineer review.

F. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of material specified on drawings, free of particles larger than ¾-inch in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

    a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation. Plasticity Index and Expansion Index Criteria do not apply to final trench backfill.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

H. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.14 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use engineered fill.
2. Under walks and pavements, use engineered fill.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to between optimum moisture content and 3 percent above optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, unstable, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds the specified moisture content and is too wet to compact to specified dry unit weight, or that exhibits instability.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:

1. Under structures, building pad preparation limits, and foundations, scarify and recompact top 8 inches of subgrade at bottom of excavation and each layer of backfill or fill soil material at a minimum of 92 percent.
2. Under walkways and pavements, scarify and recompact top 12 inches below subgrade and compact each layer of backfill or fill soil material at a minimum of 92 percent, with exception that the final 12 inches of subgrade below pavements shall be compacted to a minimum of 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at a minimum of 92 percent.

3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.18 BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:

1. Place base course material under hot-mix asphalt pavement.
2. Shape base course to required crown elevations and cross-slope grades.
3. Place base course 6 inches (150 mm) or less in compacted thickness in a single layer.
4. Place base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
5. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

C. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

3.19 BASE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact base course under cast-in-place concrete slabs-on-grade as follows:

1. Install vapor retarder on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.

4. Compact each layer of base course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

3.20 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, geotechnical engineer will observe excavations to verify design bearing capacities.

E. Testing agency will test compaction of soils in place according to ASTM D1556, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 100 feet (46 m) or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify, and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 33 42 00

STORMWATER CONVEYANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. PE pipe and fittings.
2. PVC pipe and fittings.
3. Cleanouts.
4. Stormwater inlets.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Storm water inlets. Include plans, elevations, sections, details, frames, covers, and grates.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle stormwater inlets in accordance with manufacturer's written rigging instructions.

1.07 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.01 CORRUGATED-PE PIPE AND FITTINGS

A. Source Limitations: Obtain corrugated-PE pipe and fittings from single manufacturer.

B. Corrugated-PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with watertight joints per ASTM D3212.

C. Corrugated-PE Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.02 PVC PIPE AND FITTINGS

A. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.

B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

C. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

2.03 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
2. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Shielded, Flexible Couplings:

1. Source Limitations: Obtain shielded, flexible couplings from single manufacturer.
2. Description: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings:

1. Source Limitations: Obtain ring-type, flexible couplings from single manufacturer.
2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.04 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Source Limitations: Obtain cast-iron cleanouts from single manufacturer.
2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

1. Source Limitations: Obtain PVC cleanouts from single manufacturer.

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.
3. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

2.05 STORMWATER INLETS

A. Designed Precast Concrete Inlet: ASTM C913, precast, reinforced concrete; designed in accordance with ASTM C890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: ASTM C990, bitumen or butyl rubber.
2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
4. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping in accordance with the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with 36- inch- minimum cover.
4. Install PE corrugated sewer piping in accordance with ASTM D2321.
5. Install PVC profile gravity sewer piping in accordance with ASTM D2321 and ASTM F1668.

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:

1. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
2. Join PVC profile gravity sewer piping in accordance with ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.
3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.04 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.05 STORMWATER INLET INSTALLATION

A. Construct inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.06 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

    a. Shielded flexible couplings for same or minor difference OD pipes.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.07 IDENTIFICATION

A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.08 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping in accordance with ASTM F1417.

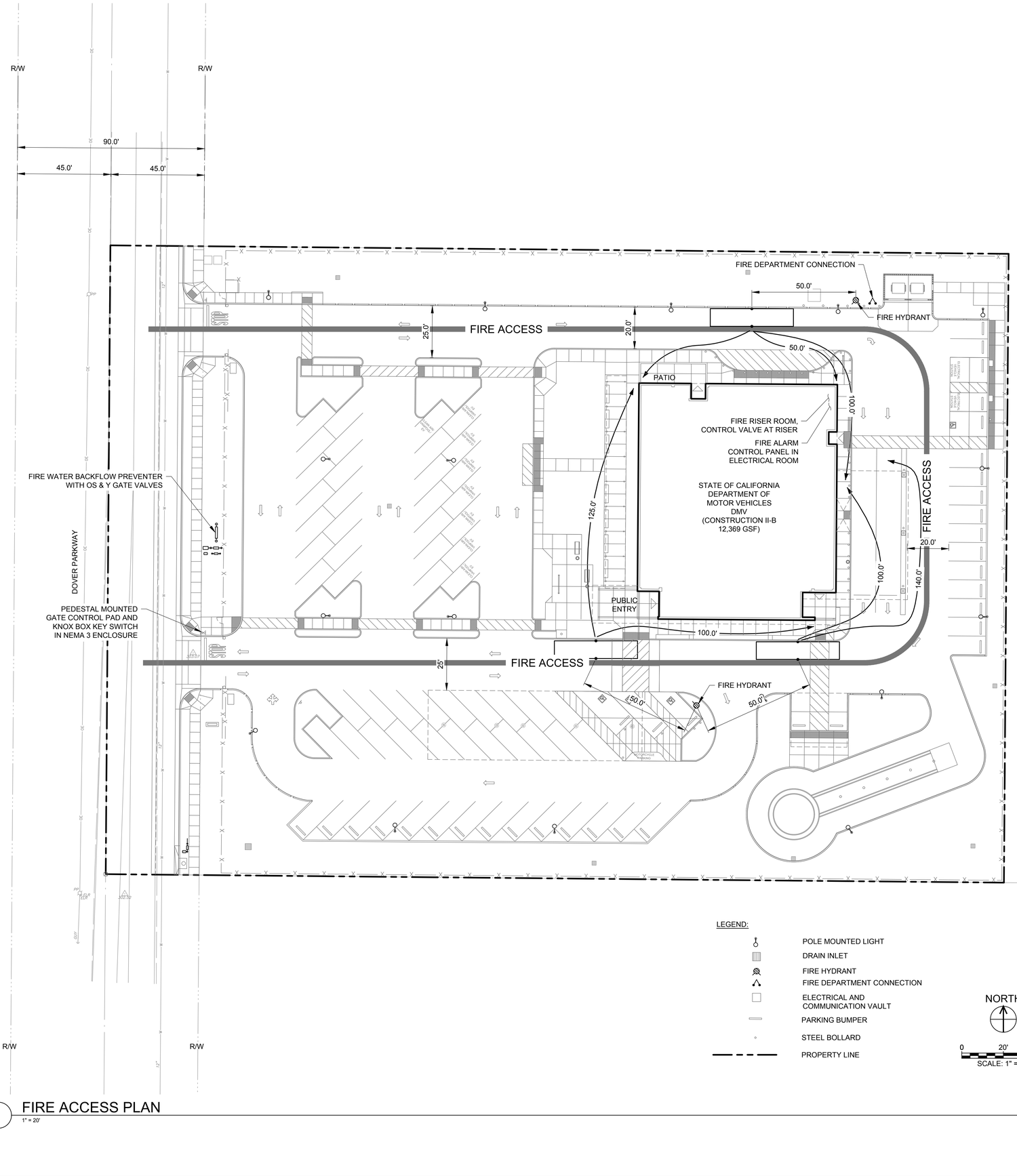
C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.09 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 33 42 00



LEGEND:

- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- ELECTRICAL AND COMMUNICATION VAULT
- PARKING BUMPER
- STEEL BOLLARD
- PROPERTY LINE

NORTH

0 20' 40'

SCALE: 1" = 20'

1 FIRE ACCESS PLAN

1" = 20'

8

Hydrant Flow Test Report

Test Date 2/09/2023 **Test Time** 9:20am

Location

DMV DELANO
DOVER PARK WAY.
DELANO, CA.

Tested by

JAKE BUSTOS &
HECTOR CONTRERAS
CONTROL FIRE PROTECTION, INC.
1347 OGDEN ST.
BAKERSFIELD, CA. 93305

Notes

SEE INSPECTION REPORT FROM STATE FIRE MARSHAL

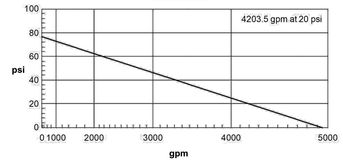
Read Hydrant

77 psi **static pressure**
70 psi **residual pressure**
2 ft **hydrant elevation**

Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1	2	2.5	.9	65	1353 gpm

Flow Graph



Created with the free hydrant flow test program from www.igneusinc.com

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY
DEPARTMENT OF FORESTRY AND FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE AND LIFE SAFETY DIVISION
INSPECTION REPORT
EN-02 (12/08)

INSPECTION REPORT

FILE NUMBER: 01-15-11-0235-10001	PAGE 01 OF PAGE 01	
NAME OF FACILITY: Dept. of Motor Vehicles	HOURS	MINUTES
NAME OF BUILDING: DMV Office -Delano		
ADDRESS: Dover Parkway Delano, CA		
DISCUSSED WITH: Danette Smith	TITLE: DGS Construction Supervisor-I	
ACCOMPANIED BY: Danette Smith	TITLE: DGS Construction Supervisor-I	

Dept. of Motor Vehicles - Delano **Govmotus #20-S-1059-CP-PI**

On February 9, 2023, Deputy State Fire Marshal-III Specialist Edward Arriaga (DSFM Arriaga) witness a fire hydrant flow test. DSFM Arriaga was accompanied by DGS Construction Supervisor-I Danette Smith, Bernard's Construction Superintendent Tim Brady, representatives from Control Fire Protection & the City of Delano.

Two fire hydrants were used for the water flow test; the test commenced at approximately 0930 hours.

Fire Hydrant-1 (Flow Hydrant)
Locate on Dover St
Total distance from fire hydrant to property line: 580 feet.
Total distance from fire hydrant to the southside of the building footprint: 790 feet.
Static was at 77 psi. Outlet was 2 ½".
Flow was at 65 psi. Outlet was 2 ½". Method of testing was a Pitot gauge.

Fire Hydrant-2 (Static/Residual Hydrant)
Locate on Morse Blvd.
Total distance from fire hydrant to property line: 604 feet.
Total distance from fire hydrant to the southside of the building footprint: 814 feet.
Static was at 70 psi (when Fire Hydrant-1 was flowing). Outlet was 2 ½".

NOTE: Fire hydrant flow test is valid for six months from 02-09-23 to 08-09-23.

NOTE: *Refer to Job Card, Building Plans, Specifications, etc., for additional required inspections. The OSFM does not perform Quality Control or Quality Assurance.*

END OF REPORT

RECEIVED BY: Danette Smith	DATE
DEPUTY STATE FIRE MARSHAL: Edward Arriaga	DATE OF INSPECTION: 02-09-23

HYDRANT FLOW TEST:

PERFORMED ON: FEBRUARY 9, 2023

STATE OF CALIFORNIA —NATURAL RESOURCES AGENCY Gavin Newsom, Governor

DEPARTMENT OF FORESTRY AND FIRE PROTECTION
Office of the State Fire Marshal
P.O. Box 944246 SACRAMENTO,
CA 94244-2460 (916) 568-2993
Website: www.osfm.fire.ca.gov

LOCAL FIRE AUTHORITY – ACCESS APPROVAL

Agency & Project Name: California Department of Motor Vehicles (DMV) - Delano

Address: 448 Dover Parkway, Delano, CA APN: 521-030-072

GovMotus Control Number: 20-1059

Pursuant to CCR Title 19 §3.00 and §3.05, the California State Fire Marshal is requesting certification from the local fire authority that the above sections are met to their satisfaction.

This form shall be scanned to the accompanying fire access plan reflecting all items under consideration, and wet signed by the local fire authority. Please complete all applicable items based on scope. California State Fire Marshal project approval may be delayed until this form is completed and returned. If you have any questions, please contact the California State Fire Marshal Plan Review Section at (916) 568-2993.

Approved	Yes	No
Fire Department Access	✓	
Fire Department Connection	✓	
Fire Hydrant	✓	
Fire Alarm Annunciator	✓	
Fire Alarm Control Panel	✓	
Knox Box	✓	
Emergency Responder Radio Coverage		✓
Medical Emergency Service Elevator		✓
Fire Service Access Elevator		✓
Bi-Directional Amplification (BDA) Systems		✓

Local Fire Authority: Kern County Fire Department
Address: 2820 M St.
City/State/ZIP: Bakersfield, CA 93301

Approval issued by: JESINA ARRIAGA
Rank/Title: FIRE INSPECTOR II
Phone Number: 661-391-3210
Signature: [signature] **Date:** 6/27/2023

"The Department of Forestry and Fire Protection serves and safeguards the people and protects the property and resources of California."

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER GODOON HO-MAN FONG CIVIL STATE OF CALIFORNIA C 87304 05/31/2023

AECOM

CONSULTANT

nacht&lewis

600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

SHEET TITLE

FIRE ACCESS PLAN

SHEET NO.

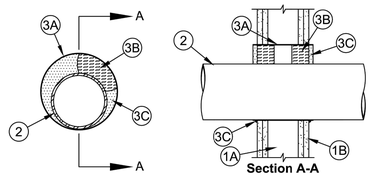
T0.2

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

Classified by
Underwriters Laboratories, Inc.
to ASTM/UL1479 (ASTM E814)

System No. W-L-1079

F Ratings - 1 and 2 Hr (See Item 1B)
T Rating - 0 Hr
L Rating At Ambient - Less Than 1 CFM/sq ft
L Rating At 400 F - Less Than 1 CFM/sq ft



Section A-A

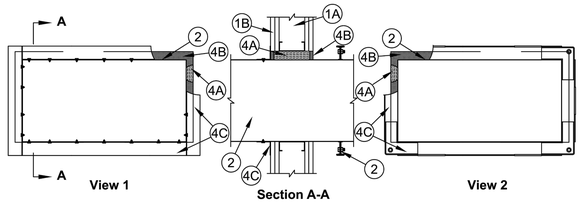
1. **Wall Assembly -** The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 or U400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
   A. **Studs -** Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC with nom 2 by 4 in. lumber end plates and cross braces. Steel studs to be min 3-5/8 in. wide and spaced max 24 in. OC.
   B. **Gypsum Board* -** 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is in wood stud walls is 13 in. Max diam of opening in steel stud walls is 16 in.

      The hourly F rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
2. **Through Penetrant -** One metallic pipe or conduit to be installed either concentrically or eccentrically within the firestop system. The annular space between pipes or conduits and periphery of opening shall be min 0 in. (point contact) to max 3 in. Pipe or conduit to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or conduits may be used:
   A. **Steel Pipe -** Nom 12 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. **Iron Pipe -** Nom 12 in. diam (or smaller) cast or ductile iron pipe.
   C. **Conduit -** Nom 4 in. diam (or smaller) electrical metallic tubing, nom 6 in. diam (or smaller) steel conduit or nom 1 in. diam (or smaller) flexible steel tubing.
   D. **Copper Pipe -** Nom 6 in. diam (or smaller) Regular (or heavier) copper pipe.
   E. **Copper Tube -** Nom 6 in. diam (or smaller) Type L (or heavier) copper tube.

Classified by
Underwriters Laboratories, Inc.
to ANSI/UL 1479 (ASTM E814) and CAN/ULC S115

System No. W-L-7202

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr	F Ratings - 1 and 2 Hr
T Rating - 0 Hr	FT Rating - 0 Hr
L Rating At Ambient - Less Than 1 CFM/sq ft	FH Ratings - 1 and 2 Hr
L Rating At 400 F - Less Than 1 CFM/sq ft	FTH Rating - 0 Hr
	L Rating At Ambient - Less Than 5.1 L/s/m3
	L Rating At 204 C - Less Than 5.1 L/s/m3



1. **Wall Assembly -** The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described within the individual U400, V400 or W400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:
   A. **Studs -** Wall framing shall consist of steel channel studs. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC. Additional studs shall be installed horizontally to form a rectangular box around the through penetrant.
   B. **Gypsum Board* -** Thickness, type, number of layers and fasteners as specified in the individual Wall and Partition Design. Min separation between penetrants to be 1 in. (25 mm). Max area of opening 17.8 sq ft (1.65 m2) with one dimension of opening being 64 in. (1.6 m) or less.

      The hourly F and FH Ratings of the firestop system are dependent upon the hourly rating of the wall in which it is installed.
2. **Steel Duct -** One max 60 by 36 in. (1524 by 914 mm) steel duct passing through opening. Steel gauge of duct shall conform with SMACNA requirements. The annular space between steel duct and edges of opening shall be min 0 in. (point contact) to max 2-1/2 in. (64 mm). Two sections of duct may be connected together on one side of the wall. Duct connection to be located max 4 in. (102 mm) from one surface of the wall. Nom 2 in. (51 mm) flanges formed on the end of both duct sections. Min 6 in. (152 mm) long by 2 in. (51 mm) wide by 16 gauge (min 0.056 in. or 1.42 mm thick) "L" shaped steel corner pieces installed at each corner of the flanges on both sides of the connection. Corner pieces attached together with 3/8 in. (10 mm) steel nuts and bolts at each corner. Min 22 gauge (min 0.029 in. or 0.74 mm thick) by 6 in. (152 mm) long steel clips attached to duct flanges at connection max 15 in. (381 mm) OC. Steel duct to be rigidly supported on both sides of wall assembly.

2A. **Coated Ducts* -** As an alternate to Item 2, max 60 by 36 in. (1524 by 914 mm) steel duct coated with BW11 coating material. Duct sections shall be assembled using bolted flanges or SMACNA approved Transverse Joint Reinforcements. Annular space between duct and periphery of opening shall be min 0 in. (point contact) to max 2-1/2 in. (64 mm). Duct to be rigidly supported on both sides of wall assembly.

FIRESPRAY INTERNATIONAL LTD - FLAMEBAR BW11 fire rated ductwork

3. **Firestop System -** The firestop system shall consist of the following:
   A. **Metallic Sleeve -** Cylindrical sleeve fabricated from 0.0165 in. thick (28 gauge) galv sheet steel and having a min 2 in. lap along the longitudinal seam. Length of steel sleeve to be equal to or max 6 in. greater than the thickness of wall. Sleeve installed by coiling the sheet steel to a diam smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers. The ends of the steel sleeve shall be flush with or extend max 3 in. beyond each surface of the wall.
   B. **Packing Material -** Min 2 in. thickness of min 4 pcf mineral wool batt insulation tightly packed into annular space between metallic pipe, conduit or tubing and steel sleeve on both sides of the wall assembly+. Packing material to be recessed from each end of steel sleeve as required to accommodate the required thickness of fill material.
   C. **Fill, Void or Cavity Material* - Sealant -** Min 1/2 in. thickness of fill material within annulus, flush with ends of steel sleeve. A min 1/4 in. diam bead of fill material shall be applied at the metallic penetrant/steel sleeve interface on both sides of wall assembly. A min 1/4 in. bead of fill material shall be applied at the steel sleeve/gypsum board interface on both surfaces of wall.

      SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

      * Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

3. **Batts and Blankets* -** (Optional, Not shown) - Nom 2 in. (51 mm) thick light density (min 3/4 pcf or 12 kg/m3) glass fiber blanket insulation jacketed on the outside with a foil-scrim-kraft facing. Longitudinal and transverse joints sealed with foil-scrim-kraft tape. Nom annular space between insulated steel duct and periphery of opening to be point contact to max 1/2 in. (13 mm) prior to installation of packing material (Item 4A).

   See Batts and Blankets (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket meeting the above specifications and bearing the UL Classification Marking with a Flame Spread value of 25 or less and a Smoke Developed value of 50 or less may be used.
4. **Firestop System -** The firestop system shall consist of the following:
   A. **Packing Material -** Min 4 in. (102 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into annular space such that glass fiber blanket insulation on steel duct is compressed to a maximum overall thickness of 1/2 in. (13 mm). Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material.
   B. **Fill, Void or Cavity Material* - Sealant -** Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall.

      SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant, SpecSeal LCI Sealant
   C. **Retaining Angles -** Min 16 gauge (min 0.056 in. or 1.42 mm thick) galv steel angles sized to lap duct a min of 2 in. (51 mm) and to lap periphery of opening a min of 1 in. (25 mm). Angles attached to all four sides of steel duct on both sides of wall with No. 10 (or larger) steel sheet metal screws spaced 1 in. (25 mm) from each end and max 4 in. (102 mm) OC. When steel duct connection (Item 2) is located within 4 in. (102 mm) of wall surface, steel retaining angle only required on side of wall opposite steel duct connection. When optional insulation is present, angles attached to all four sides through glass fiber blanket insulation

      *** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

GENERAL NOTES:

1. DETAILS SHOWN APPLY TO ALL WALL PENETRATIONS OF COMMUNICATION ROOM 111.

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER
GORDON HO-MAN TONG
C 87304
CIVIL
STATE OF CALIFORNIA
05/31/2023

AECOM
CONSULTANT
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www.nachtlewis.com
P 916.329.4000
ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADDENDUM 01	05/31/23

DATE 05/31/2023

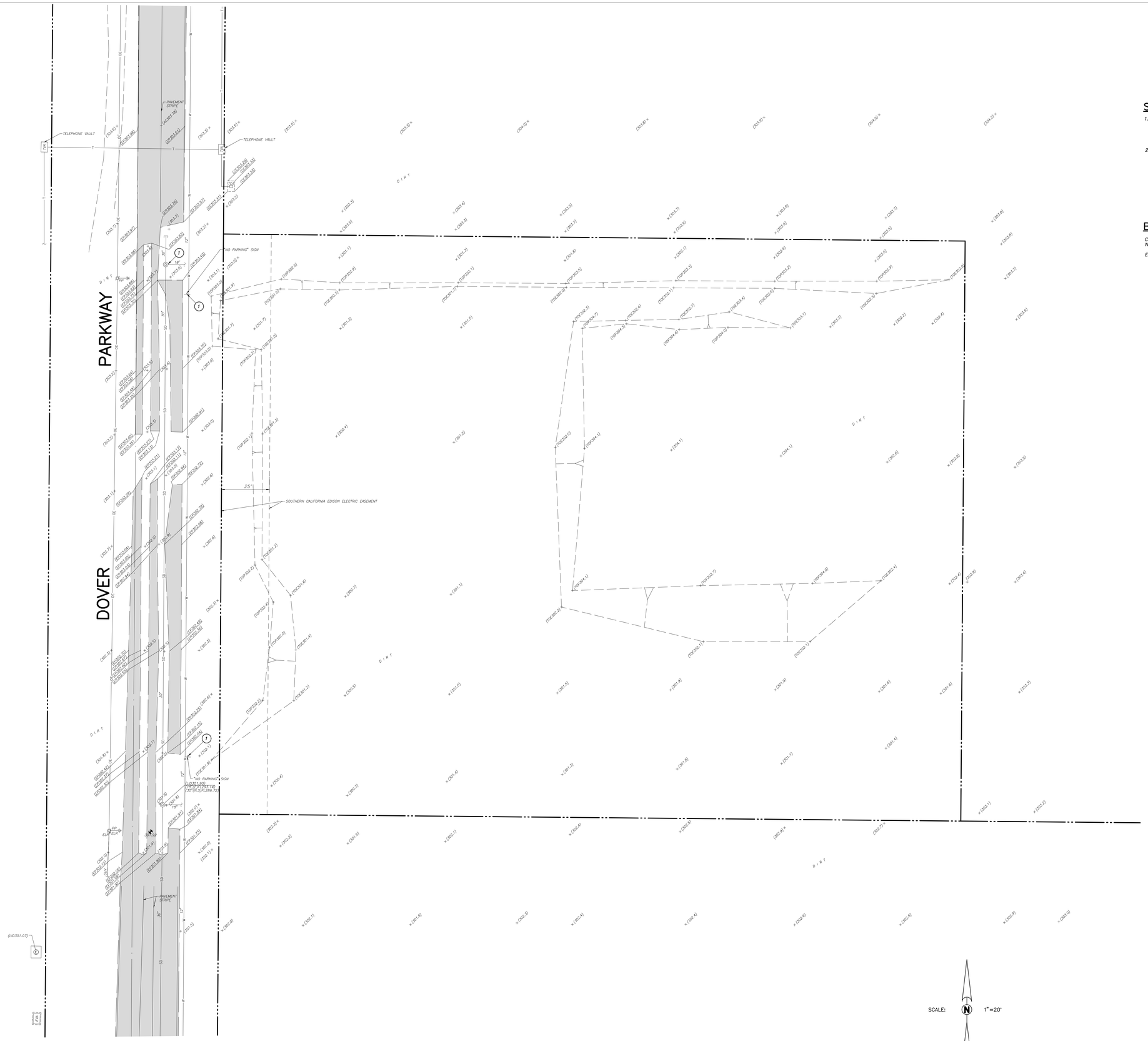
JOB NO. DGS 140724

SHEET TITLE

UL DETAILS

SHEET NO.

T0.4



SURVEY NOTES:

1. THIS TOPOGRAPHIC SURVEY LOCATES SPECIFIC PHYSICAL FEATURES OF THE SITE AND THEIR ELEVATION AS DETERMINED NECESSARY BY THE PROJECT ENGINEER. THE INFORMATION SHOWN REFLECTS THE DATA OBTAINED BY FIELD SURVEY CONDUCTED ON 5/5/23.

2. UTILITY INFORMATION SHOWN HEREON IS BASED ON RECORD INFORMATION SUPPLIED TO THE ENGINEER BY UTILITY COMPANIES, PUBLIC AGENCIES AND THE PROPERTY OWNER, TOGETHER WITH OBSERVATION OF VISIBLE EVIDENCE BY A FIELD SURVEY. THE ENGINEER CAN MAKE NO GUARANTEE AS TO THE ACCURACY OR COMPLETENESS OF THE UNDERGROUND UTILITY FACILITIES SHOWN. PRIOR TO ANY SITE EXCAVATIONS, THE CONTRACTOR SHALL CONTACT THE OWNER AND UNDERGROUND SERVICE ALERT (USA) AND REQUEST THAT THEY IDENTIFY THE LOCATION OF ALL UNDERGROUND UTILITIES AT THE SITE.

BENCHMARK:

CHISELED "X" AT CENTERLINE OF DOVER PARKWAY APPROXIMATELY 270' NORTH OF THE INTERSECTION OF BELMONT STREET

ELEV.= 301.92 NAVD88 DATUM

LEGEND:

(335.21)	EXISTING ELEVATION
AC	ASPHALTIC CONCRETE
CE	CONCRETE EDGE
EP	EDGE OF PAVEMENT
EVA	ELECTRICAL VAULT
TCA	TELEPHONE CABINET
TOE	TOE OF SLOPE
TOP	TOP OF SLOPE
TVA	TELEPHONE VAULT
△312.55	SURVEY CONTROL POINT
	BENCHMARK
Ⓔ	ELECTRICAL MANHOLE
ELR	ELECTRICAL RISER
GUY	GUY
PP	POWER POLE
	SLOPE
Ⓓ	STORM DRAIN MANHOLE
	STREET LIGHT
	ASPHALT CONCRETE PAVEMENT
	EDGE OF ASPHALT CONCRETE PAVEMENT
	EDGE OF CONCRETE
OE	OVERHEAD ELECTRIC
18"	STORM DRAIN LINE; SIZE AS NOTED
T	UNDERGROUND TELEPHONE
W 12"	WATER LINE; SIZE AS NOTED
	PAVEMENT STRIPING
	DIRT
	PROPERTY LINE
	RIGHT OF WAY LINE
	SECTION LINE
	EASEMENT LINE
1	FEATURE BASED ON CONSTRUCTION DRAWINGS; NOT FOUND BY SURVEY

SCALE: N 1"=20'

0 5 20 40
SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER
JEFFREY D. BRAUER
No. 36183
CIVIL
STATE OF CALIFORNIA

5/19/23
Date Signed:

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

nacht&lewis
600 O Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

CONSULTANT

Blair, Church & Flynn
CONSULTING ENGINEERS

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE

DATE 05/19/23

JOB NO. DGS 140724

SHEET TITLE

TOPOGRAPHIC SURVEY

SHEET NO.

V1.01

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

GENERAL NOTES:

1. CONTRACTOR TO COORDINATE WITH THE CITY OF DELANO PRIOR TO ANY CONSTRUCTION WORK PERFORMED WITHIN THE RIGHT OF WAY.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED FOR CONSTRUCTION.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING DIGGING PERMIT PRIOR TO ANY EXCAVATION OR TRENCHING ACTIVITIES, IF NECESSARY.
4. COORDINATE WITH STATE PRIOR TO SALVAGING ITEMS OR HAULING MATERIALS FROM THE CONSTRUCTION SITE.
5. CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF EXISTING UTILITIES AND EXERCISE PROPER CARE IN EXCAVATION OF THE AREA. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPLACED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE.
6. SWPPP BEST MANAGEMENT PRACTICES SHALL BE EMPLOYED AT ALL TIMES DURING CONSTRUCTION.
7. CONTRACTOR SHALL PERFORM THE MINIMUM CLEARING NECESSARY FOR WORK TO BE PERFORMED. CONTRACTOR SHALL BE RESPONSIBLE FOR RETURNING ALL DISTURBED AREAS TO THEIR ORIGINAL OR BETTER CONDITION IN ACCORDANCE WITH THE SPECIFICATIONS.
8. CONTRACTOR IS RESPONSIBLE FOR ALL PROJECT SAFETY INCLUDING, BUT NOT LIMITED TO, TRENCH EXCAVATION AND SHORING, AND SITE SECURITY.
9. ALL DIMENSIONS SHOWN ON PLANS ARE TO FACE OF CURB, OUTSIDE EDGE, CENTER OF STRIPE OR CENTER OF BOLLARD.

8

10. ALL UNDERGROUND METALLIC PIPE AND FITTINGS SHALL BE INSTALLED WITH THE FOLLOWING PIPE WRAP SYSTEM OR EQUIVALENT PIPE PROTECTION SYSTEM. THE TAPE WRAP SYSTEM SHALL BE COMPOSED OF A PRIMER (POLYKEN 1027 PRIMER) AND MULTILAYER SYSTEM (POLYKEN 980/955) AT MINIMUM 25 MIL THICKNESS AND 50% OVERLAP. PIPE/FITTING CLEANING, SURFACE PREPARATION, AND WRAP SYSTEM INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION.

SURVEY NOTES:

TOPOGRAPHY: EXISTING TOPOGRAPHY AND SITE CONDITION INFORMATION SHOWN ON THESE PLANS ARE BASED ON A SURVEY COMPLETED BY JEFFERY D. BRIANS, RCE 36182 AT BLAIR, CHURCH & FLYNN.

8

SITE BENCHMARK:

CHISELED "X" AT CENTERLINE OF DOVER PARKWAY, APPROXIMATELY 270' NORTH OF THE INTERSECTION OF BELMONT STREET.

ELEVATION = 301.92' NAVD88 DATUM

DOVER PARKWAY STREET IMPROVEMENTS:

REFER TO SEPARATE DESIGN PACKAGE FOR CONSTRUCTION OF STREET IMPROVEMENTS ALONG DOVER PARKWAY. DESIGN PACKAGE IS THE CITY OF DELANO APPROVED DESIGN OF OFF-SITE IMPROVEMENTS WITHIN THE ADJOINING RIGHT OF WAY. IF THERE ARE DISCREPANCIES BETWEEN THESE PLANS AND STREET IMPROVEMENT PLANS, STREET IMPROVEMENT PLANS SHALL GOVERN.

CONTRACTOR SHALL OBTAIN ENCROACHMENT PERMIT FROM THE CITY OF DELANO PRIOR TO COMMENCING WORK IN RIGHT OF WAY,

ABBREVIATIONS:

&	AND
℄	CENTERLINE
°	DEGREES
Ø	DIAMETER
'	FEET, MINUTES
"	INCHES, SECONDS
#	NUMBER
%	PERCENT
ACC	ACCESSIBLE
ADJ.	ADJACENT
ASTM	ASTM INTERNATIONAL
AWWA	AMERICAN WATER WORKS ASSOCIATION
BC	BEGIN CURVE
BL	BEGIN LINE
BMP'S	BEST MANAGEMENT PRACTICES
CA	CALIFORNIA
CF	CUBIC FEET
CFS	CUBIC FEET PER SECOND
CLR	CLEARANCE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
CONT.	CONTINUOUS
CY	CUBIC YARD
DGS	DEPARTMENT OF GENERAL SERVICES
DI	DRAINAGE/DRAIN INLET
DIA	DIAMETER
DIV.	DIVISION
DMV	DEPARTMENT OF MOTOR VEHICLES
DWG.	DRAWING
E	EAST\EASTING
EC	END CURVE
EL	END LINE
ELEV	ELEVATION
ELL	ELBOW
EV	ELECTRIC VEHICLE
EVA	ELECTRIC VEHICLE ACCESSIBLE
E.W.	EACH WAY
FDC	FIRE DEPARTMENT CONNECTION
FF	FINISHED FLOOR
FS	FINISHED SURFACE (FINISHED GRADE ELEVATION)
FT.	FEET
FW	FIRE WATER
HDPE	HIGH-DENSITY POLYETHYLENE
I.D.	INSIDE DIMENSION
INV	INVERT
ISA	INTERNATIONAL SYMBOL OF ACCESS
LED	LIGHT-EMITTING DIODE
LF	LINEAR FEET/FOOT
MAX.	MAXIMUM
MIN.	MINIMUM
N	NORTH\NORTHING
NAVD88	NORTH AMERICAN VERTICAL DATUM OF 1988
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NO.	NUMBER
NPDES	NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM
NTS	NOT TO SCALE
O.C.	ON CENTER
O.D.	OUTSIDE DIMENSION
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OS & Y	OUTSIDE STEM AND YOKE
OZ	OUNCE
PCC	PORTLAND CEMENT CONCRETE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PV	PHOTOVOLTAIC
PVC	POLYVINYL CHLORIDE
R	RADIUS
RCE	REGISTERED CIVIL ENGINEER
R/W	RIGHT OF WAY
S	SLOPE, SOUTH
SCH	SCHEDULE
SDR	STANDARD DIMENSION RATIO
SDRN	STORM DRAIN
SQ	SQUARE
SS	SANITARY SEWER
SSCO	SANITARY SEWER CLEANOUT
STA	STATION
STD	STANDARD
SWPPP	STORM WATER POLLUTION PREVENTION PLAN
TOC	TOP OF CURB
TYP	TYPICAL
W	WEST
W/	WITH
WWF	WELDED WIRE FABRIC

LEGEND:

- # — KEYNOTE/CONSTRUCTION NOTE
- VIEW NUMBER / SHEET NUMBER — DETAIL CALLOUT
- PV CONDUIT
- E(UG) — ELECTRICAL UNDERGROUND
- F — FIRE WATER
- SS — SANITARY SEWER
- W — DOMESTIC WATER
- SD — STORM SEWER
- CU — COMMUNICATION LINE
- G — NATURAL GAS LINE
- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- ELECTRICAL AND COMMUNICATION VAULT
- PARKING BUMPER
- STEEL BOLLARD
- SWALE FLOW-LINE DIRECTION
- CHAIN-LINK CONSTRUCTION FENCE
- SILT FENCE OR FIBER ROLL
- PROPERTY LINE
- DROUGHT TOLERANT, EASILY MAINTAINED LANDSCAPING
- ASPHALT PAVEMENT
- CONCRETE PAVEMENT
- CONCRETE WALKWAYS

DRAWING INDEX

8

Hydrant Flow Test Report

Test Date 2/09/2023 **Test Time** 9:20am

Location
DMV DELANO
DOVER PARK WAY.
DELANO, CA.

Tested by
JAKE BUSTOS &
HECTOR CONTRERAS
CONTROL FIRE PROTECTION, INC.
1347 OGDEN ST.
BAKERSFIELD, CA. 93305

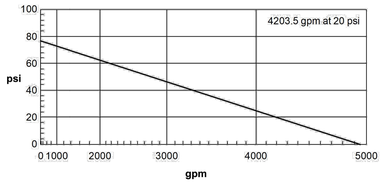
Notes
SEE INSPECTION REPORT FROM STATE FIRE MARSHAL

Read Hydrant
77 psi **static pressure**
70 psi **residual pressure**
2 ft **hydrant elevation**

Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1	2	2.5	.9	65	1353 gpm

Flow Graph



Created with the free hydrant flow test program from www.igneusinc.com

HYDRANT FLOW TEST:

PERFORMED ON: FEBRUARY 9, 2023

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY
DEPARTMENT OF FORESTRY AND FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE AND LIFE SAFETY DIVISION
INSPECTION REPORT
EN-02 (12/08)

INSPECTION REPORT

FILE NUMBER: 01-15-11-0235-10001	PAGE 01 OF PAGE 01	
NAME OF FACILITY: Dept. of Motor Vehicles	HOURS	MINUTES
NAME OF BUILDING: DMV Office -Delano		
ADDRESS: Dover Parkway Delano, CA		
DISCUSSED WITH: Danette Smith	TITLE: DGS Construction Supervisor-I	
ACCOMPANIED BY: Danette Smith	TITLE: DGS Construction Supervisor-I	

Dept. of Motor Vehicles - Delano **Govmotus #20-S-1059-CP-PI**

On February 9, 2023, Deputy State Fire Marshal-III Specialist Edward Arriaga (DSFM Arriaga) witness a fire hydrant flow test. DSFM Arriaga was accompanied by DGS Construction Supervisor-I Danette Smith, Bernard's Construction Superintendent Tim Brady, representatives from Control Fire Protection & the City of Delano.

Two fire hydrants were used for the water flow test; the test commenced at approximately 0930 hours.

Fire Hydrant-1 (Flow Hydrant)
Locate on Dover St
Total distance from fire hydrant to property line: 580 feet.
Total distance from fire hydrant to the southside of the building footprint: 790 feet.
Static was at 77 psi. Outlet was 2 ½".
Flow was at 65 psi. Outlet was 2 ½". Method of testing was a Pitot gauge.

Fire Hydrant-2 (Static/Residual Hydrant)
Locate on Morse Blvd.
Total distance from fire hydrant to property line: 604 feet.
Total distance from fire hydrant to the southside of the building footprint: 814 feet.
Static was at 70 psi (when Fire Hydrant-1 was flowing). Outlet was 2 ½".

NOTE: Fire hydrant flow test is valid for six months from 02-09-23 to 08-09-23.

NOTE: *Refer to Job Card, Building Plans, Specifications, etc., for additional required inspections. The OSFM does not perform Quality Control or Quality Assurance.*

*****END OF REPORT*****

RECEIVED BY	DATE
Danette Smith	
DEPUTY STATE FIRE MARSHAL: Edward Arriaga	DATE OF INSPECTION: 02-09-23

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER — GORDON HO-MAN FONG — C 87304 — CIVIL — STATE OF CALIFORNIA
05/31/2023

CONSULTANT
AECOM

nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADDENDUM 01	05/31/23

DATE 05/31/2023

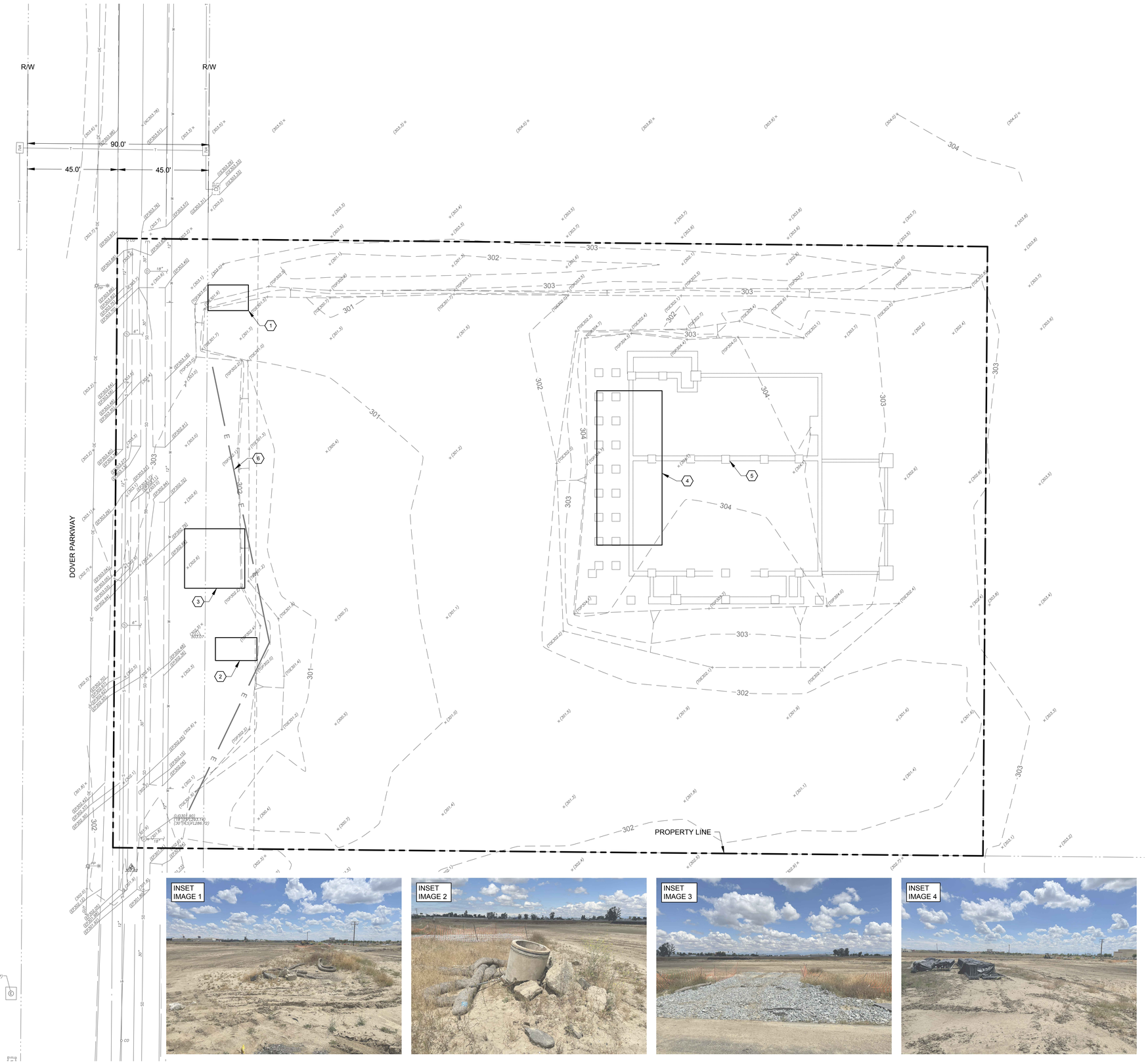
JOB NO. DGS 140724

SHEET TITLE

CIVIL NOTES, ABBREVIATIONS, & LEGEND

SHEET NO.

C0.01



1 EXISTING CONDITIONS AND DEMOLITION PLAN
1" = 20'

KEYNOTES:

1. REMOVE AND DISPOSE OF CONCRETE RUBBLE AND FIBER ROLLS. SEE INSET IMAGE 1.
2. REMOVE AND DISPOSE OF CONCRETE RUBBLE, CONCRETE RISER SECTION AND FIBER ROLLS. SEE INSET IMAGE 2.
3. CRUSHED AGGREGATE. CONTRACTOR TO CONFIRM ENTRANCE MEETS REQUIREMENTS OF DETAIL C-1/C5.01 IF UTILIZED AS CONSTRUCTION ENTRANCE. SEE INSET IMAGE 3.
4. APPROXIMATE LOCATION OF EXISTING BAR JOISTS STORED ON-SITE. SEE INSET IMAGE 4.
5. LOCATION OF PREVIOUSLY PREPARED BUILDING PAD AND FOOTINGS. IN MARCH 2023 FOOTING WERE FILLED BY PUSHING ON-SITE SOILS INTO TRENCHES. SOIL WAS NOT COMPACTED OR TESTED DURING BACKFILL OPERATIONS. SEE SHEET C1.05, C4.02, C4.03, AND SPECIFICATION 31 20 00 FOR PROPOSED GRADING AND EARTHWORK REQUIREMENTS.
6. APPROXIMATE LOCATION OF PREVIOUSLY INSTALLED TEMPORARY UNDERGROUND ELECTRICAL LINES. CONTRACTOR SHALL CONFIRM EXISTENCE, AND REMOVE IF PRESENT.

SHEET NOTES:

1. EXISTING CONDITIONS SHOWN ARE BASED ON TOPOGRAPHIC SURVEY SHOWN ON SHEET V1.01 AND SITE WALK PERFORMED BY CIVIL ENGINEER ON MAY 4, 2023.
2. CONTRACTOR SHALL ALERT STATE IMMEDIATELY OF CONDITIONS THAT DIFFER FROM THIS PLAN.
3. REMOVE AND PROPERLY DISPOSE OF ALL CONCRETE RUBBLE, DEBRIS, FIBER ROLLS, TRASH, PALLETS, SANDBAGS, PIPING, CONDUITS, AND TEMPORARY FENCING CURRENTLY ON SITE.

LEGEND:

(335.21)	EXISTING ELEVATION
EP	EDGE OF PAVEMENT
TCA	TELEPHONE CABINET
TOE	TOE OF SLOPE
TOP	TOP OF SLOPE
TVA	TELEPHONE VAULT
12.55	SURVEY CONTROL POINT
	BENCHMARK
E	ELECTRICAL MANHOLE
ELR	ELECTRICAL RISER
GUY	GUY
PP	POWER POLE
	SLOPE
	STORM DRAIN MANHOLE
	STREET LIGHT
OE	OVERHEAD ELECTRIC
18" SD	STORM DRAIN LINE; SIZE AS NOTED
T	UNDERGROUND TELEPHONE
12" W	WATER LINE; SIZE AS NOTED
	PROPERTY LINE
300	MAJOR EXISTING CONTOUR LINE
301	MINOR EXISTING CONTOUR LINE

NORTH

0 20' 40'
SCALE: 1" = 20'

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER
GORDON HO-MAN FONG
C 87304
CIVIL
STATE OF CALIFORNIA
05/31/2023

CONSULTANT
AECOM

nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADDENDUM 01	05/31/23

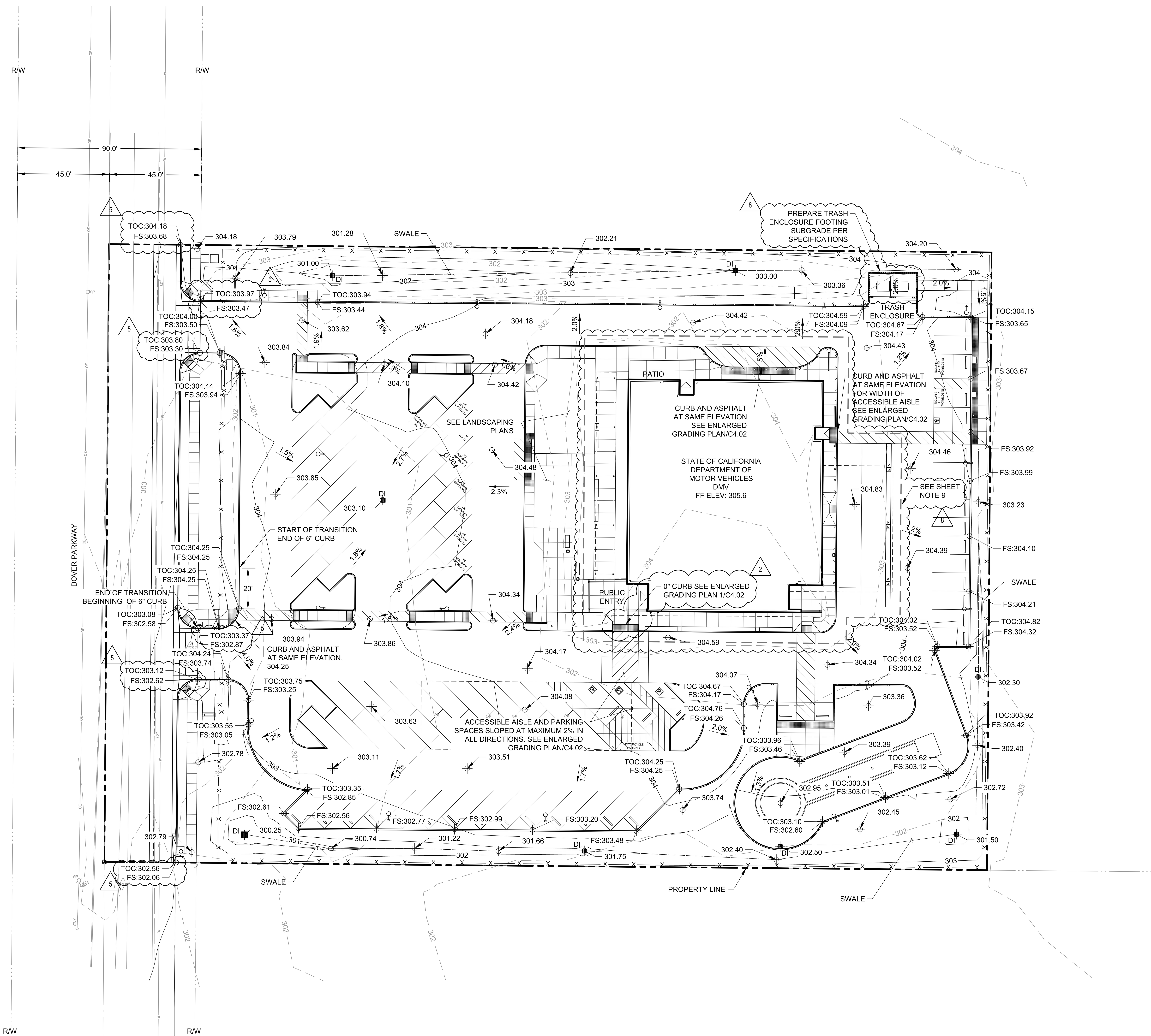
DATE 05/31/2023

JOB NO. DGS 140724

SHEET TITLE
EXISTING CONDITIONS AND DEMOLITION PLAN

SHEET NO.
C1.00

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET



1 GRADING PLAN
1" = 20'

SHEET NOTES:

1. CONTRACTOR SHALL ADHERE TO ALL UNDERGROUND SERVICE ALERT REQUIREMENTS BY CALLING 811 AND OBTAIN ANY REQUIRED GRADING PERMITS.
2. CONTRACTOR SHALL HAVE ALL TEMPORARY EROSION AND SEDIMENTATION MEASURES IN PLACE PRIOR TO STARTING EARTH DISTURBING ACTIVITIES.
3. CONTRACTOR SHALL LIMIT THE AMOUNT OF SITE DISTURBANCE TO WHAT IS NECESSARY FOR SITE GRADING AND INSTALLATION OF TEMPORARY EROSION CONTROL BMPS.
4. CONTRACTOR SHALL COORDINATE WITH THE CITY OF DELANO PRIOR TO ANY CONSTRUCTION WORK PERFORMED WITHIN THE RIGHT OF WAY.
5. CONTOURS AND SPOT ELEVATIONS SHOWN ARE FINAL FINISHED GRADES.
6. SEE SHEET C1.08 FOR STORM DRAIN PLAN.
7. SEE SHEET C4.01 TO C4.03 FOR ENLARGED GRADING PLANS.
8. ALL ACCESSIBLE PATHS SHALL BE GRADES TO NOT EXCEED 2% IN ANY DIRECTION. ACCESSIBLE PATHS ARE DENOTED BY THE DIAGONAL PAVEMENT STRIPING.
9. BUILDING PAD AREA SHALL BE OVER-EXCAVATED TO AN ELEVATION OF 298 FEET, AND TO A DEPTH OF AT LEAST 1.5 FEET BELOW BOTTOM OF ALL FOOTINGS, WHICHEVER REQUIRES THE DEEPER EXCAVATION. SLOT CUTTING ONLY BELOW FOUNDATIONS IS NOT PERMITTED. THE OVER-EXCAVATION LIMITS SHALL INCLUDE THE ENTIRE BUILDING FOOTPRINT, ALL FOUNDATIONS, AND ADJACENT WALKWAYS, A MINIMUM OF 5 FEET HORIZONTALLY BEYOND THE EDGES OF THE FOUNDATIONS, AND A MINIMUM OF 5 FEET BEYOND ALL WALKWAYS ADJACENT TO THE BUILDING, WHICHEVER IS GREATER. FOLLOWING EXCAVATION OF THE NEAR SURFACE SOILS TO THE DEPTHS RECOMMENDED ABOVE, GEOTECHNICAL ENGINEER SHALL BE REQUESTED TO VERIFY THAT THE EXPOSED SOILS ARE CONSISTENT WITH THE ANTICIPATED CONDITIONS, AND VERIFICATION FROM THE CONTRACTOR'S SURVEYOR SHALL BE PROVIDED THAT THE HORIZONTAL AND VERTICAL OVER EXCAVATION LIMITS REQUIRED FOR THE PROJECT HAVE BEEN ACHIEVED.

SITE BENCHMARK:

CHISELED "X" AT CENTERLINE OF DOVER PARKWAY APPROXIMATELY 270' NORTH OF THE INTERSECTION OF BELMONT STREET.

ELEVATION = 301.92' NAVD88 DATUM

LEGEND:

SWALE FLOWLINE DIRECTION

NORTH

0 20' 40'
SCALE: 1" = 20'

AGENCY APPROVAL

SFM APPROVAL

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NO.	DESCRIPTION	DATE
2	DSA REVIEW	08/07/20
5	CITY PLAN CHECK	09/15/21
8	ADDENDUM 01	05/31/23

DATE 05/31/2023

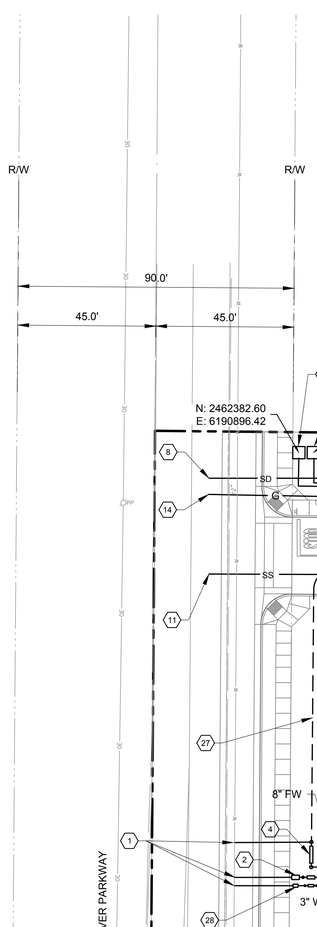
JOB NO. DGS 140724

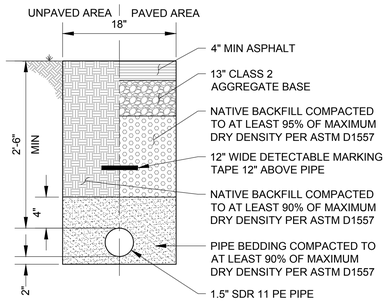
SHEET TITLE

GRADING PLAN

SHEET NO.

C1.05

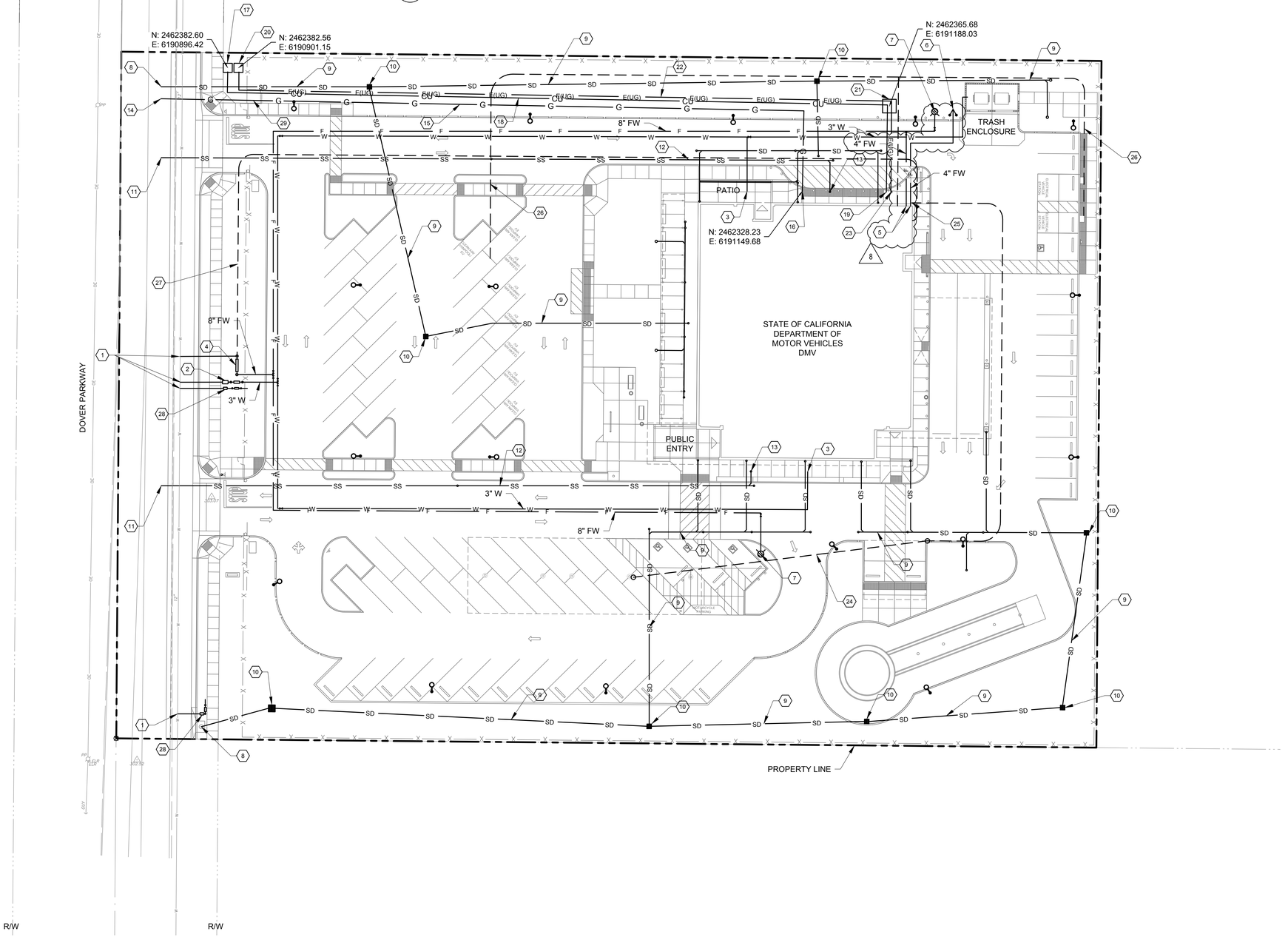




NOTES:

1. BELOW GRADE NATURAL GAS PIPE FROM SOUTHERN CALIFORNIA GAS COMPANY (SOCAL GAS) METER TO BUILDING POINT OF CONNECTION TO BE 1.5-INCH POLYETHYLENE (PE) SDR 11 PIPE. PIPE SHALL BE INSTALLED PER SOCAL GAS AND PIPE MANUFACTURER'S RECOMMENDATIONS, WHICHEVER IS MORE STRINGENT.
2. CONTRACTOR SHALL TRANSITION FROM BELOW GROUND PE PIPE TO ABOVE GROUND STEEL PIPE AT GAS METER AND BUILDING POINT OF CONNECTION. TRANSITION FITTINGS AND CONNECTIONS PER SOCAL GAS REQUIREMENTS.
3. NATURAL GAS SHALL BE INSTALLED 5 FEET HORIZONTALLY FROM ALL WET UTILITIES.
4. GAS METER SHALL MEET SOCAL GAS REQUIREMENTS AND THE BELOW:
   - 4.1. METER SHALL BE OR EQUIVALENT TO: HONEYWELL BK-250.
   - 4.2. RECORD AT INTERVALS OF ONE HOUR OR LESS AND TRANSMIT DATA TO A REMOTE LOCATION.
   - 4.3. DATA COLLECTION SYSTEM MUST USE A LOCAL AREA NETWORK, BUILDING AUTOMATION SYSTEM, WIRELESS NETWORK OR COMPARABLE.
   - 4.4. SYSTEM MUST BE CAPABLE OF STORING ALL METER DATA FOR AT LEAST 36 MONTH.
   - 4.5. DATA MUST BE REMOTELY ACCESSIBLE.
   - 4.6. MUST BE CAPABLE OF REPORTING HOURLY, DAILY, MONTHLY AND ANNUAL ENERGY USE.

1 NATURAL GAS TRENCH AND METER NOTES
NTS



1 UTILITY PLAN
1" = 20'

KEYNOTES:

1. CONNECT TO EXISTING 12 INCH WATER LINE ALONG DOVER PARKWAY
2. INSTALL DOMESTIC WATER METER AND REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER
3. POINT OF CONNECTION FOR DOMESTIC WATER LINE 5 FEET FROM BUILDING. SEE PLUMBING FOR CONTINUATION
4. INSTALL FIRE WATER DOUBLE CHECK DETECTOR BACKFLOW PREVENTER, SEE SHEET C1.07
5. CONNECT TO FIRE RISER ROOM, SEE SHEET C1.07
6. INSTALL FIRE DEPARTMENT CONNECTION , SEE SHEET C1.07
7. INSTALL FIRE HYDRANT, SEE SHEET C1.07
8. CONNECT TO STORM SEWER
9. INSTALL STORM SEWER LINE, SEE SHEET C1.08
10. INSTALL 2'X2' PRECAST CONCRETE DRAIN INLET
11. CONNECT TO SANITARY SEWER
12. INSTALL SANITARY SEWER LINE, SEE SHEET C1.09
13. POINT OF CONNECTION FOR SANITARY SEWER LINE 5 FEET FROM BUILDING. SEE PLUMBING FOR CONTINUATION
14. CONNECT TO NATURAL GAS MAIN
15. INSTALL 1.5" POLYETHYLENE NATURAL GAS LINE
16. POINT OF CONNECTION FOR NATURAL GAS LINE 5 FEET FROM BUILDING. SEE PLUMBING FOR CONTINUATION.
17. INSTALL NEW COMMUNICATION VAULT, SEE ELECTRICAL
18. INSTALL NEW COMMUNICATION LINE, SEE ELECTRICAL
19. POINT OF CONNECTION FOR COMMUNICATION LINE 5 FEET FROM BUILDING. SEE ELECTRICAL FOR CONTINUATION
20. INSTALL NEW ELECTRICAL VAULT, SEE ELECTRICAL
21. INSTALL NEW ELECTRICAL TRANSFORMER, SEE ELECTRICAL
22. INSTALL NEW ELECTRICAL LINE, SEE ELECTRICAL
23. POINT OF CONNECTION FOR ELECTRICAL LINE 5 FEET FROM BUILDING. SEE ELECTRICAL FOR CONTINUATION
24. INSTALL PV CONDUIT
25. POINT OF CONNECTION FOR PV CONDUIT LINE 5 FEET FROM BUILDING. SEE ELECTRICAL FOR CONTINUATION.
26. INSTALL CONDUIT FOR EV CHARGER. SEE ELECTRICAL SITE PLAN.
27. INSTALL CONDUIT FROM FIRE WATER BACKFLOW PREVENTER TO FIRE ALARM CONTROL PANEL IN ELECTRICAL ROOM. SEE ELECTRICAL SITE PLAN
28. INSTALL IRRIGATION METER AND REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER. SEE LANDSCAPING FOR CONTINUATION.
29. INSTALL NATURAL GAS METER PER SOUTHERN CALIFORNIA GAS COMPANY REQUIREMENTS.

SHEET NOTES:

1. SEE SHEET C1.07 FOR WATER PLAN
2. SEE SHEET C1.08 FOR STORM DRAIN PLAN
3. SEE SHEET C1.09 FOR SANITARY SEWER PLAN
4. SEE ELECTRICAL FOR SITE ELECTRICAL PLAN
5. ALL UNDERGROUND METALLIC PIPE AND FITTINGS SHALL BE INSTALLED WITH THE FOLLOWING PIPE WRAP SYSTEM OR EQUIVALENT PIPE PROTECTION SYSTEM. THE TAPE WRAP SYSTEM SHALL BE COMPOSED OF A PRIMER (POLYKEN 1027 PRIMER) AND MULTILAYER SYSTEM (POLYKEN 980/955) AT MINIMUM 25 MIL THICKNESS AND 50% OVERLAP. PIPE/FITTING CLEANING, SURFACE PREPARATION, AND WRAP SYSTEM INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION.

LEGEND:

- PV CONDUIT
- E(UG) — ELECTRICAL UNDERGROUND
- F — FIRE WATER
- SS — SANITARY SEWER
- W — DOMESTIC WATER
- SD — STORM SEWER
- CU — COMMUNICATION LINE
- G — NATURAL GAS LINE
- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- ELECTRICAL AND COMMUNICATION VAULT

NORTH

0 20' 40'
SCALE: 1" = 20'

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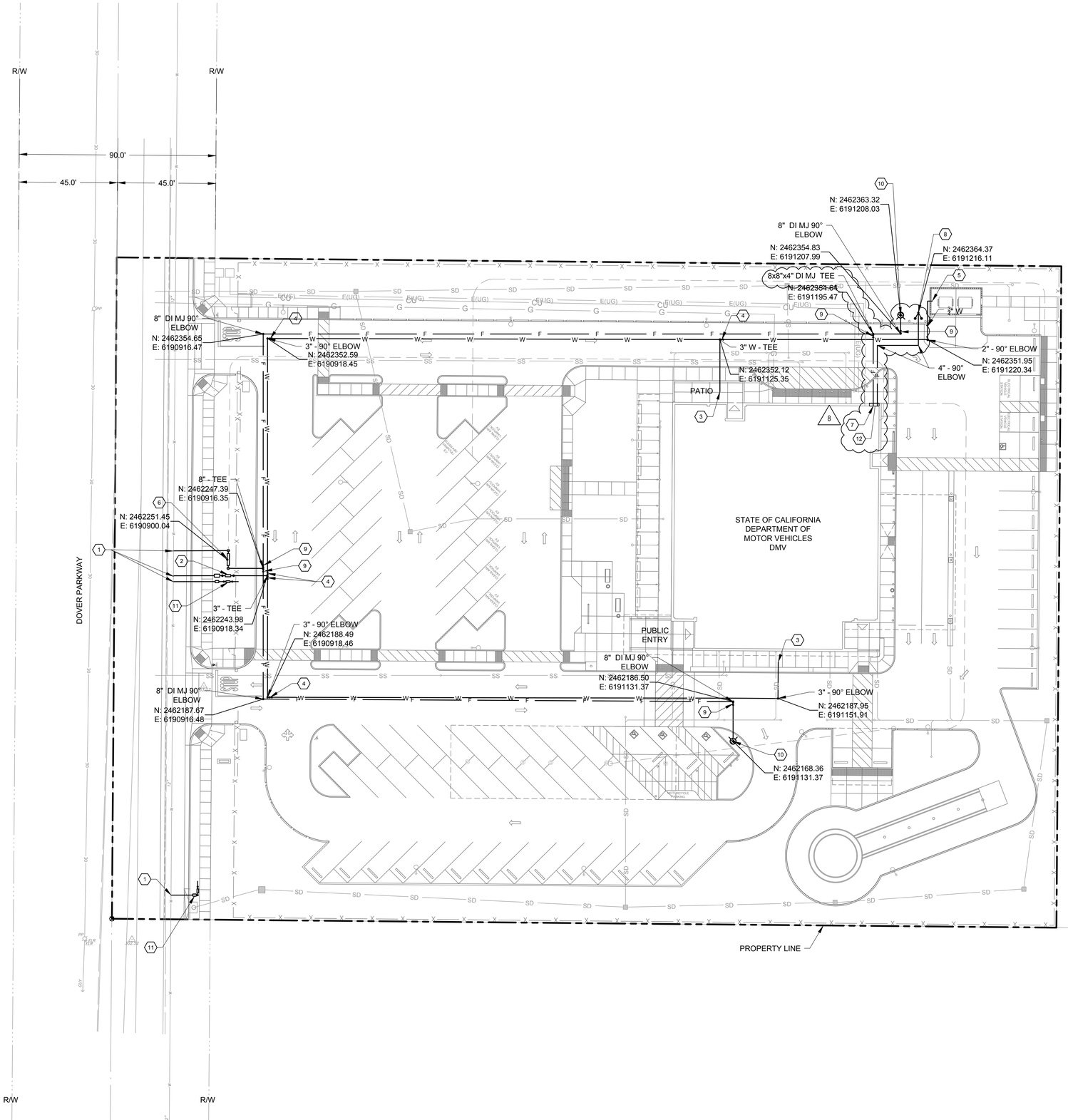
JOB NO. DGS 140724

SHEET TITLE

UTILITY PLAN

SHEET NO.

C1.06



1 WATER PLAN
1" = 20'

KEYNOTES:

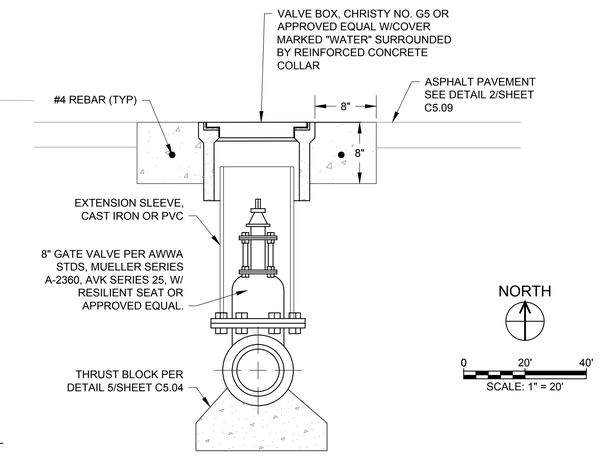
1. CONNECT TO EXISTING 12 INCH WATER LINE ALONG DOVER PARKWAY. COORDINATE WITH CITY OF DELANO ON REQUIREMENTS. CONTRACTOR IS RESPONSIBLE FOR ALL ITEMS NECESSARY TO MAKE CONNECTION. SEE DETAIL 1/C5.04 AND 2/C5.04 FOR IRRIGATION AND DOMESTIC WATER CONNECTION AND METER.
2. INSTALL 3" DOMESTIC WATER REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER. INSTALL ZURN 375 OR APPROVED EQUAL
3. POINT OF CONNECTION FOR DOMESTIC WATER LINE 5 FEET FROM BUILDING. SEE PLUMBING FOR CONTINUATION
4. INSTALL 3" BALL VALVE WITH TRAFFIC RATED COVER AND FRAME. COVER SHALL BE MARKED "WATER". VAULT SHALL BE SUPPORTED WITH 8 INCH WIDE AND DEEP REINFORCED CONCRETE COLLAR WITH #4 REBAR. BOTTOM OF VALVE BOX SHALL INCLUDE 6" THICK LAYER OF $\frac{3}{4}$" GRAVEL PLACED IN TWO- 3 INCH LIFTS.
5. INSTALL HOSE BIB. HOSE BIB SHALL BE LOCKABLE AND RECESSED IN CMU BLOCK WALL. HOSE BIB SHALL BE WOODFORD MODEL B24 OR APPROVED EQUAL.
6. INSTALL FIRE WATER DOUBLE CHECK DETECTOR BACKFLOW PREVENTER WITH OS&Y GATE VALVES
7. CONNECT TO FIRE RISER ROOM. SEE DETAIL 2/C5.05
8. INSTALL FIRE DEPARTMENT CONNECTION , SEE DETAIL 4/C5.05
9. INSTALL 8" DUCTILE IRON MECHANICAL JOINT GATE VALVE, SEE DETAIL 2 THIS SHEET.
10. INSTALL FIRE HYDRANT, SEE DETAIL 1/C5.05
11. INSTALL 1" IRRIGATION REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER. INSTALL ZURN 375XLB OR APPROVED EQUAL.
12. REFER TO DETAIL 4/S5.1 FOR REQUIRED INSTALLATION OF PARALLEL PIPES AT CONCRETE FOOTINGS.

SHEET NOTES:

1. ALL DOMESTIC WATER LINES SHALL BE 3" PVC, ASTM D2241, SDR 21 RATING.
2. ALL FIRE WATER LINES SHALL BE 8" AWWA C900, DR-18 PVC.
3. THRUST BLOCKS SHALL BE INSTALLED AT ALL CHANGES IN DIRECTION ON BOTH THE DOMESTIC AND FIRE WATER LINES. SEE DETAIL 5/C5.04
4. SEE SHEET C1.06 FOR UTILITY PLAN
5. SEE SHEETS C5.04 AND C5.05 FOR WATER DETAILS

LEGEND:

- PV CONDUIT
- E(UG) ELECTRICAL UNDERGROUND
- F FIRE WATER
- SS SANITARY SEWER
- W DOMESTIC WATER
- SD STORM SEWER
- CU COMMUNICATION LINE
- G NATURAL GAS LINE
- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- ELECTRICAL AND COMMUNICATION VAULT



2 GATE VALVE AND VALVE BOX
NTS

NORTH

0 20' 40'
SCALE: 1" = 20'

AGENCY APPROVAL

SFM APPROVAL

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REVISIONS		
NO.	DESCRIPTION	DATE
1	ADDENDUM 01	05/31/23

DATE 05/31/2023
JOB NO. DGS 140724
SHEET TITLE
WATER PLAN
SHEET NO.
C1.07

1 STORM DRAIN PLAN
1" = 20'

NORTH

0 20' 40'
SCALE: 1" = 20'

KEYNOTES:

1. CONNECT TO STORM SEWER, COORDINATE WITH CITY OF DELANO ON REQUIREMENTS. CONTRACTOR IS RESPONSIBLE FOR ALL ITEMS NECESSARY TO MAKE CONNECTION.
2. CONNECT DOWNSPOUTS TO 4" SDR 26 PVC STORM SEWER LATERALS. LATERALS SHALL BE SLOPED AT 2% UNLESS OTHERWISE NOTED. SEE DETAIL 1/C5.07
3. CONSTRUCT STORM DRAIN CLEANOUT, SEE DETAIL 3/C5.07
4. CONSTRUCT 4" TRENCH DRAIN FOR PATIO AREA, SEE DETAIL 5 AND 6/C5.06
5. INSTALL 6" PVC DOUBLE WYE WITH 1/8 BEND
6. CONSTRUCT AREA DRAIN, SEE DETAIL 2/C5.07
7. INSTALL INLET MARKER, SEE DETAIL 4/C5.06

SHEET NOTES:

1. ALL CHANGES IN DIRECTION OF 4" ROOF DRAIN LATERALS SHALL CONSIST OF A 4" TO 6" PVC WYE AND 1/8 BEND.
2. AREA DRAINS SHALL BE CONNECTED TO 6" PVC SDR 26 PIPE. ALL CHANGES IN DIRECTION TO INCLUDE 6" PVC WYE AND 1/8 BEND.
3. FILTER BAGS SHALL BE INSTALLED IN ALL DRAIN INLETS. SEE DETAIL 3/C5.06.
4. SEE SHEET C1.06 FOR UTILITY PLAN
5. SEE SHEETS C2.01 THROUGH C2.04 FOR STORM DRAIN PLANS AND PROFILES.
6. ADS HP-STORM PIPE OR APPROVED EQUAL SHALL BE USED FOR ALL STORM DRAIN PIPE WITHIN CITY RIGHT OF WAY. PIPE SHALL MEET ASTM F2881 OR AASHTO M330 STANDARDS AND HAVE A MANNING'S "n" VALUE OF 0.012. JOINTS SHALL BE WATERTIGHT IN ACCORDANCE WITH ASTM D3212. GASKETS SHALL MEET REQUIREMENTS OF ASTM F477. GASKETS SHALL BE INSTALLED BY PIPE MANUFACTURER AND COVERED WITH REMOVAL PROTECTIVE WRAP TO ENSURE THE GASKET IS FREE FROM DEBRIS PRIOR TO INSTALLATION. A JOINT LUBRICANT SHALL BE USED ON GASKET AND BELL DURING ASSEMBLY. TEST JOINTS IN ACCORDANCE WITH ASTM F1417 OR ASTM F2487. CONTACT MANUFACTURER FOR RECOMMENDED LEAKAGE RATES. INSTALL PIPE PER ASTM D2321 AND MANUFACTURER RECOMMENDATIONS.
7. CONTRACTOR SHALL FIELD VERIFY LOCATION AND INVERT OF PREVIOUSLY CONSTRUCTED STUB-OUT TO SITE. INSTALL WATERTIGHT FITTING AT END OF EXISTING STUB-OUT AND CONNECT NEW HP-STORM PIPE.

LEGEND:

- PV CONDUIT
- E(UG) ELECTRICAL UNDERGROUND
- F FIRE WATER
- SS SANITARY SEWER
- W DOMESTIC WATER
- SD STORM SEWER
- CU COMMUNICATION LINE
- G NATURAL GAS LINE
- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- ELECTRICAL AND COMMUNICATION VAULT

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REVISIONS			
NO.	DESCRIPTION	DATE
1	CITY REVIEW	07/02/20
2	CITY PLAN CHECK	09/15/21
3	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

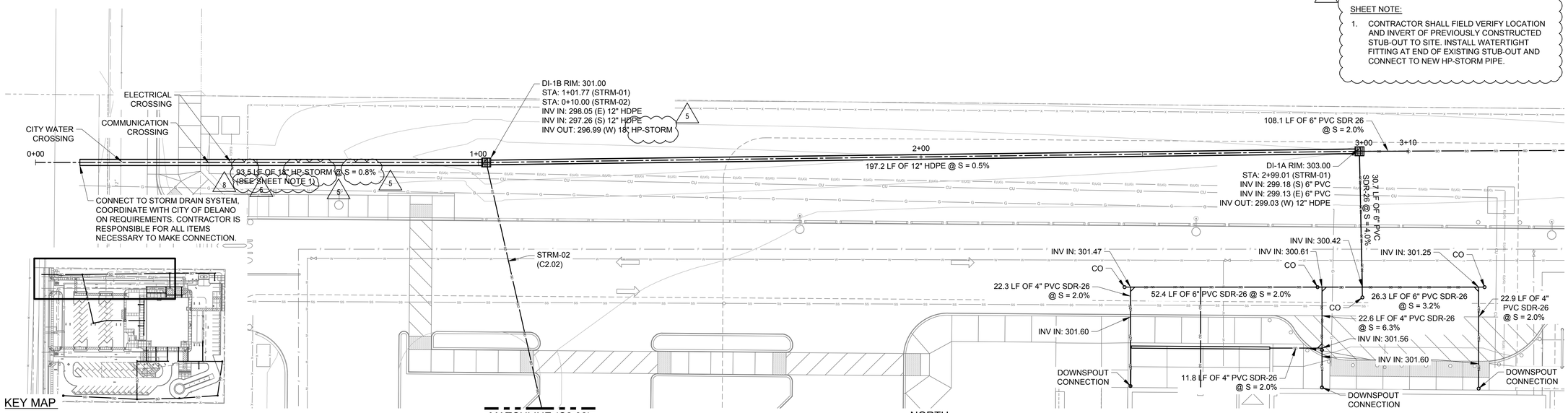
SHEET TITLE

STORM DRAIN PLAN

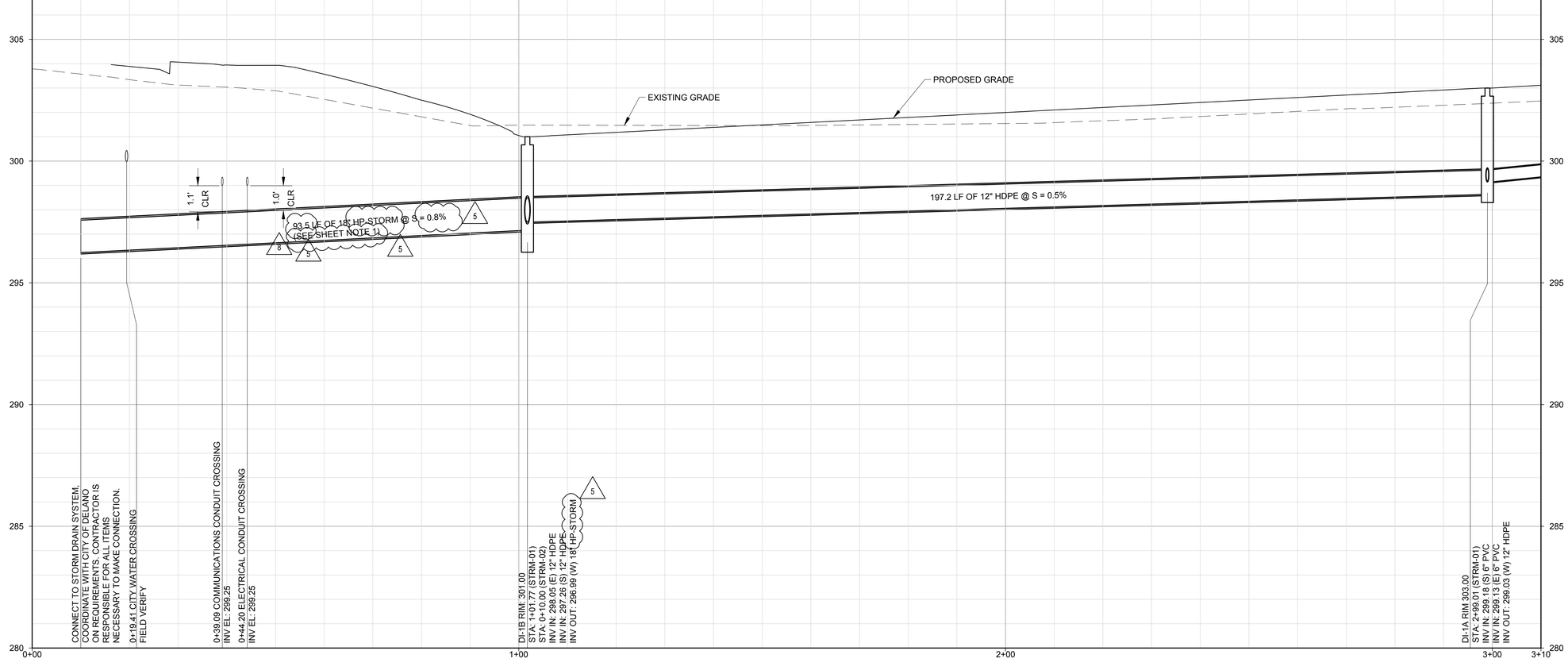
SHEET NO.

C1.08

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET



STORM DRAIN SYSTEM (STRM-01) STA: 0+00 TO STA: 3+10
SCALE: 1" = 10'



STORM WATER SYSTEM (STRM-01) STA: 0+00 TO STA: 3+10
SCALE: HOR: 1" = 10'
VER: 1" = 2'

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

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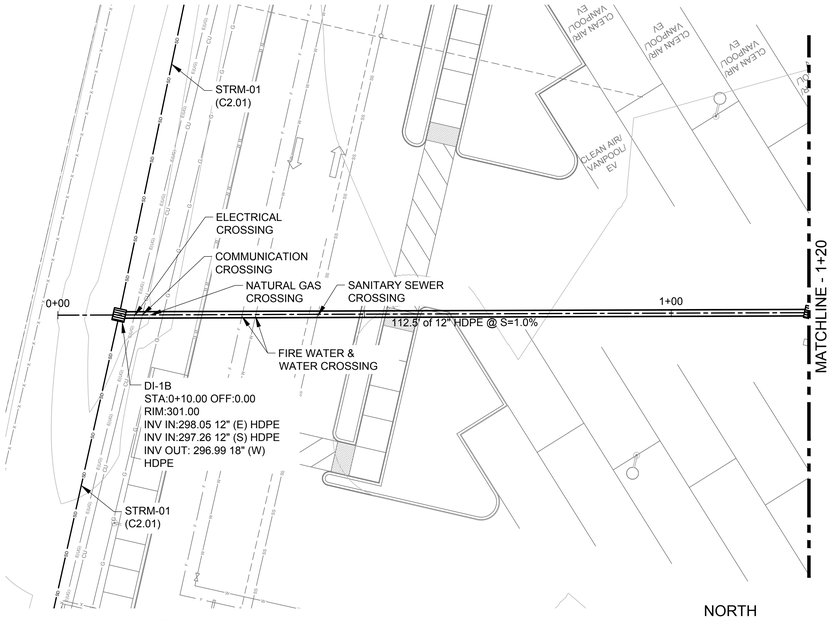
JOB NO. DGS 140724

SHEET TITLE

STORM DRAIN SYSTEM PLAN & PROFILE 1 OF 4

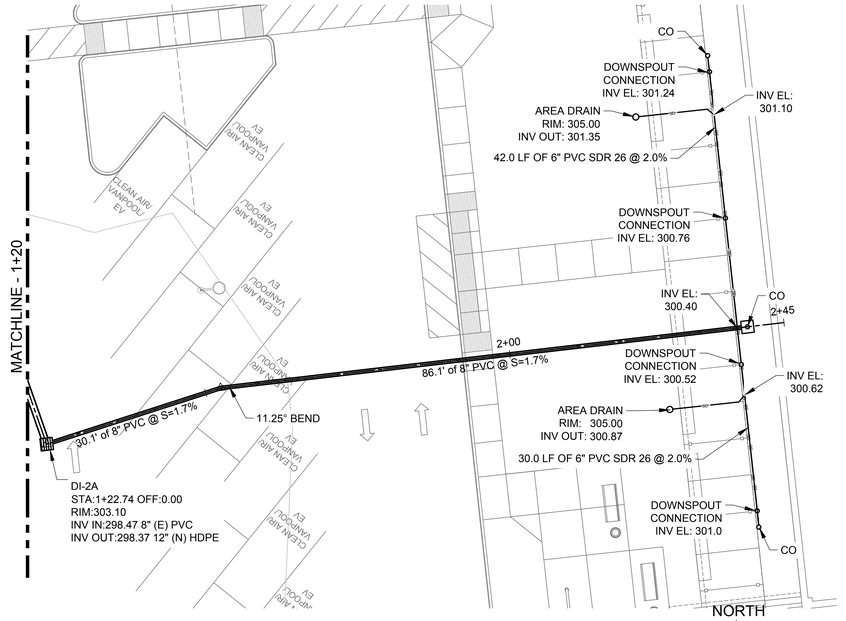
SHEET NO.

C2.01



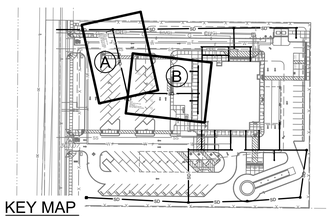
A STORM DRAIN SYSTEM (STRM-02) STA: 0+00 TO STA: 1+20

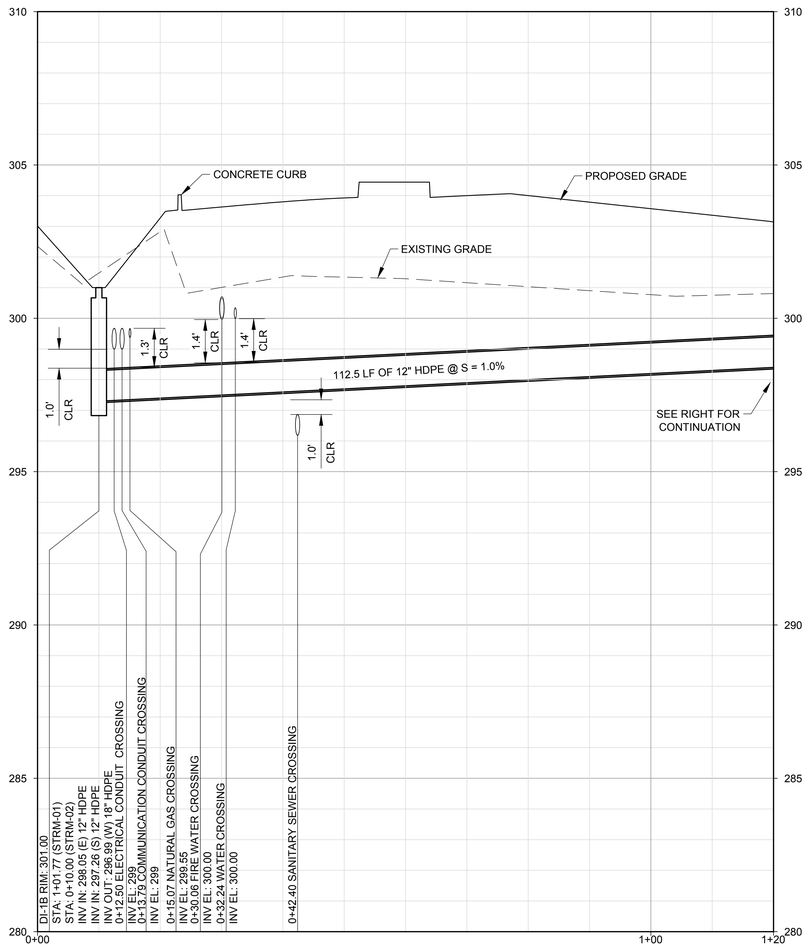
SCALE: 1" = 10'



B STORM DRAIN SYSTEM (STRM-02) STA: 1+20 TO STA: 2+45

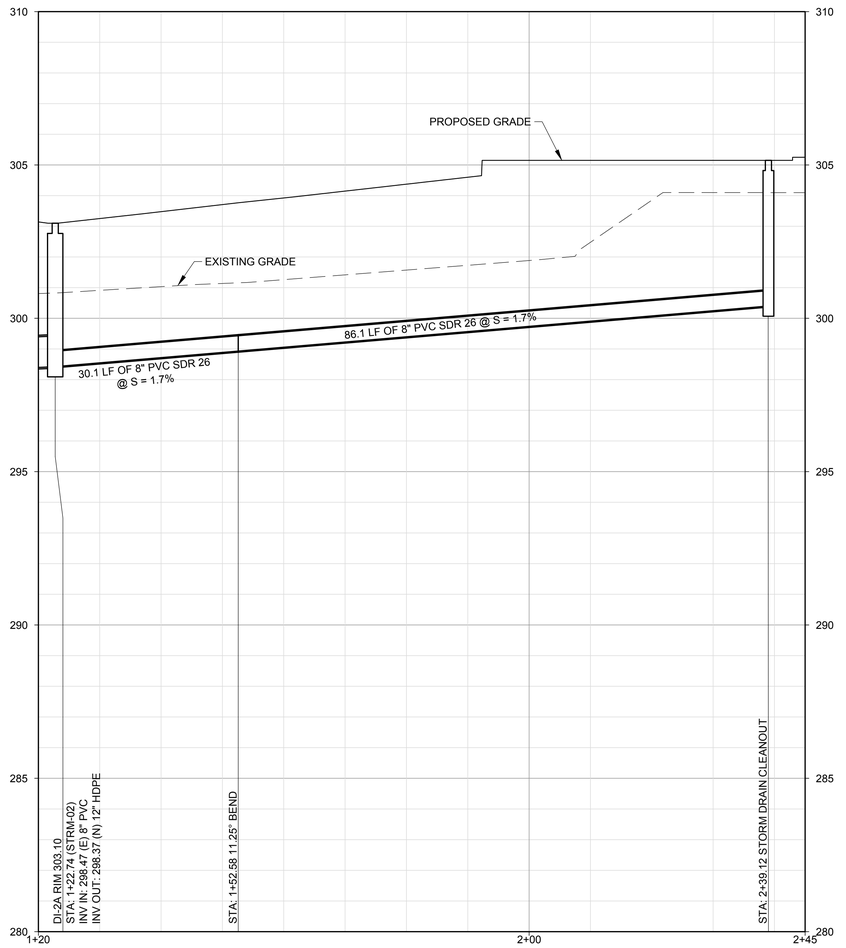
SCALE: 1" = 10'





STORM DRAIN SYSTEM (STRM-02) STA: 0+00 TO STA: 1+20

SCALE: HOR: 1" = 10'
VER: 1" = 2'



STORM DRAIN SYSTEM (STRM-02) STA: 1+20 TO STA: 2+45

SCALE: HOR: 1" = 10'
VER: 1" = 2'

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

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2	ADDENDUM 01	05/31/23

DATE 05/31/2023

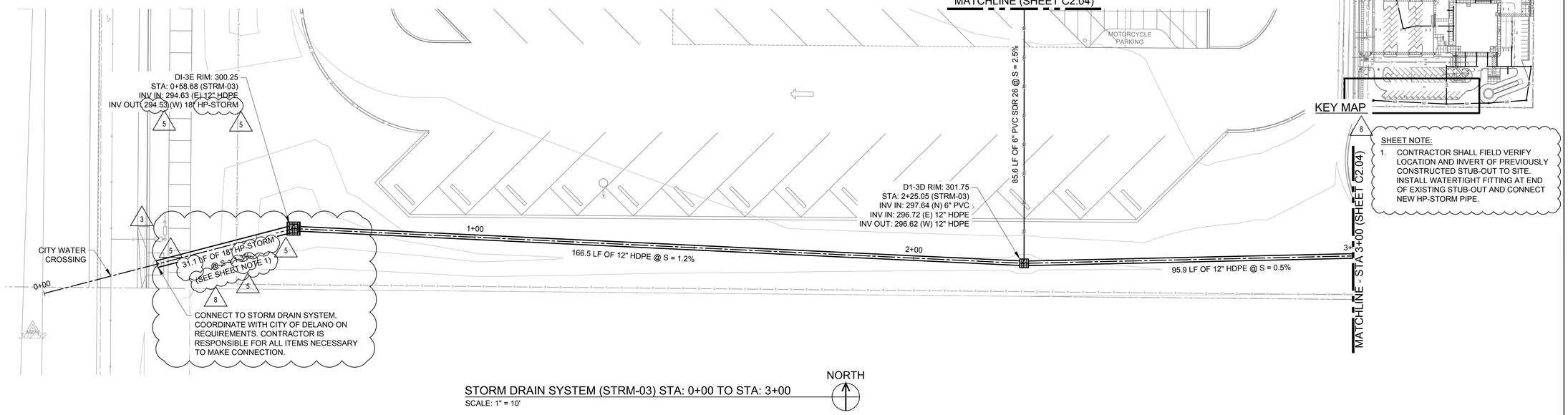
JOB NO. DGS 140724

SHEET TITLE

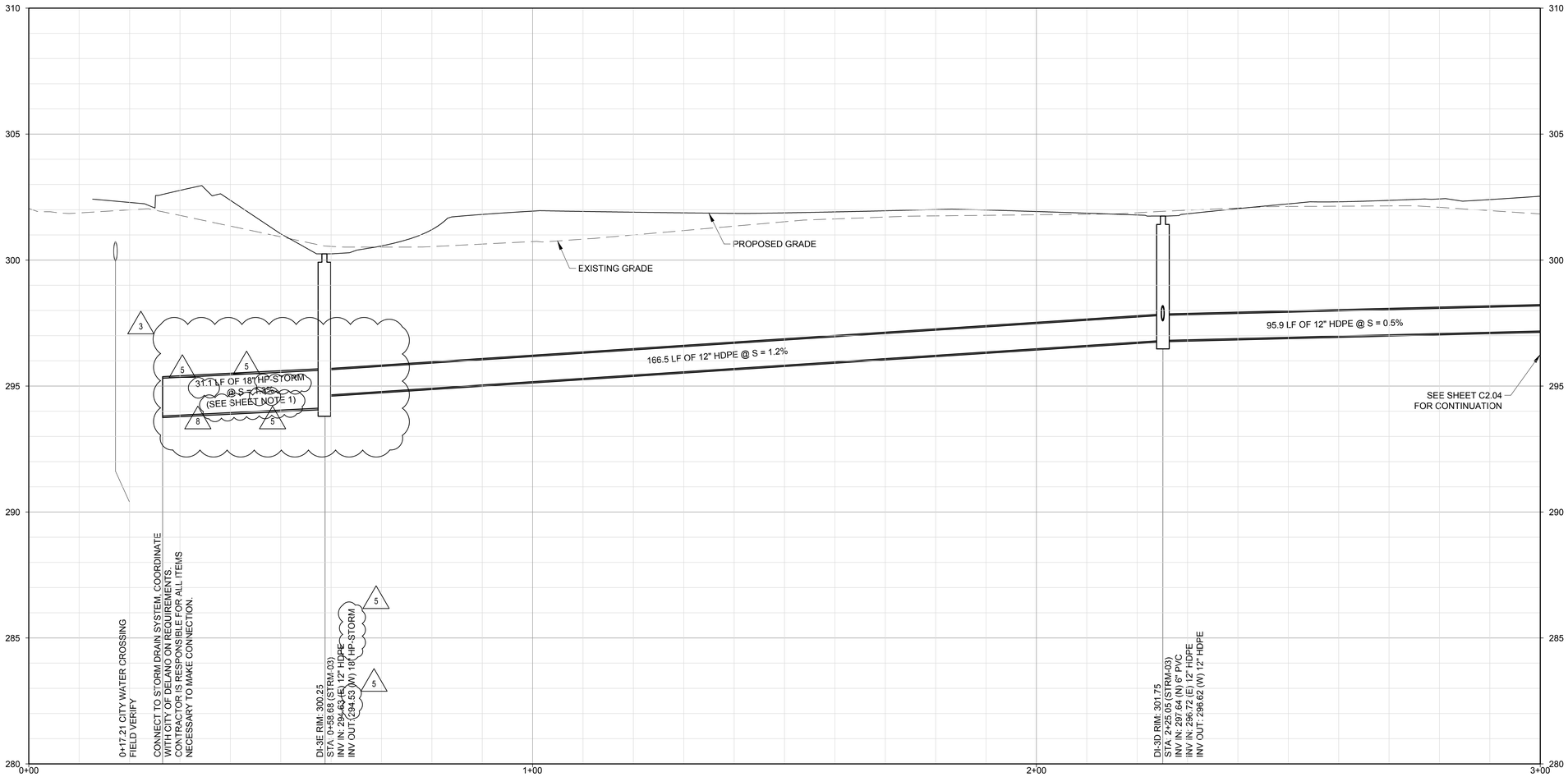
STORM DRAIN SYSTEM PLAN & PROFILE 2 OF 4

SHEET NO.

C2.02



STORM DRAIN SYSTEM (STRM-03) STA: 0+00 TO STA: 3+00
SCALE: 1" = 10'



STORM DRAIN SYSTEM (STRM-03) STA: 0+00 TO STA: 3+00
SCALE: HOR: 1" = 10'
VER: 1" = 2'

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER GORDON HO-MAN FONG C 87304 CIVIL STATE OF CALIFORNIA
05/31/2023

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AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	CITY REVIEW	07/02/20
2	CITY PLAN CHECK	09/15/21
3	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

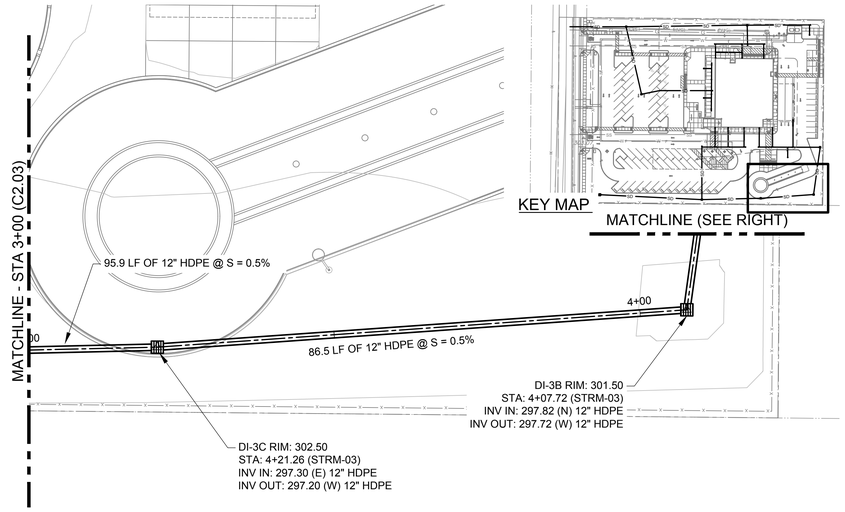
SHEET TITLE

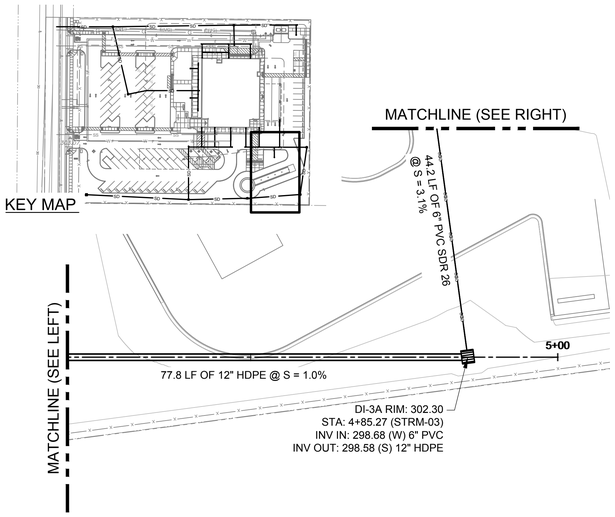
STORM DRAIN SYSTEM PLAN & PROFILE 3 OF 4

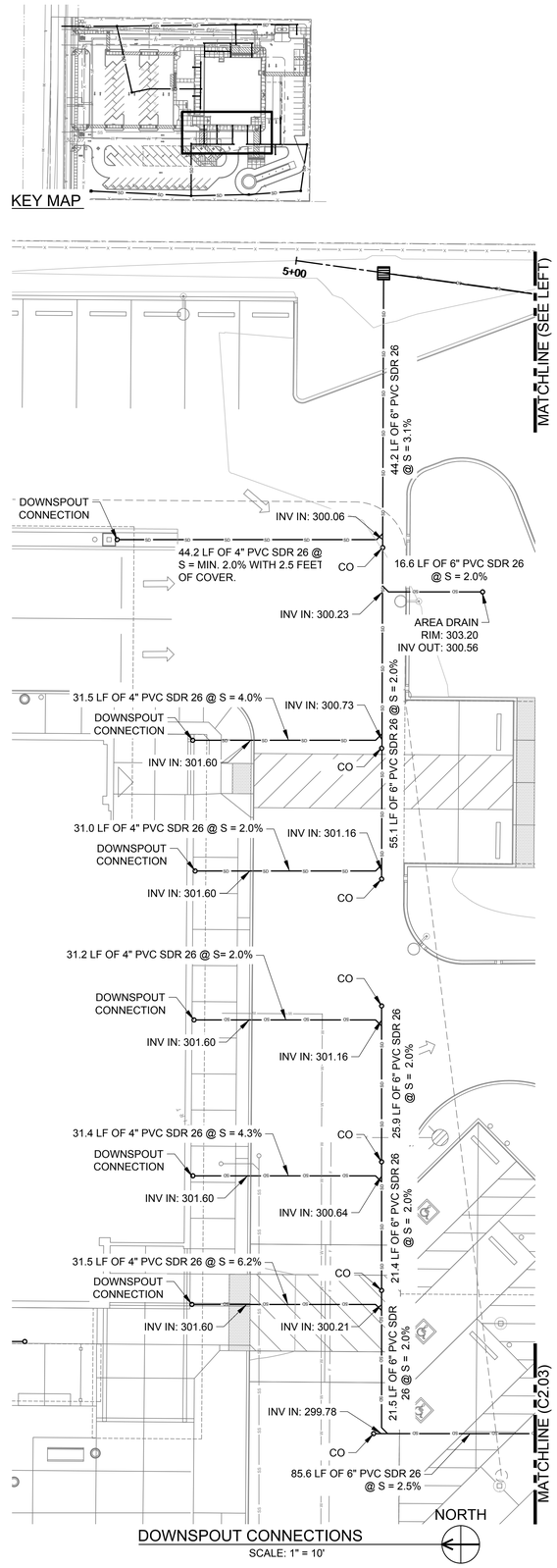
SHEET NO.

C2.03

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

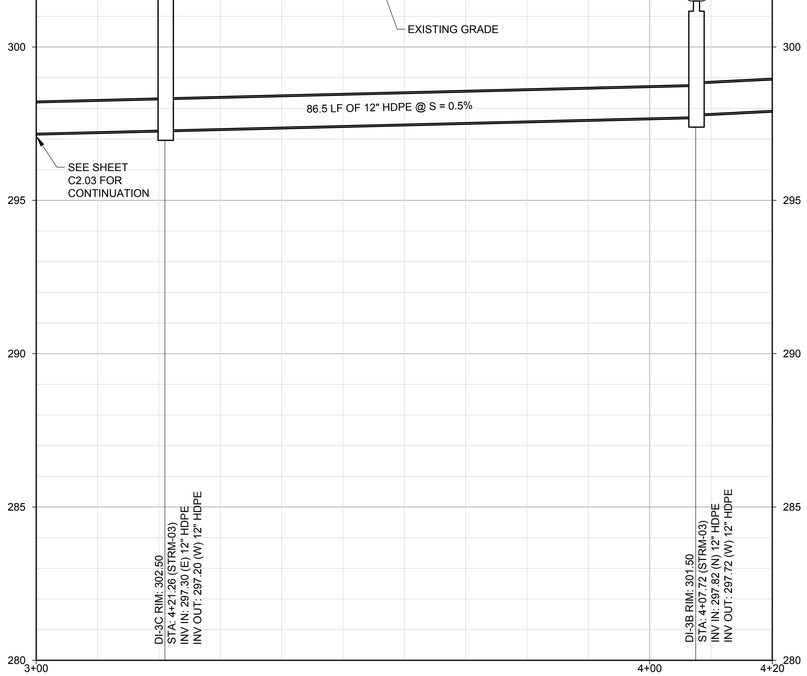






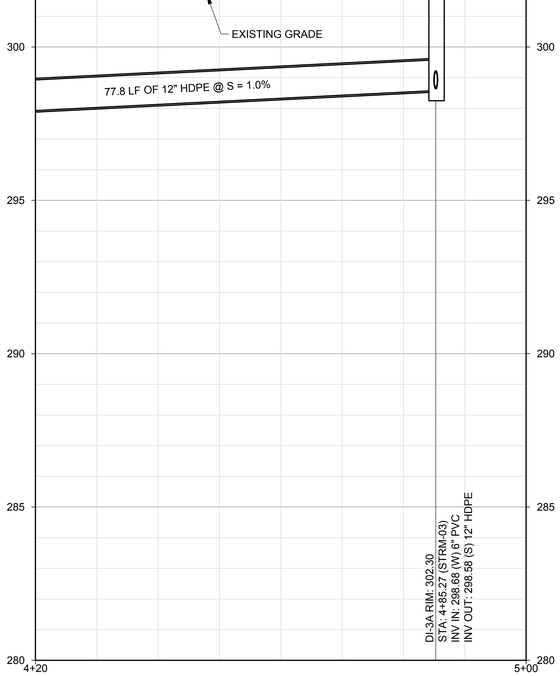
DOWNSPOUT CONNECTIONS
SCALE: 1" = 10'

STORM DRAIN SYSTEM (STRM-03) STA: 3+00 TO STA: 4+20
SCALE: 1" = 10'



STORM DRAIN SYSTEM (STRM-03) STA: 3+00 TO STA: 4+20
HOR: 1" = 10' SCALE:
VER: 1" = 2'

STORM DRAIN SYSTEM (STRM-03) STA: 4+20 TO STA: 5+00
SCALE: 1" = 10'



STORM DRAIN SYSTEM (STRM-03) STA: 4+20 TO STA: 5+00
SCALE: HOR: 1" = 10'
VER: 1" = 2'

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

AGENCY APPROVAL

SFM APPROVAL

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Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER
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REVISIONS

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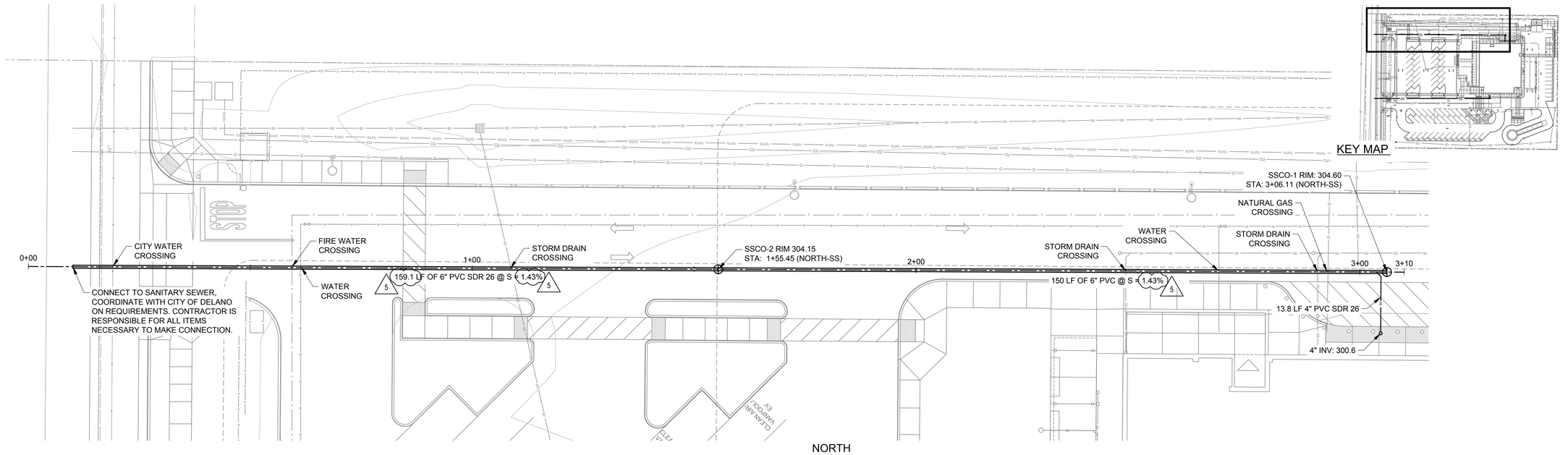
JOB NO. DGS 140724

SHEET TITLE

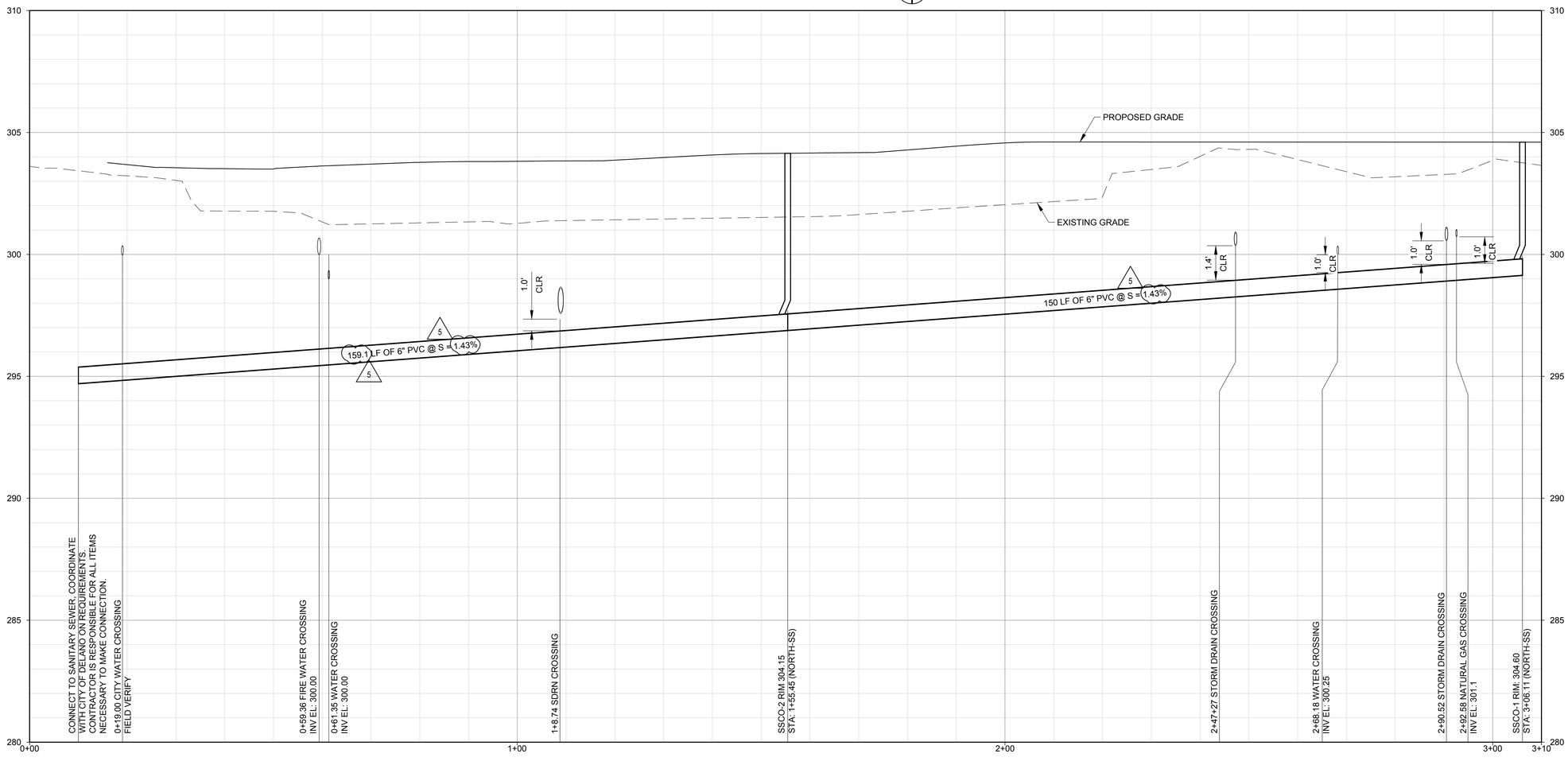
STORM DRAIN SYSTEM PLAN & PROFILE 4 OF 4

SHEET NO.

C2.04



SANITARY SYSTEM NORTH - PLAN
SCALE: 1" = 10'



SANITARY SYSTEM NORTH - PROFILE
SCALE: HOR: 1" = 10'
VER: 1" = 2'

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

AGENCY APPROVAL

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JOB NO. DGS 140724

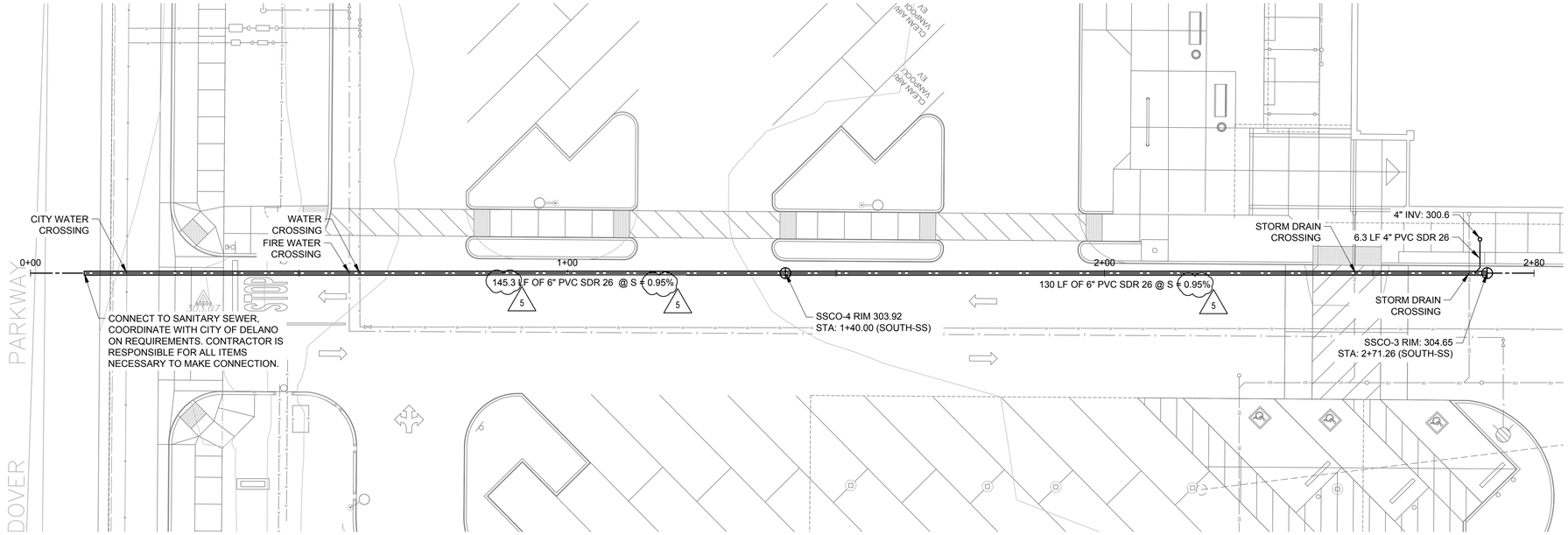
SHEET TITLE

SANITARY SYSTEM - NORTH PLAN & PROFILE

SHEET NO.

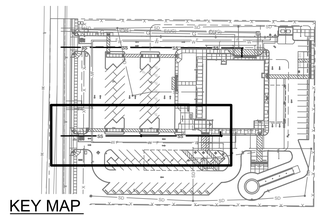
C2.05

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

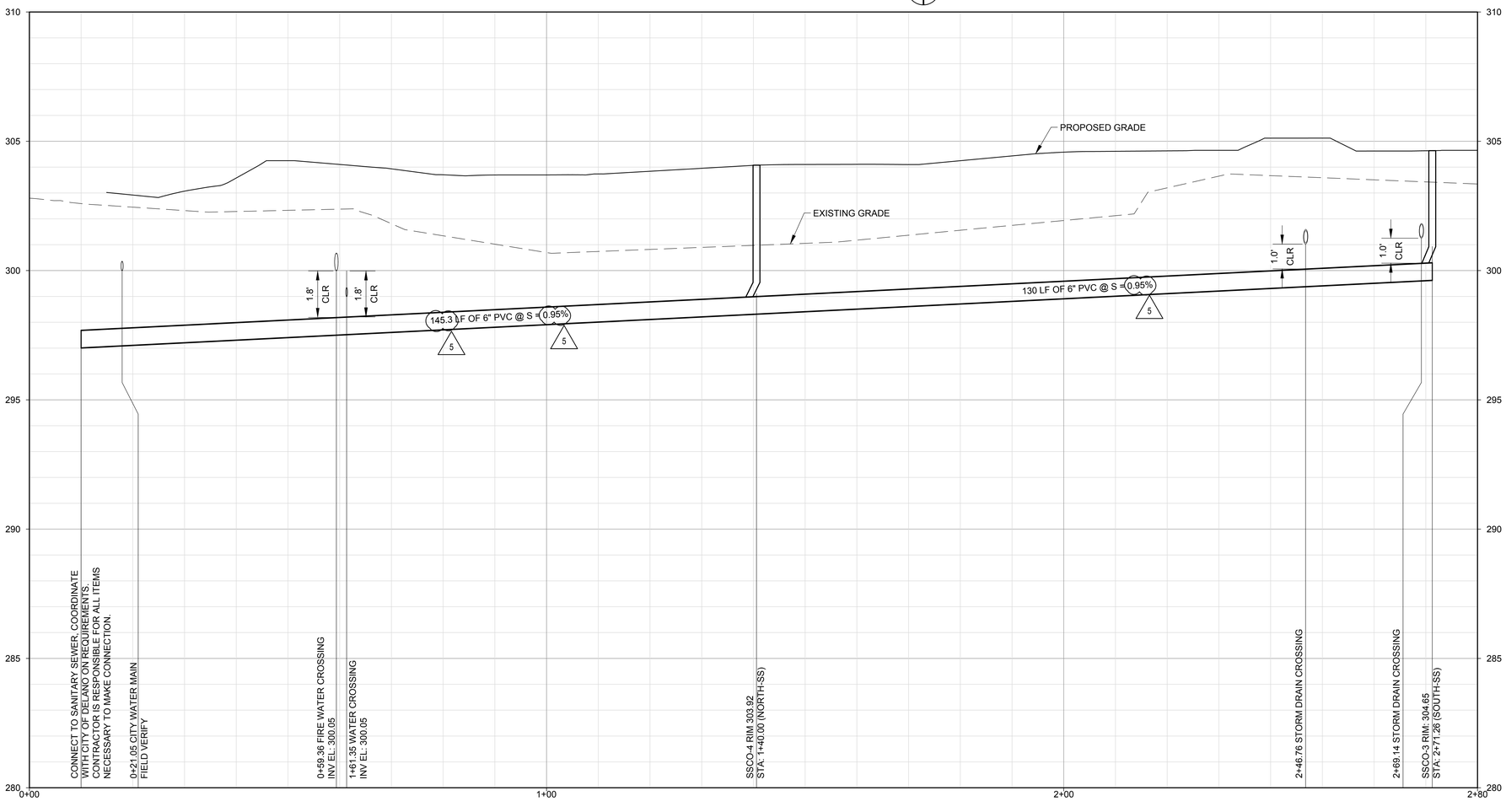


SANITARY SYSTEM SOUTH - PLAN
SCALE: 1" = 10'

NORTH



KEY MAP



SANITARY SYSTEM SOUTH - PROFILE
SCALE: HOR: 1" = 10'
VER: 1" = 2'

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1	CITY PLAN CHECK	09/15/21
2	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

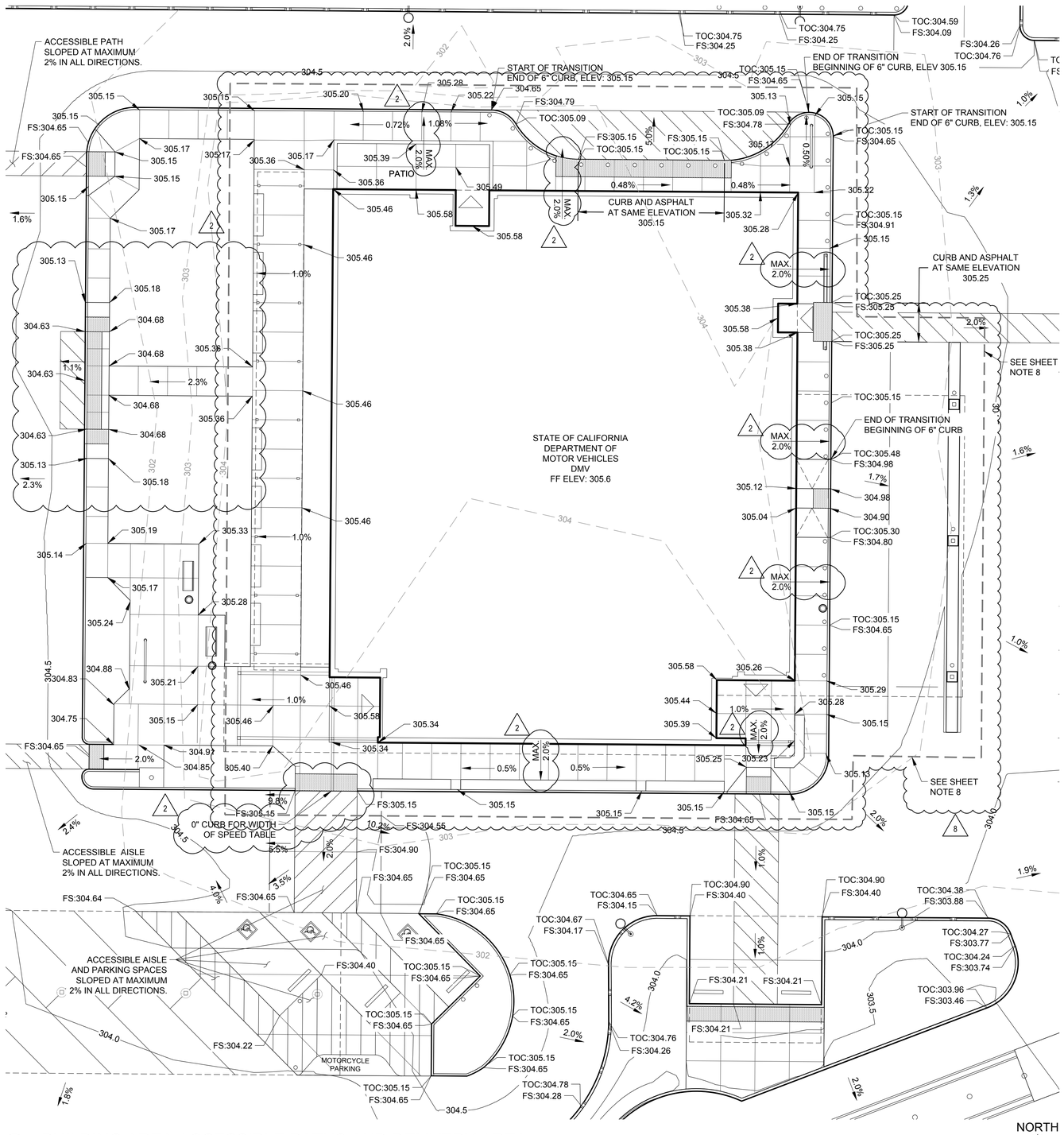
SHEET TITLE

SANITARY SYSTEM - SOUTH PLAN & PROFILE

SHEET NO.

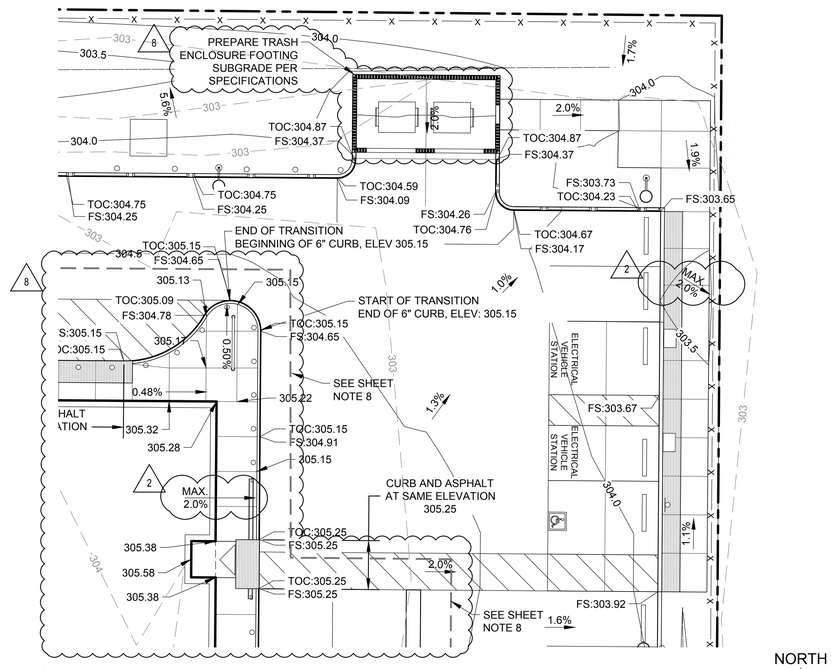
C2.06

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET



1 BUILDING AREA ACCESSIBLE PATHS AND DELIVERY AREA
1" = 10'

NORTH
0 10' 20'
SCALE: 1" = 10'



2 ACCESSIBLE PARKING AND CROSSING AT TRASH ENCLOSURE
1" = 10'

NORTH
0 10' 20'
SCALE: 1" = 10'

SHEET NOTES:

1. CONTRACTOR SHALL ADHERE TO ALL UNDERGROUND SERVICE ALERT REQUIREMENTS BY CALLING 811 AND OBTAIN ANY REQUIRED GRADING PERMITS.
2. CONTRACTOR SHALL HAVE ALL TEMPORARY EROSION AND SEDIMENTATION MEASURES IN PLACE PRIOR TO STARTING EARTH DISTURBING ACTIVITIES.
3. CONTRACTOR SHALL COORDINATE WITH THE CITY OF DELANO PRIOR TO ANY CONSTRUCTION WORK PERFORMED WITHIN THE RIGHT OF WAY.
4. CONTOURS AND SPOT ELEVATIONS SHOWN ARE FINAL FINISHED GRADES.
5. CONTOUR INTERVALS SHOWN ARE 0.5 FEET
6. SIDEWALK SHALL BE SLOPED MAX. 2% AWAY FROM BUILDING WHEN PLACED IMMEDIATE AGAINST FOUNDATION
7. ALL ACCESSIBLE PATHS SHALL BE GRADES TO NOT EXCEED 2% IN ANY DIRECTION. ACCESSIBLE PATHS ARE DENOTED BY THE DIAGONAL PAVEMENT STRIPING.
8. BUILDING PAD AREA SHALL BE OVER-EXCAVATED TO AN ELEVATION OF 298 FEET, AND TO A DEPTH OF AT LEAST 1.5 FEET BELOW BOTTOM OF ALL FOOTINGS, WHICHEVER REQUIRES THE DEEPER EXCAVATION. SLOT CUTTING ONLY BELOW FOUNDATIONS IS NOT PERMITTED. THE OVER-EXCAVATION LIMITS SHALL INCLUDE THE ENTIRE BUILDING FOOTPRINT, ALL FOUNDATIONS, AND ADJACENT WALKWAYS, A MINIMUM OF 5 FEET HORIZONTALLY BEYOND THE EDGES OF THE FOUNDATIONS, AND A MINIMUM OF 5 FEET BEYOND ALL WALKWAYS ADJACENT TO THE BUILDING, WHICHEVER IS GREATER. FOLLOWING EXCAVATION OF THE NEAR SURFACE SOILS TO THE DEPTHS RECOMMENDED ABOVE, GEOTECHNICAL ENGINEER SHALL BE REQUESTED TO VERIFY THAT THE EXPOSED SOILS ARE CONSISTENT WITH THE ANTICIPATED CONDITIONS, AND VERIFICATION FROM THE CONTRACTOR'S SURVEYOR SHALL BE PROVIDED THAT THE HORIZONTAL AND VERTICAL OVER EXCAVATION LIMITS REQUIRED FOR THE PROJECT HAVE BEEN ACHIEVED.

SITE BENCHMARK:

CHISELED "X" AT CENTERLINE OF DOVER PARKWAY APPROXIMATELY 270' NORTH OF THE INTERSECTION OF BELMONT STREET.

ELEVATION = 301.92' NAVD88 DATUM

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

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REVISIONS

NO.	DESCRIPTION	DATE
1	DSA REVIEW	08/07/20
1	ADDENDUM 01	05/31/23

DATE 05/31/2023

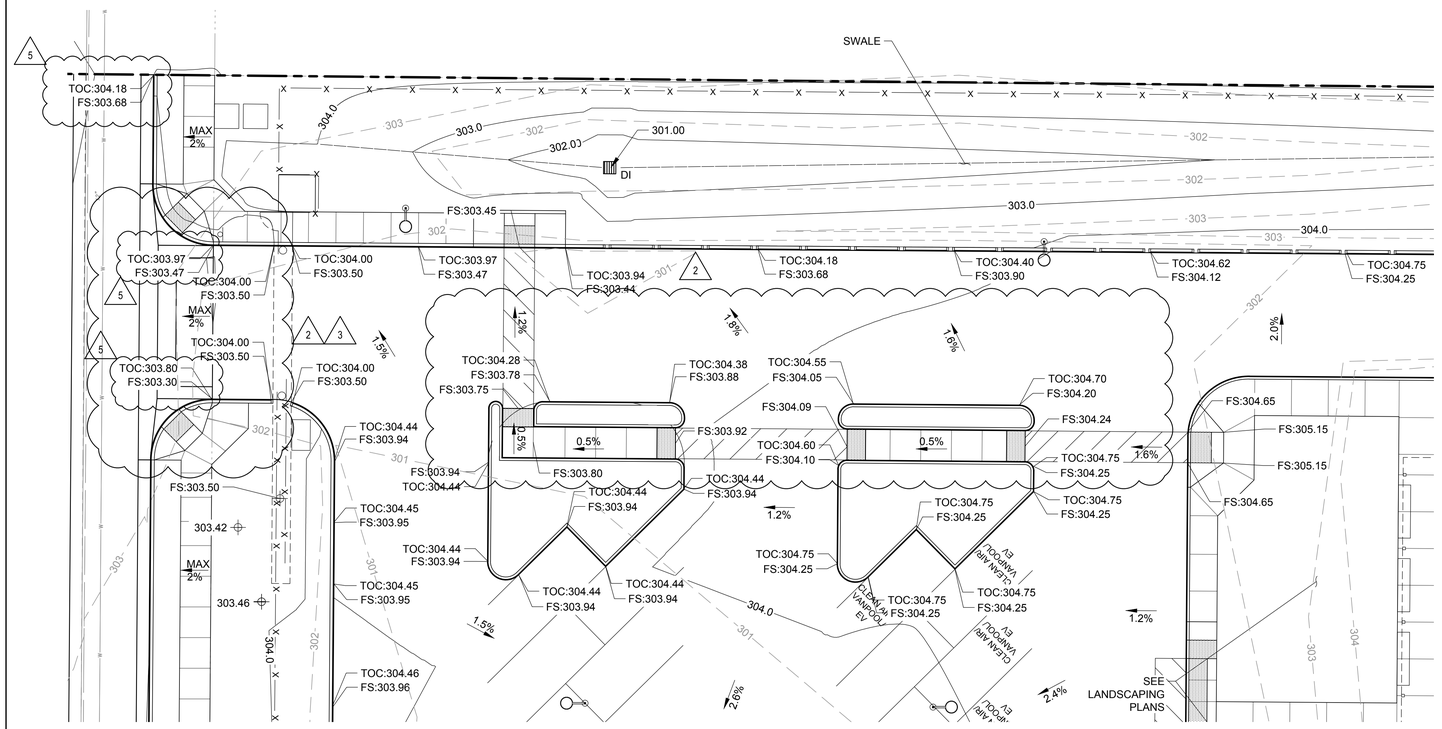
JOB NO. DGS 140724

SHEET TITLE

ENLARGED GRADING PLAN 1 OF 2

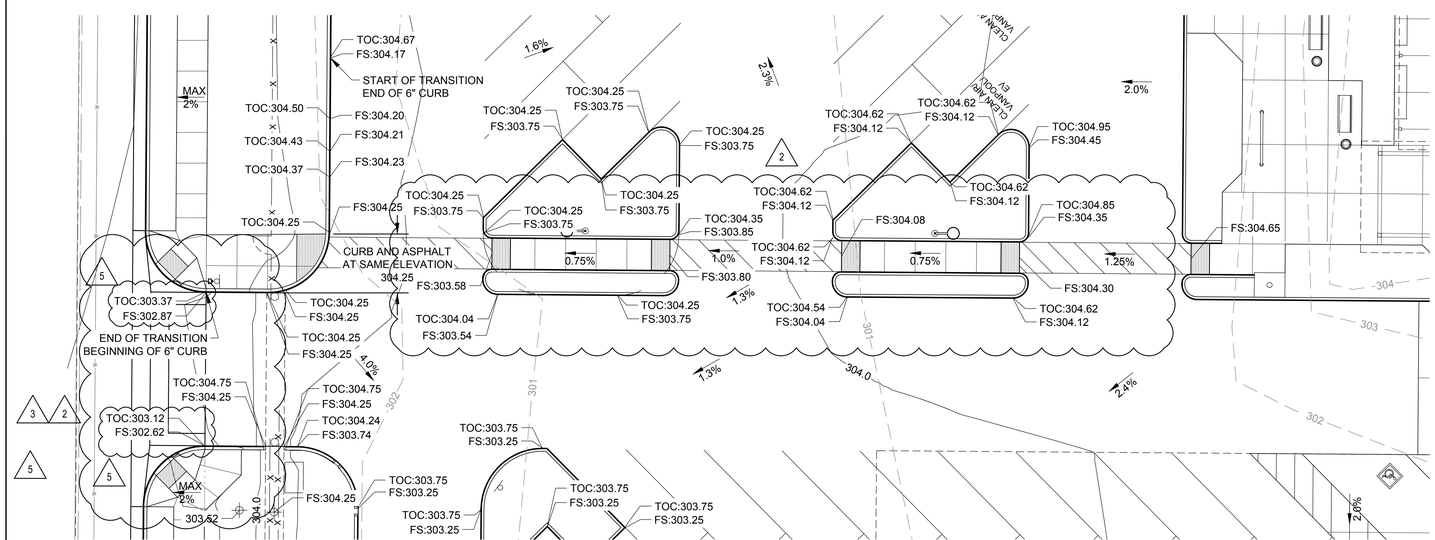
SHEET NO.

C4.02



1 NORTH ENTRANCE ACCESSIBLE PATH
1" = 10'

NORTH
0 10' 20'
SCALE: 1" = 10'



2 SOUTH ENTRANCE ACCESSIBLE PATH
1" = 10'

NORTH
0 10' 20'
SCALE: 1" = 10'

SHEET NOTES:

1. CONTRACTOR SHALL ADHERE TO ALL UNDERGROUND SERVICE ALERT REQUIREMENTS BY CALLING 811 AND OBTAIN ANY REQUIRED GRADING PERMITS.
2. CONTRACTOR SHALL HAVE ALL TEMPORARY EROSION AND SEDIMENTATION MEASURES IN PLACE PRIOR TO STARTING EARTH DISTURBING ACTIVITIES.
3. CONTRACTOR SHALL LIMIT THE AMOUNT OF SITE DISTURBANCE TO WHAT IS NECESSARY FOR SITE GRADING AND INSTALLATION OF TEMPORARY EROSION CONTROL BMPS.
4. CONTRACTOR SHALL COORDINATE WITH THE CITY OF DELANO PRIOR TO ANY CONSTRUCTION WORK PERFORMED WITHIN THE RIGHT OF WAY.
5. CONTOURS AND SPOT ELEVATIONS SHOWN ARE FINAL FINISHED GRADES.
6. CONTOUR INTERVAL SHOWN IS 1 FOOT.
7. ALL ACCESSIBLE PATHS SHALL BE GRADES TO NOT EXCEED 2% IN ANY DIRECTION. ACCESSIBLE PATHS ARE DENOTED BY THE DIAGONAL PAVEMENT STRIPING.

8 SITE BENCHMARK:

CHISELED "X" AT CENTERLINE OF DOVER PARKWAY APPROXIMATELY 270' NORTH OF THE INTERSECTION OF BELMONT STREET.

ELEVATION = 301.92' NAVD88 DATUM

LEGEND:

SWALE FLOWLINE DIRECTION

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

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NO.	DESCRIPTION	DATE
1	DSA REVIEW	08/07/20
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4	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

SHEET TITLE

ENLARGED GRADING PLAN 2 OF 2

SHEET NO.

C4.03

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
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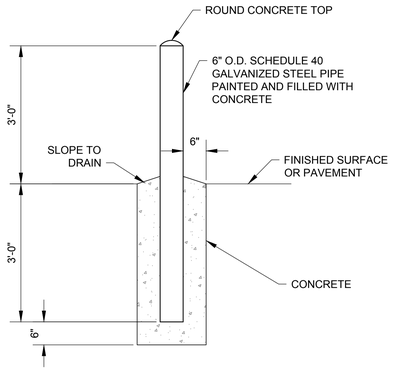
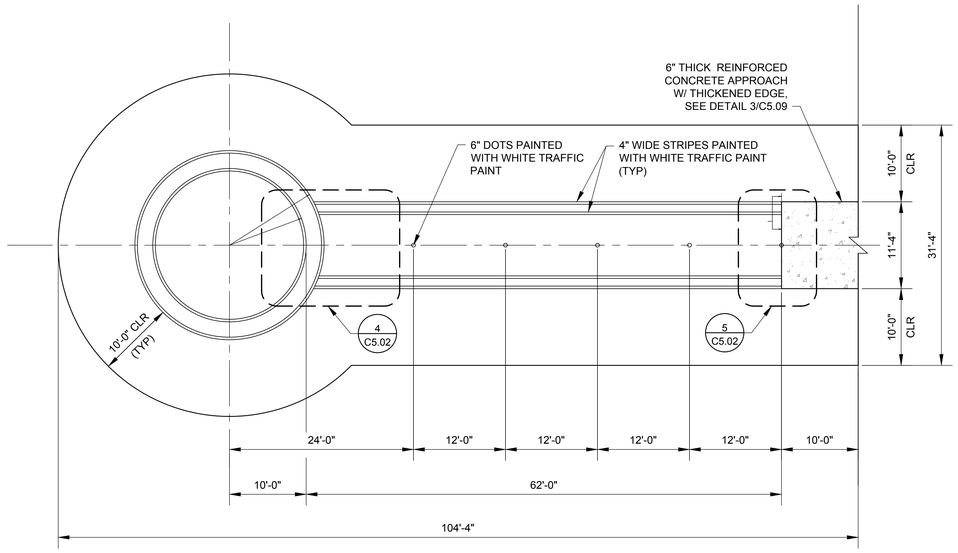
ONE INCH = TWENTY FEET



NOTES:

1. STEEL PIPE SHALL BE GALVANIZED (2.0 OZ. ZINC/SQ.FT.)
2. CONCRETE FILL SHALL HAVE MAXIMUM AGGREGATE SIZE OF 3/8 INCH PER SPECIFICATIONS
3. GENERAL COLOR OF BOLLARDS SHALL MATCH DARK ACCENT COLORS OF BUILDING'S EXTERIOR. CONTRACTOR SHALL CONFIRM COLOR SELECTION WITH DMV.
4. BOLLARDS PROTECTING TRANSFORMERS AND FIRE DEPARTMENT CONNECTION SHALL BE PAINTED RED.
5. BOLLARDS PROTECTING GAS METERS SHALL BE PAINTED YELLOW.

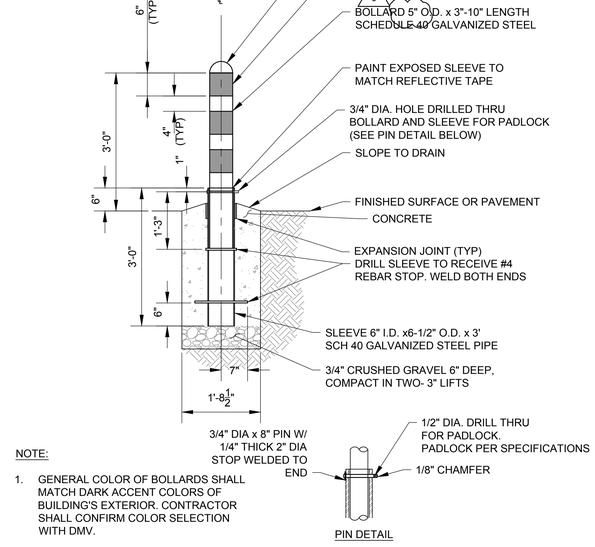
1 STEEL BOLLARD
3/4" = 1'-0"



NOTES:

1. A 10'-0" CLEARANCE SHALL BE MAINTAINED FROM THE FURTHEST OUTSIDE POINT OF THE STRIPING TO ANY OBSTRUCTION.
2. SKIRT AND TEST PATTERN SHALL BE CONSTRUCTED OF ASPHALT.
3. MEASUREMENTS FROM OUTSIDE OF STRIPE LINE.

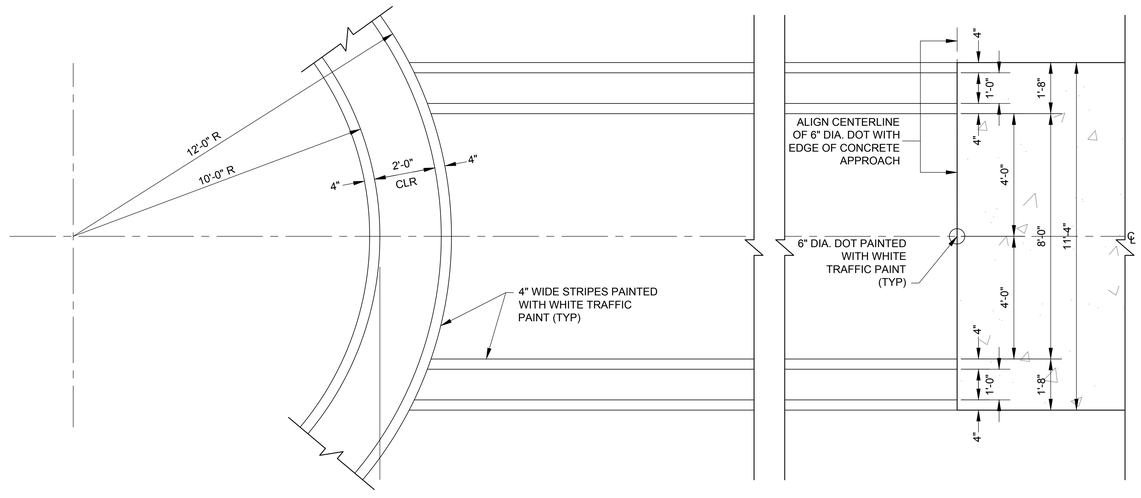
3 MOTORCYCLE TEST AREA
1-1/2" = 1'-0"



NOTE:

1. GENERAL COLOR OF BOLLARDS SHALL MATCH DARK ACCENT COLORS OF BUILDING'S EXTERIOR. CONTRACTOR SHALL CONFIRM COLOR SELECTION WITH DMV.

2 REMOVEABLE BOLLARD
3/4" = 1'-0"



4 MOTORCYCLE TEST AREA STRIPING
NTS

5 DETAIL
NTS

AGENCY APPROVAL

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CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

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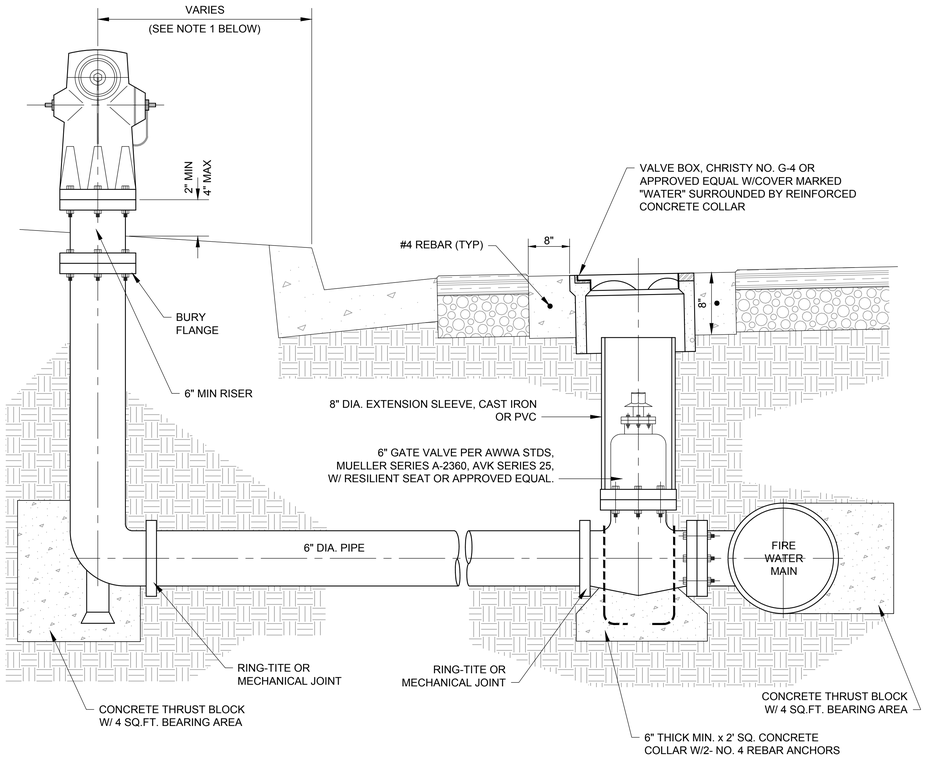
SHEET TITLE

CIVIL SITE DETAILS

SHEET NO.

C5.02

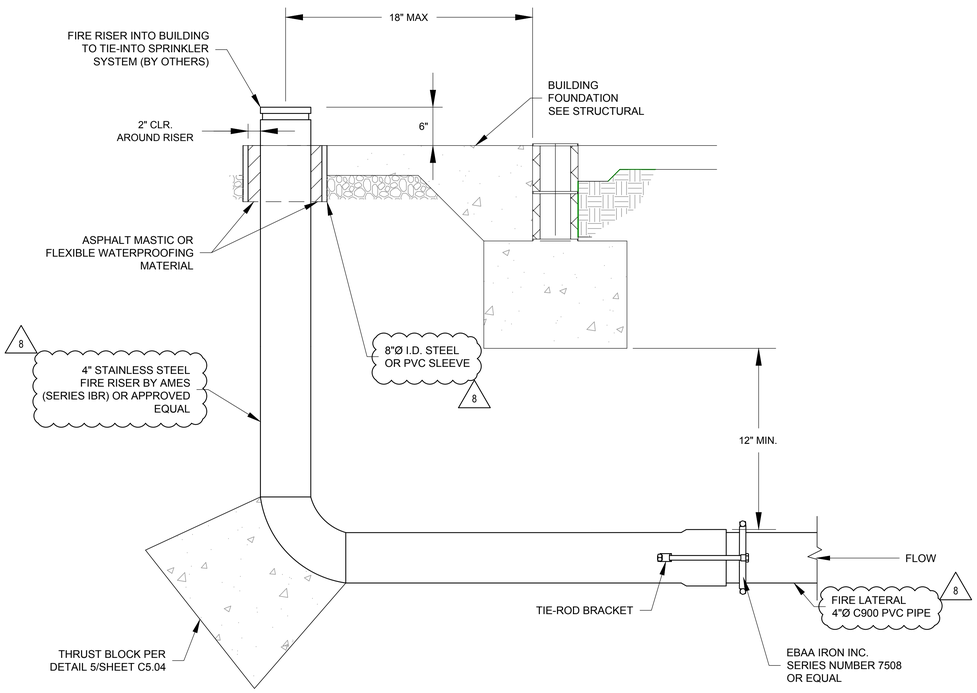


NOTES:

1. HYDRANT MINIMUM 18" BEHIND FACE OF CURB. BREAK-OFF BOLTS REQUIRED ON ALL HYDRANTS.
2. ALL HYDRANTS SHALL HAVE A MINIMUM OF 3' CLEAR TO ANY OBSTRUCTIONS.
3. FIRE HYDRANT SHALL BE AVK NO. 2490 W/ 2 2-1/2" NOZZLES AND 1 - 4-1/2" NOZZLE.
4. 4-1/2" STEAMER CONNECTION SHALL FACE ROADWAY AND 2-1/2" SHALL LAY PARALLEL WITH SAID ROADWAY.

1 FIRE HYDRANT ASSEMBLY (CITY OF DELANO STANDARD W1)

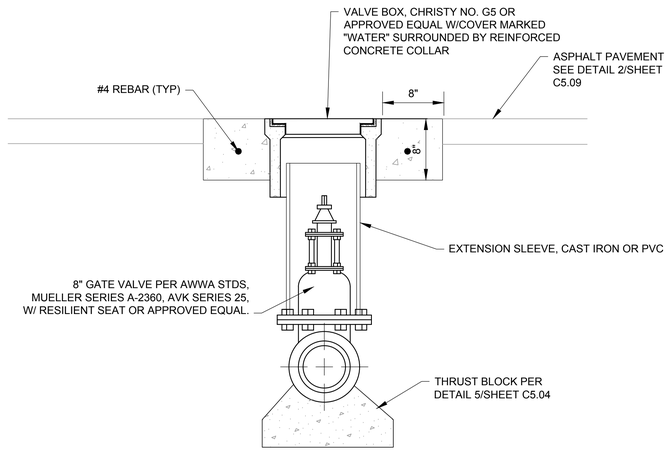
NTS



NOTE:
1. PIPE JOINTS SHALL NOT BE LOCATED DIRECTLY UNDER FOUNDATION FOOTINGS

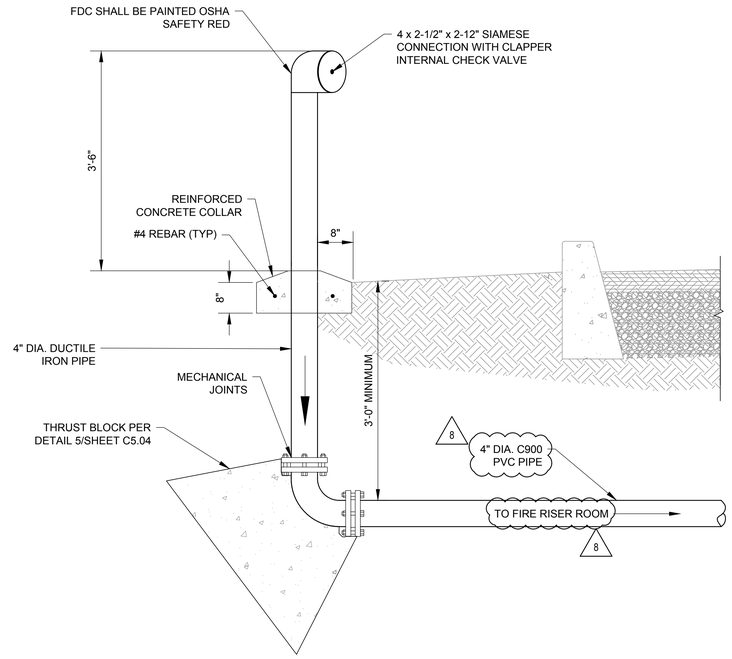
2 FIRE RISER

NTS



3 GATE VALVE AND VALVE BOX

NTS



4 FIRE DEPARTMENT CONNECTION

NTS

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DATE 05/31/2023

JOB NO. DGS 140724

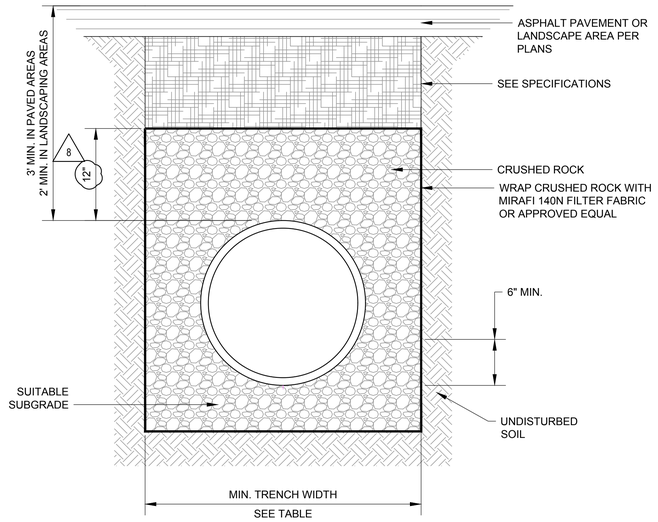
SHEET TITLE

WATER UTILITY DETAILS 2 OF 2

SHEET NO.

C5.05

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

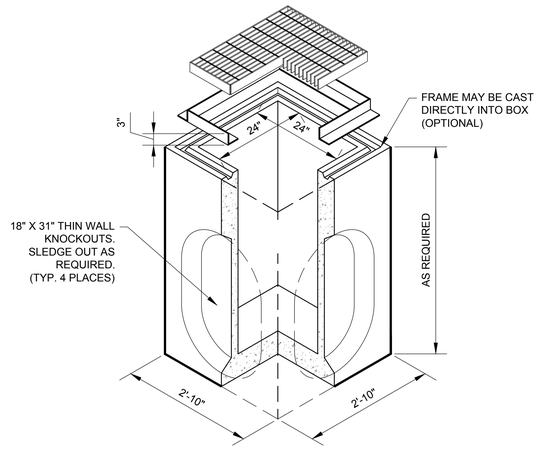


NOTES:

1. CONTRACTOR SHALL INSTALL ALL PIPE IN ACCORDANCE WITH ASTM D2321 - *STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY-FLOW APPLICATIONS*, LATEST EDITION.
2. BEDDING MATERIAL SHALL BE 3/4" GRADATION CRUSHED ROCK. COMPACT CRUSHED ROCK UTILIZING VIBRATORY COMPACTORS IN THE PRESENCE OF SOIL INSPECTOR.
3. CRUSHED ROCK SHALL BE USED IN THE PIPE ZONE AND EXTENDING A MINIMUM OF 12" ABOVE THE PIPE CROWN. MATERIAL SHALL BE INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION. DURING BACKFILL PLACEMENT,CARE SHOULD BE TAKEN TO PREVENT ROCKS LARGER THAN 1 ½ INCHES (38 mm) FROM ENTERING THE BACKFILL MATERIAL IMMEDIATELY AROUND THE PIPE.
4. CRUSHED ROCK SHALL BE WRAPPED IN FILTER FABRIC. FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR INSTALLATION AND LAP LENGTH.

MINIMUM TRENCH WIDTHS	
PIPE DIA. (INCH)	MIN. TRENCH WIDTH (INCH)
12	30
18	39

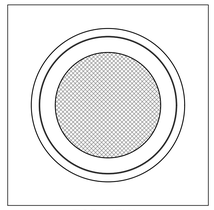
1 STORM DRAIN TRENCH
1" = 1'-0"



NOTES:

1. DRAIN INLET, FRAME, AND GRATE TO BE PRECAST CONCRETE 24"X 24" SQUARE DRAIN INLET SIZED TO BE COMPATIBLE WITH FILTER INLET IN DETAIL 3 THIS SHEET.
2. FRAME AND GRATE ASSEMBLY SHALL BE MINIMUM H-20 TRAFFIC RATED
3. DRAIN INLET SHALL BE PLACED ON MINIMUM 6" LAYER OF COMPACTED CLASS 2 AGGREGATE BASE. AGGREGATE BASE SHALL BE COMPACTED TO AT LEAST 95% OF MAXIMUM DRY DENSITY PER ASTM D1557
4. ALL DRAIN INLETS SHALL BE INSTALLED WITH AN FILTER INLET. SEE DETAIL 3.

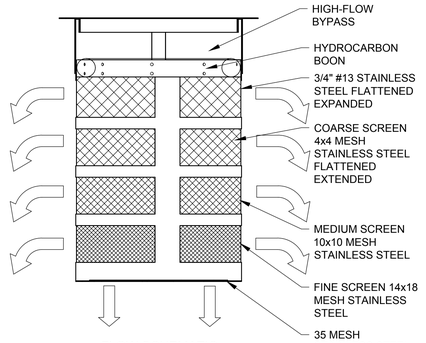
2 PRECAST DRAIN INLET
3/4" = 1'-0"



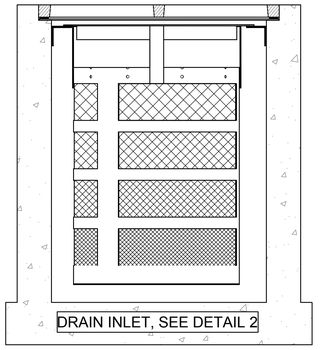
TOP VIEW

NOTES:

1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL
2. HYDROCARBON BOOM SHALL BE 2" DIAMETER AND CONNECTED, MECHANICALLY TO THE FILTER FRAME WITH RAILS ALLOWING IT TO FLOAT ON THE WATER SURFACE REGARDLESS OF HEIGHT.
3. USE BIO-GRATE-MLS OR APPROVED EQUAL.



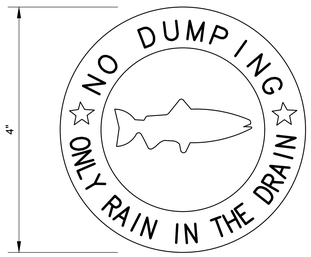
FLOW SCHEMATIC



DRAIN INLET, SEE DETAIL 2

MODEL #	TREATMENT FLOW (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-MLS 24-24-24	*5.31*	*5.31*	*1.80*

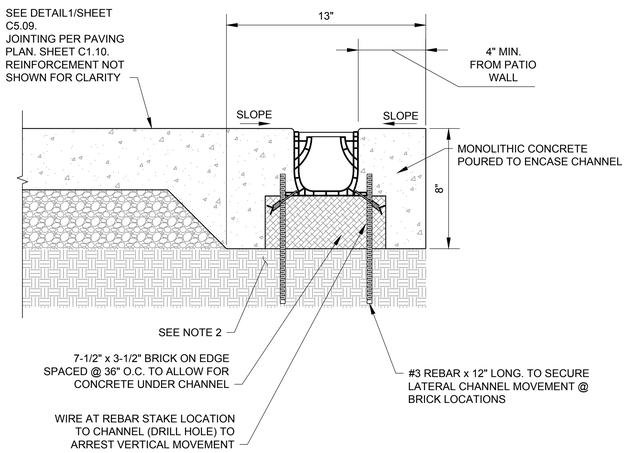
3 FILTER INLET
NTS



NOTES:

1. INSTALL 4" DIAMETER STAINLESS STEEL ENVIROMARKER DISC, MANUFACTURED BY ALMETEK INDUSTRIES, INC. OR APPROVED EQUAL.
2. APPLY MARKER PER MANUFACTURER'S THEFT PROOF INSTALLATION RECOMMENDATIONS, WITH RIVET FASTENERS.
3. LOGO AND COLOR OF DISC TO BE PRE-APPROVED BY DMV PRIOR TO ORDERING.

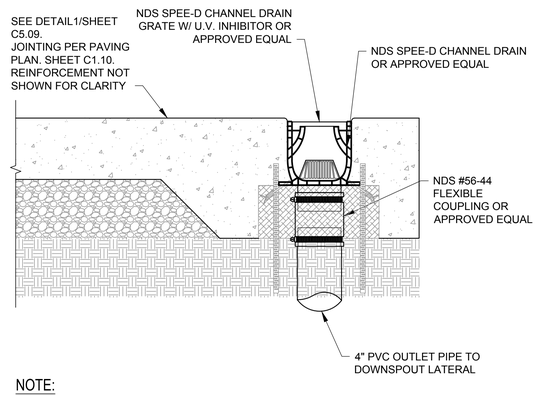
4 INLET MARKER
3" = 1'-0"



NOTES:

1. USE 4" NDS SPEE-D CHANNEL DRAIN WITH GALVANIZED STEEL CHANNEL GRATES (PART NO. 254) OR APPROVED EQUAL.
2. MINIMUM TOP 6" OF EXISTING SUBGRADE SHALL BE RECOMPACTED TO AT LEAST 95% OF MAXIMUM DRY DENSITY PER ASTM D1557.

5 TRENCH DRAIN
3" = 1'-0"



NOTE:

1. CONTRACTOR SHALL INSTALL OUTLET PIPE TO TRENCH DRAIN PER MANUFACTURER'S SPECIFICATIONS.

6 TRENCH DRAIN CONNECTION TO OUTLET PIPE
1-1/2" = 1'-0"

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER GORDON HO-MAN TONG C 67304 CIVIL STATE OF CALIFORNIA

05/31/2023

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AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

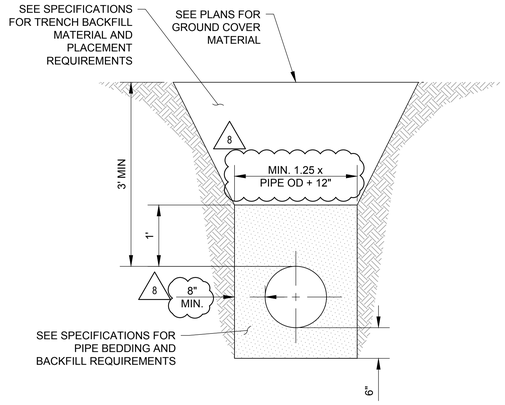
SHEET TITLE

STORM DRAIN DETAILS 1 OF 2

SHEET NO.

C5.06

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

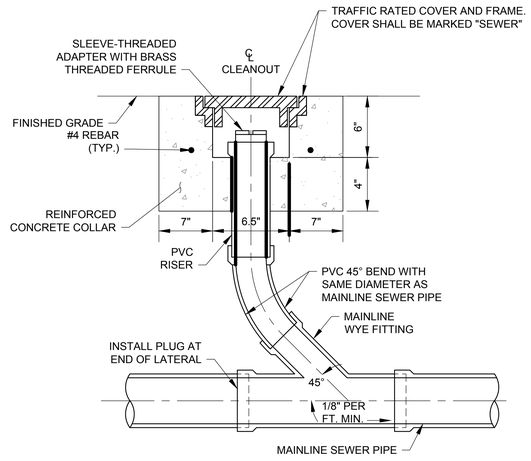


NOTES:

1. CONTRACTOR SHALL INSTALL ALL PIPE IN ACCORDANCE WITH ASTM D2321 - *STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY-FLOW APPLICATIONS*, LATEST EDITION.
2. THE MINIMUM TOP 6 INCHES OF THE UTILITY TRENCH SHALL BE COMPACTED TO AT LEAST 95% OF MAXIMUM DRY DENSITY PER ASTM D1557.

1 SANITARY SEWER TRENCH

1" = 1'-0"



2 SANITARY SEWER CLEAN-OUT

NTS

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER
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DATE 05/31/2023

JOB NO. DGS 140724

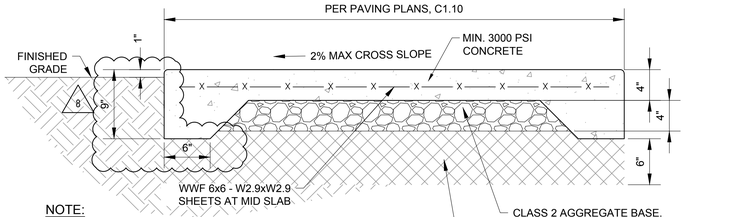
SHEET TITLE

SANITARY SEWER DETAILS

SHEET NO.

C5.08

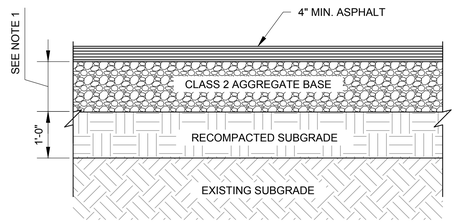
ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET



NOTE:

1. SEE ARCHITECTURAL/STRUCTURAL FOR ANCHORING OF CONCRETE SEAT WALLS TO SIDEWALKS
2. $\frac{1}{8}$" X 1" DEEP TOOLED WEAKENED PLANE JOINTS SHALL BE SPACED NO GREATER THAN 6 FEET APART AS SHOWN ON PAVING PLAN.
3. EXPANSIONS JOINTS, $\frac{1}{2}$" PRE-MOLDED MATERIAL SHALL BE PLACED AT 30 FOOT INTERVALS AND AT THE BEGINNING AND END OF CURB RADII.

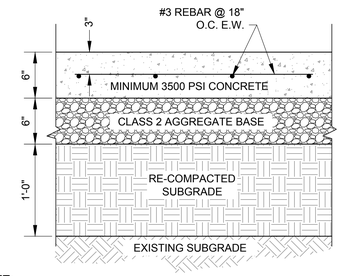
1 CONCRETE WALKWAY
1-1/2" = 1'-0"



NOTE:

1. AGGREGATE BASE SHALL BE 6" FOR PARKING SPACES AND 13" FOR ALL OTHER AREAS. BASE SHALL TRANSITION AT A 45 DEGREE ANGLE FROM END OF PARKING SPACE FOR CHANGE IN THICKNESS.
2. AGGREGATE BASE AND MINIMUM TOP 12" OF EXISTING SUBGRADE SHALL BE RECOMPACTED TO AT LEAST 95% OF MAXIMUM DRY DENSITY PER ASTM D1557.
3. AGGREGATE BASE AND SUBGRADE SHALL BE COMPACTED IN LIFTS NOT TO EXCEED SIX INCHES (6") IN COMPACTED THICKNESS.

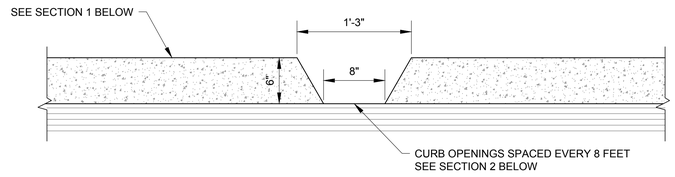
2 ASPHALT PAVEMENT
3/4" = 1'-0"



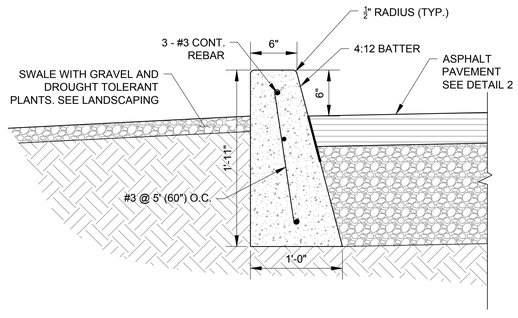
NOTE:

1. AGGREGATE BASE AND MINIMUM TOP 12" OF EXISTING SUBGRADE SHALL BE RECOMPACTED TO AT LEAST 95% OF MAXIMUM DRY DENSITY PER ASTM D1557.
2. AGGREGATE BASE AND SUBGRADE SHALL BE COMPACTED IN LIFTS NOT TO EXCEED SIX INCHES (6") IN COMPACTED THICKNESS.
3. CONCRETE SHALL HAVE THICKENED EDGES AT LEAST 8 INCHES THICK AND 36 INCHES WIDE. SEE DETAIL 7.

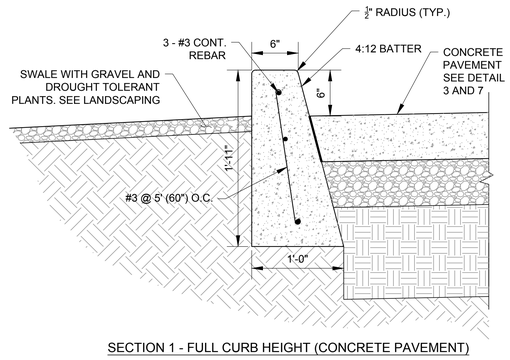
3 CONCRETE PAVEMENT
NTS



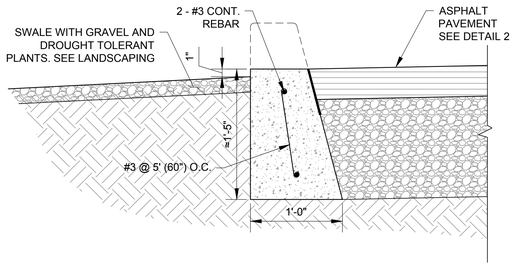
CURB ELEVATION



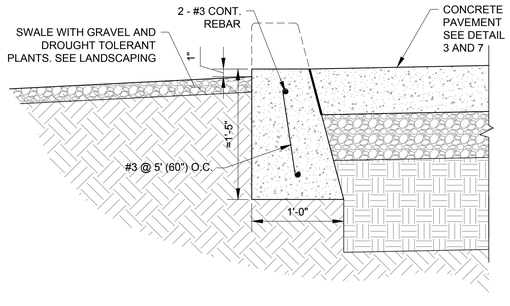
SECTION 1 - FULL CURB HEIGHT (ASPHALT PAVEMENT)



SECTION 1 - FULL CURB HEIGHT (CONCRETE PAVEMENT)



SECTION 2 - CURB-CUT LOCATION (ASPHALT PAVEMENT)

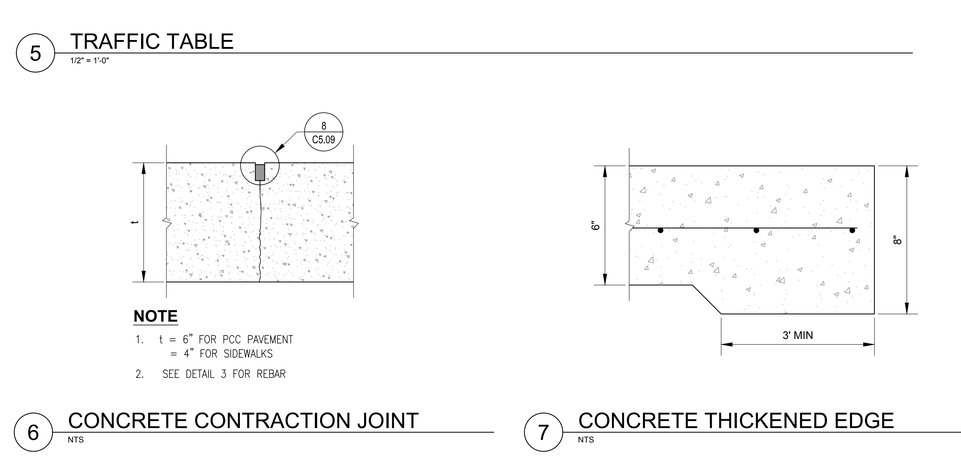


SECTION 2 - CURB-CUT LOCATION (CONCRETE PAVEMENT)

NOTES:

1. SAW-CUT 1/8", 1" DEEP, WEAKENED PLANE JOINTS AT MAXIMUM 8 FOOT INTERVALS AND AT THE BEGINNING AND END OF CURB RADII.
2. EXPANSIONS JOINTS, $\frac{1}{2}$" PRE-MOLDED MATERIAL SHALL BE PLACED AT 30 FOOT INTERVALS AND AT THE BEGINNING AND END OF CURB RADII.
3. SEE SHEET C1.10 FOR LOCATION OF EACH CURB TYPE.
4. SECTION 1 - FULL HEIGHT CURBS SHALL BE USED FOR FULL LENGTH CURBS WITHOUT CURB CUTS.

4 CONCRETE CURB
1-1/2" = 1'-0"



NOTE:

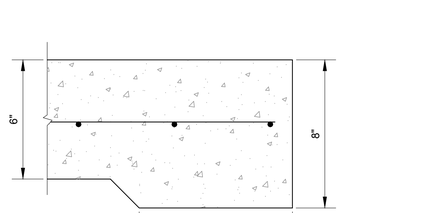
1. SEE DETAIL 3, THIS SHEET FOR CONCRETE PAVEMENT SECTION.
2. TRAFFIC TABLE SHALL BE CONSTRUCTED AT LOCATION SHOWN ON SITE PLAN, SHEET C1.02
3. SLOPES ALONG TRAFFIC TABLE AND ACCESSIBLE AISLE SHALL NOT EXCEED 2% ANY DIRECTION. SEE SHEET C4.02 FOR ENLARGED GRADING PLAN.

5 TRAFFIC TABLE
1/2" = 1'-0"

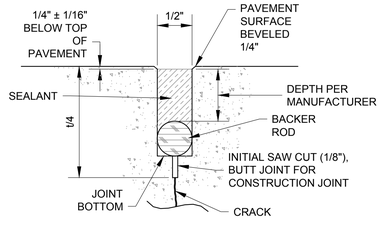
NOTE

1. t = 6" FOR PCC PAVEMENT
   = 4" FOR SIDEWALKS
2. SEE DETAIL 3 FOR REBAR

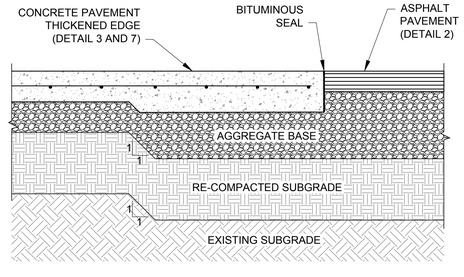
6 CONCRETE CONTRACTION JOINT
NTS



7 CONCRETE THICKENED EDGE
NTS



8 CONCRETE JOINT SEALANT
NTS



9 CONCRETE TO ASPHALT TRANSITION
NTS

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER GORDON HO-MAN FONG C 87304 Civil STATE OF CALIFORNIA

05/31/2023

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ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

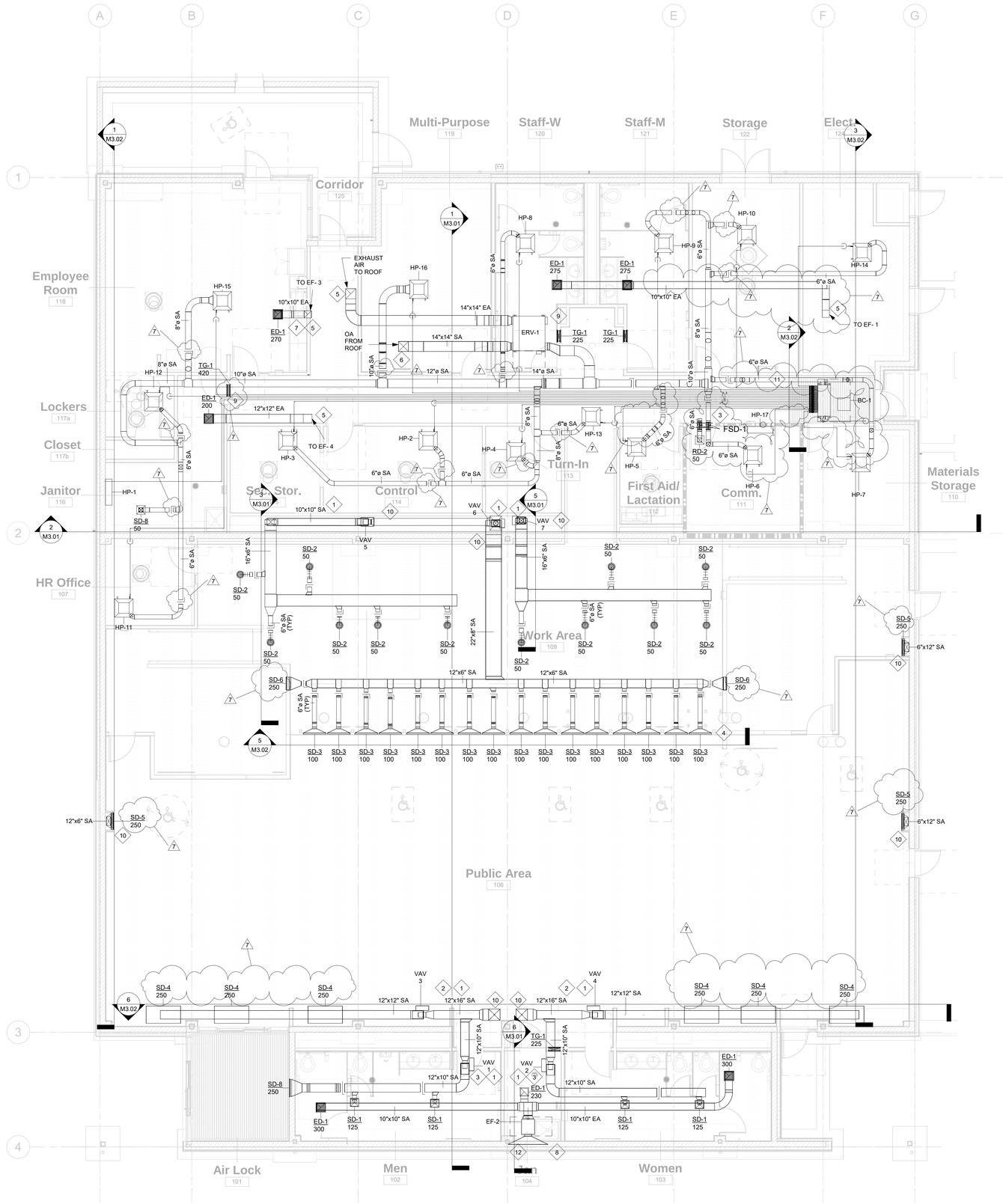
SHEET TITLE

PAVEMENT DETAILS

SHEET NO.

C5.09

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET



1 MECHANICAL PLAN
3/16" = 1'-0"

KEYNOTES:

THESE KEYNOTES APPLY TO THIS SHEET ONLY

1. 18" x 18" WALL ACCESS PANEL AT EACH VAV.
2. ACCESS PANEL IN SOFFIT.
3. ACCESS PANEL IN CEILING.
4. COORDINATE DIFFUSERS WITH ARCHITECTURE WALL THICKNESS AND TERRAZO BASE.
5. EXHAUST THRU ROOF.
6. SUPPLY THRU ROOF.
7. WALL SWITCH FOR EXHAUST FAN.
8. EXHAUST THRU LOUVER.
9. PROVIDE A 1'X4' OPENING FOR PLENUM RETURN.
10. SUPPLY AIR FROM AHU-1
11. FOR VRF PIPING SIZE SEE MECHANICAL CONTROLS SHEET M7.01
12. COORDINATE WITH ARCHITECTURAL ON LOCATION/SIZE OF LOUVER

SHEET NOTES:

THESE SHEET NOTES APPLY TO THIS SHEET ONLY

A. PROVIDE ACCESS PANELS IN ALL HARD LID CEILINGS FOR SERVICE ACCESS AT INDOOR VRF UNITS AS REQUIRED BY MANUFACTURER

B. COORDINATE SD-2 WITH FURNITURE AND FLOOR ACCESS.

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV

DOVER PARKWAY, DELANO

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REGISTERED PROFESSIONAL ENGINEER
SHANE E. RUDISAILER
No. 33415
EXP. JUNE 2024
MECHANICAL
STATE OF CALIFORNIA
24 MAY 2023

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ARCHITECT

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NO.	DESCRIPTION	DATE
7	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

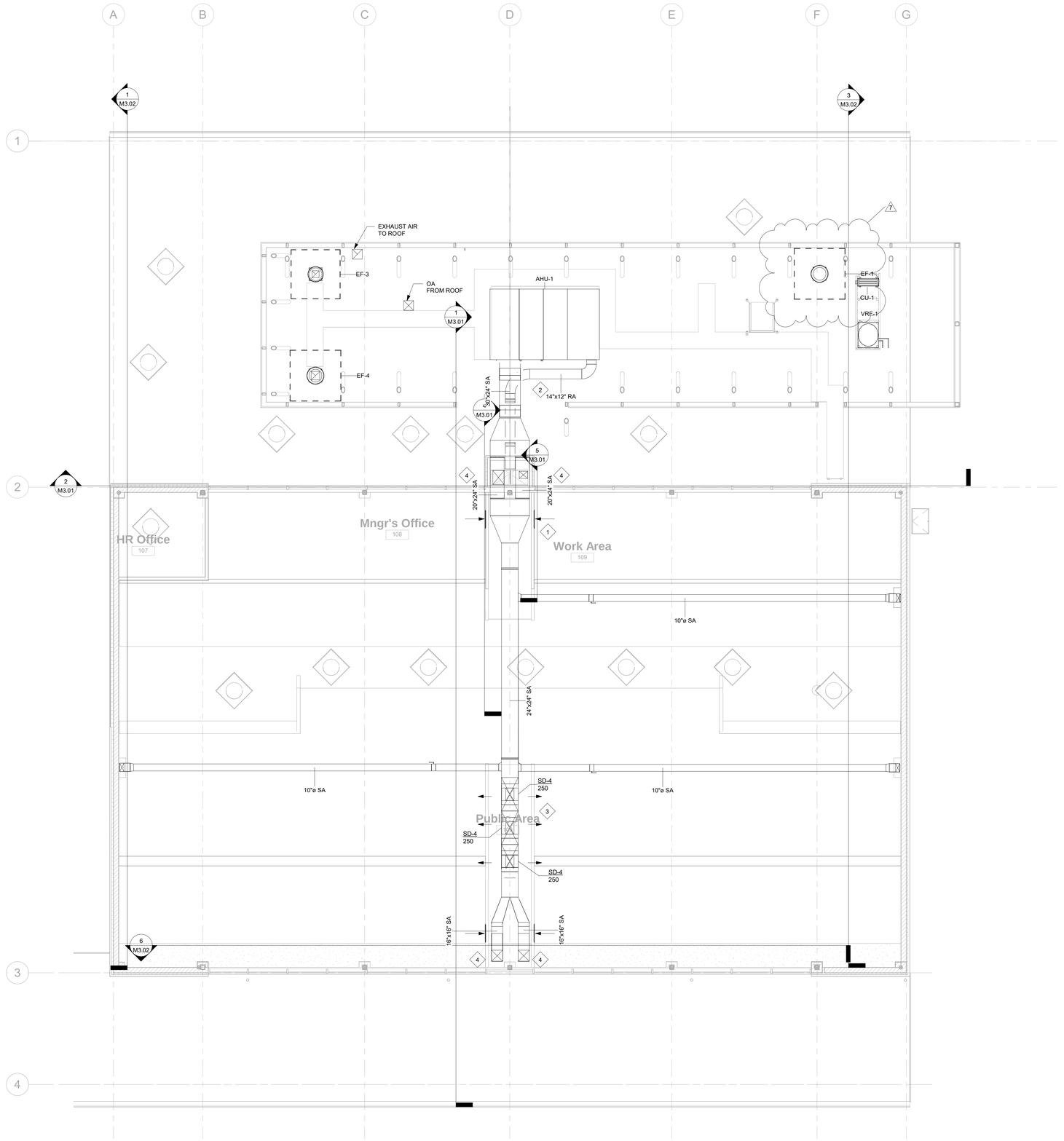
SHEET TITLE

MECHANICAL PLAN

SHEET NO.

M1.01

ONE INCH = TWENTY FEET
ONE - EIGHTH INCH = ONE FOOT
ONE - SIXTEENTH INCH = ONE FOOT
ONE - QUARTER INCH = ONE FOOT
THREE - QUARTERS INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE AND ONE - HALF INCH = ONE FOOT



KEYNOTES:

THESE KEYNOTES APPLY TO THIS SHEET ONLY

1. RETURN SLOT DIFFUSERS INSTALLED AT TOP OF SPINE.
2. RETURN DUCT UNDER SUPPLY
3. SUPPLY DIFFUSERS ON BOTTOM FACE OF SPINE. ARROW INDICATES FLOW DIRECTION.
4. SUPPLY AIR DOWN TO VAV, SEE SHEET M1.01

1 MECHANICAL PLAN ABOVE 14' ELEVATION
3/16" = 1'-0"

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV

DOVER PARKWAY, DELANO

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REGISTERED PROFESSIONAL ENGINEER
SHANE E. RUSSELL
No. 33415
EXP. JUNE 2024
MECHANICAL
STATE OF CALIFORNIA
24 MAY 2023

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7	ADDENDUM 01	05/31/23

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JOB NO. DGS 140724

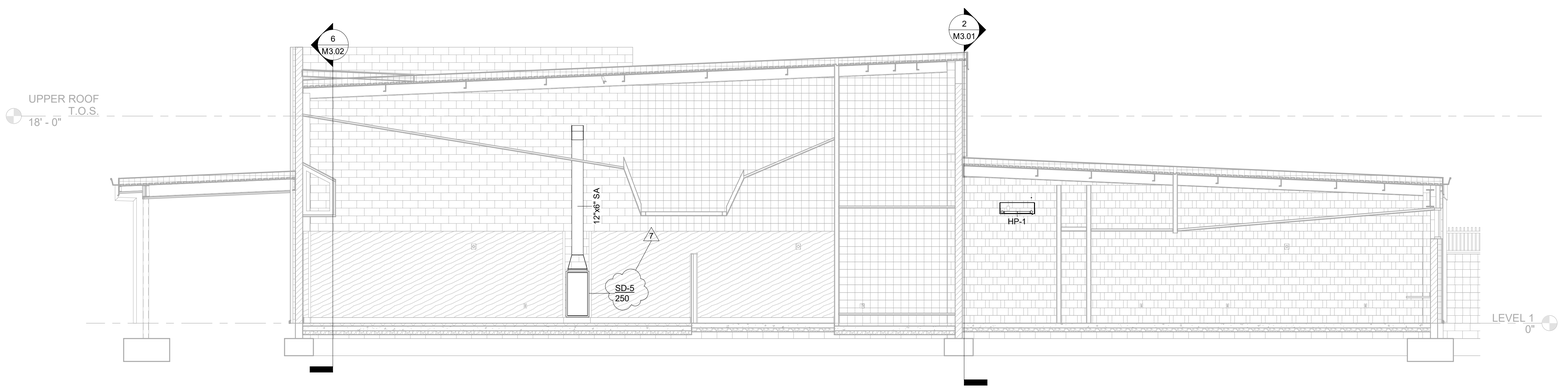
SHEET TITLE

MECHANICAL PLAN AT 14' ELEVATION

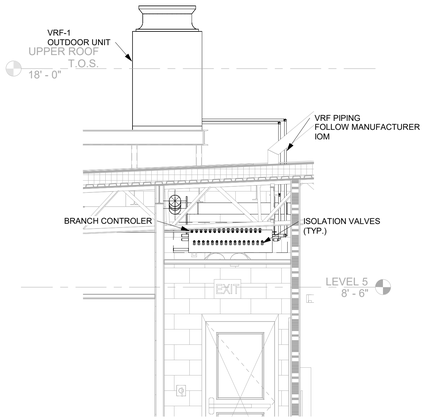
SHEET NO.

M1.04

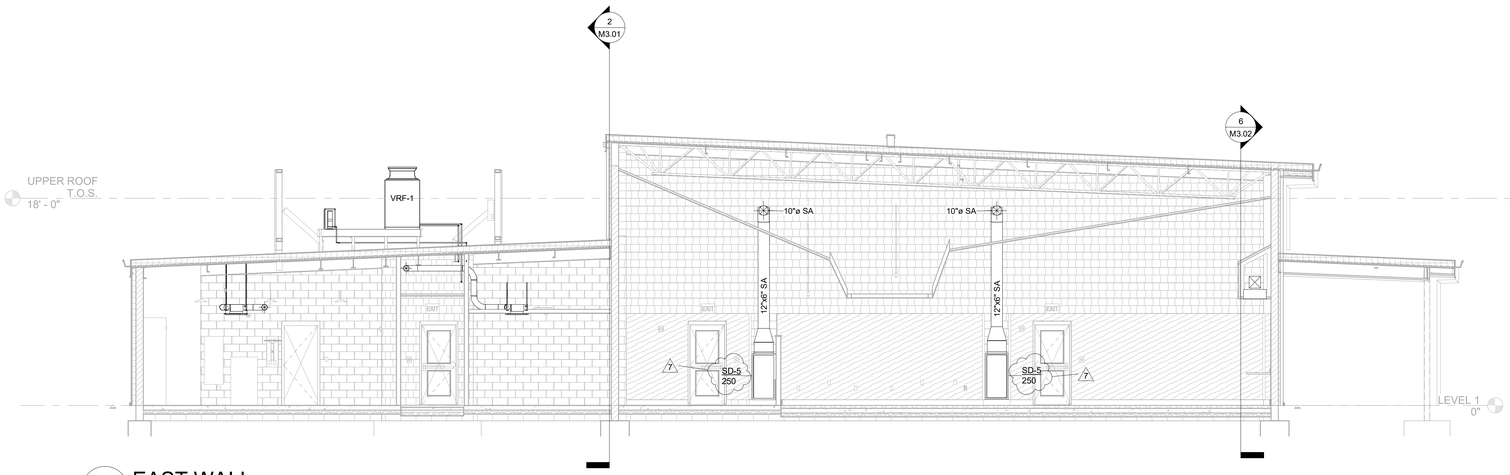
ONE INCH = TWENTY FEET
ONE - SIXTEENTH INCH = ONE FOOT
ONE - EIGHTH INCH = ONE FOOT
ONE - QUARTER INCH = ONE FOOT
THREE - QUARTERS INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE AND ONE - HALF INCH = ONE FOOT



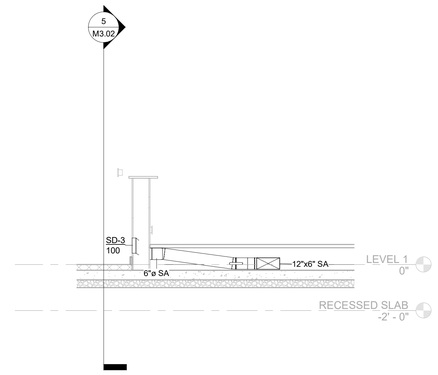
1 WEST WALL
3/16" = 1'-0"



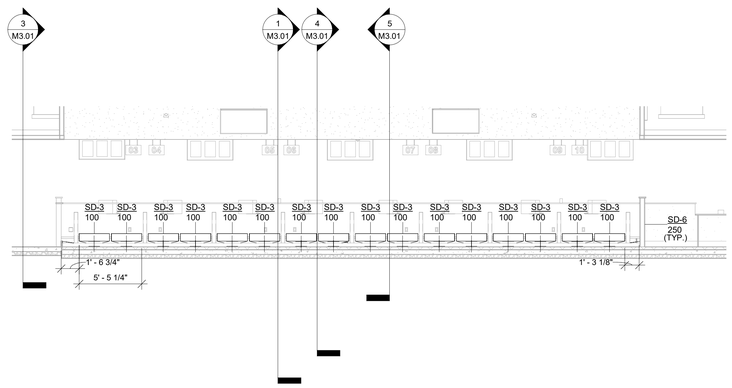
2 BRANCH CONTROLER
N.T.S



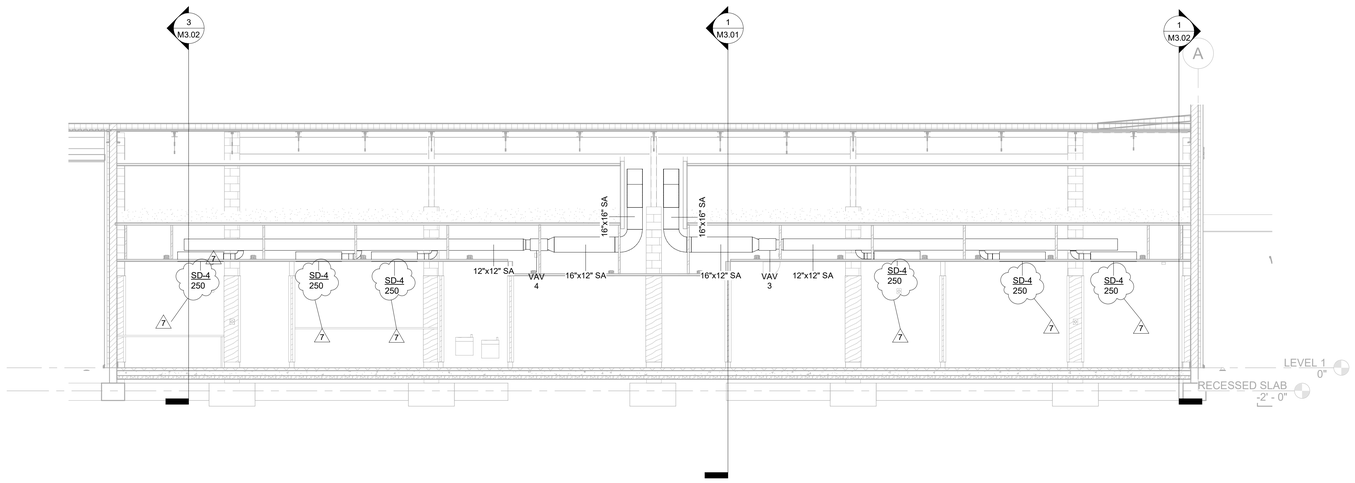
3 EAST WALL
3/16" = 1'-0"



4 SECTION COUNTER VIEW
3/8" = 1'-0"



5 FRONT VIEW AT COUNTER
3/16" = 1'-0"



6 SOUTH WALL
3/16" = 1'-0"

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV
DOVER PARKWAY, DELANO

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REGISTERED PROFESSIONAL ENGINEER
SHANE E. RUSSELL
No. 33415
EXP. JUNE 2024
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24 MAY 2023

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ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

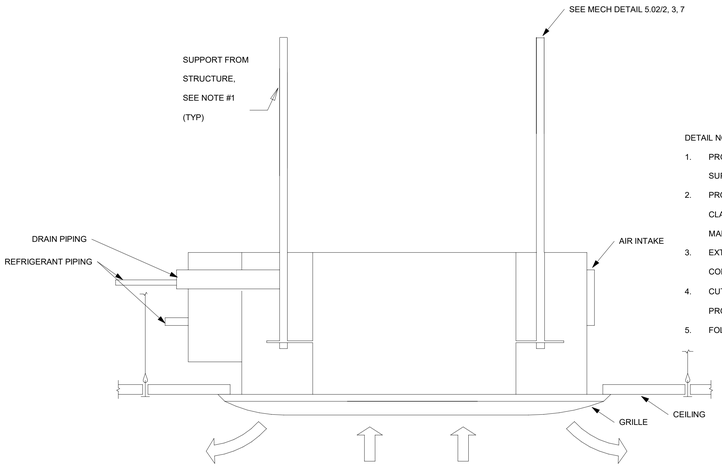
SHEET TITLE

MECHANICAL
SECTIONS

SHEET NO.

M3.02

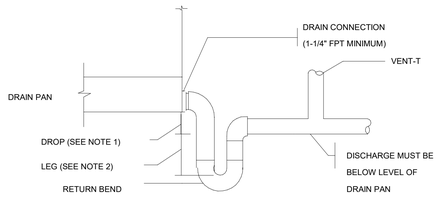
ONE INCH = TWENTY FEET
ONE - SIXTEENTH INCH = ONE FOOT
ONE - EIGHTH INCH = ONE FOOT
ONE - QUARTER INCH = ONE FOOT
THREE - QUARTERS INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE AND ONE - HALF INCH = ONE FOOT



DETAIL NOTES :

1. PROVIDE THREADED ROD AND RESTAINED SPRING ISOLATORS TO SUPPORT UNIT.
2. PROVIDE UNI-STRUT (OR SIMILAR) TRAPEZE HANGERS AND PIPE CLAMPS. INSTALL PIPEWORK IN A NEAT AND WORKMANLIKE MANNER. RUN PARALLEL TO BUILDING STRUCTURE.
3. EXTEND REFRIGERANT LINE SETS TO ASSOCIATED BRANCH CIRCUIT CONTROLLER.
4. CUT/PATCH FOR INSTALLATION OF CEILING-MOUNTED UNITS. PROVIDE ADDITIONAL GRID-TEE AS REQUIRED.
5. FOLLOW MANUFACTURER IOM GUIDANGE TO SUPPORT.

1 CASSETTE
N.T.S



NOTES

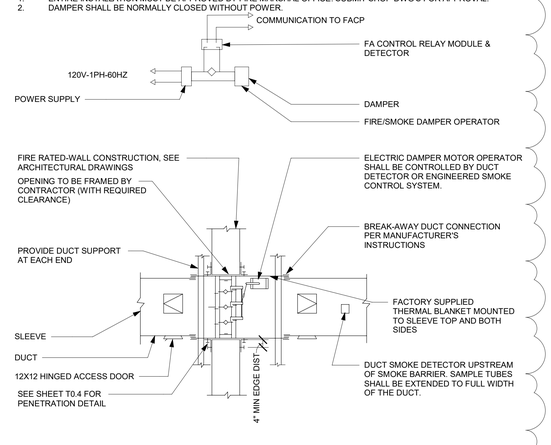
1. MIN. DROP REQUIRED USE OF STANDARD FITTINGS SHOWN EXCEEDS THIS MINIMUM.
2. X/2 + 1" = LEG FOR DRAW THRU UNIT WHERE X=NEGATIVE STATIC PRESSURE AT FAN INLET. (MIN 5")
3. ADD STRUCTURAL STEEL TO RAISE THE BOTTOM OF THE UNIT TO ACCOMMODATE TRAP HEIGHT.
4. PITCH DRAIN FOR PROPER RUN-OFF AND DISCHARGE TO APPROVED RECEPTABLE.
5. SUPPORT DRAIN LINES TO PREVENT SAG AND CONDENSATE OVERFLOW.
6. MANUALLY PRIME FILL TRAP BEFORE START-UP TO FORM INITIAL DRAIN SEAL.

PIPE SIZING CHART	
PIPE SIZE	MAX. COOLING LOAD
3/4"	2 TONS
1"	5 TONS
1-1/4"	30 TONS
1- 1/2"	50 TONS

2 CONDENSATE DRAIN PIPING FOR RTU
N.T.S

NOTES:

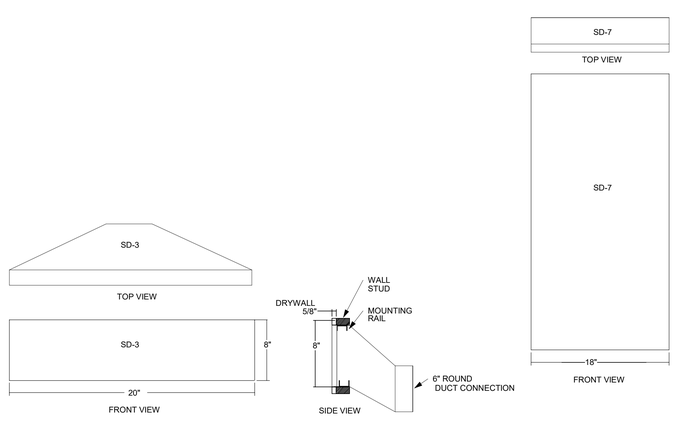
1. ENTIRE INSTALLATION MUST BE APPROVED BY FIRE MARSHAL OFFICE. SUBMIT SHOP DWG'S FOR APPROVAL.
2. DAMPER SHALL BE NORMALLY CLOSED WITHOUT POWER.



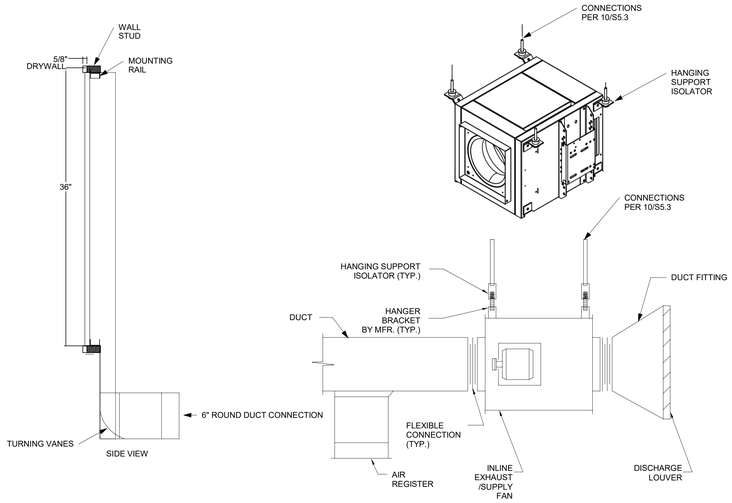
WHERE INSTALLATION DETAIL AND MANUFACTURER'S INSTALLATION INSTRUCTIONS CONFLICT, MFR'RS INSTRUCTIONS SHALL PREVAIL.

10 FIRE & SMOKE DAMPER
N.T.S

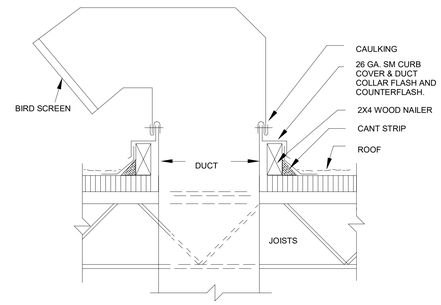
7



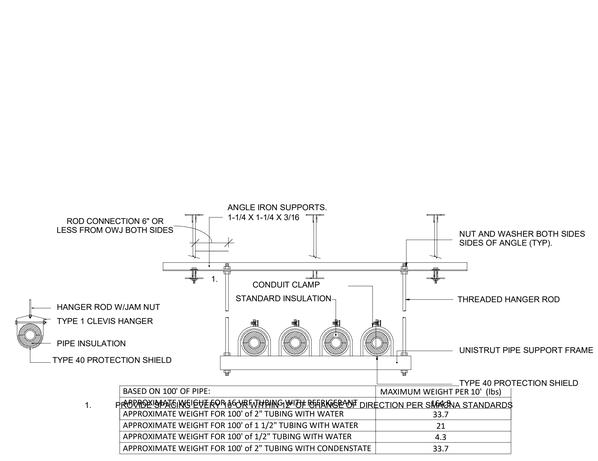
3 AFR DIFFUSER
N.T.S



4 INLINE EXHAUST FAN
N.T.S



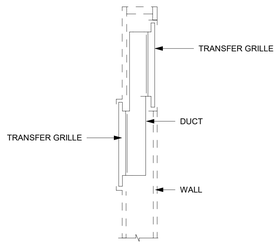
5 ROOF DUCT PENETRATION
N.T.S



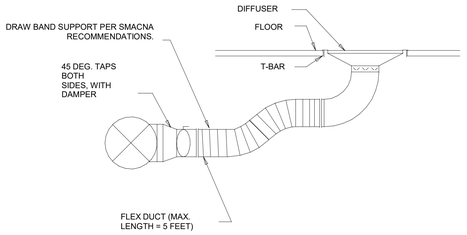
BASED ON 100' OF PIPE:	MAXIMUM WEIGHT PER 10' (lbs)
APPROXIMATE WEIGHT FOR 100' of 2" TUBING WITH WATER	33.7
APPROXIMATE WEIGHT FOR 100' of 1 1/2" TUBING WITH WATER	21
APPROXIMATE WEIGHT FOR 100' of 1/2" TUBING WITH WATER	4.3
APPROXIMATE WEIGHT FOR 100' of 2" TUBING WITH CONDENSTATE	33.7

1. PROVIDE HANGING EVERY 4'-0" OR WITHIN 1' OF CHANGE OF DIRECTION PER SMACNA STANDARDS

6 PIPE HANGER DETAIL
N.T.S



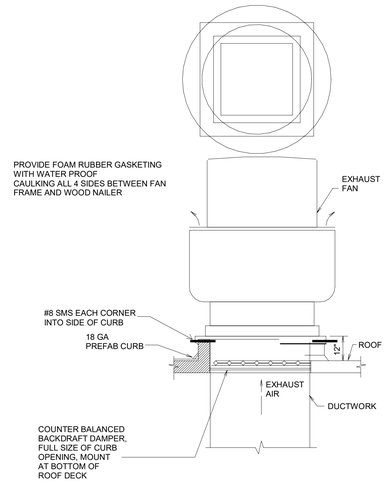
7 TRANSFER AIR GRILLE
N.T.S



NOTE:

1. INNER FLEXIBLE DUCT SHALL BE BANDED TO DUCT. INSULATION AND VAPOR BARRIER SHALL BE EXTENDED OVER DUCT AND TAPED.
2. NO BENDS GREATER THAN 15 DEGS. PERMITTED IN FLEXIBLE DUCT.

8 FLEX DUCT TO UNDERFLOOR DIFFUSER
N.T.S



9 EXHAUST FAN MOUNTING DETAIL
N.T.S

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JOB NO. DGS 140724

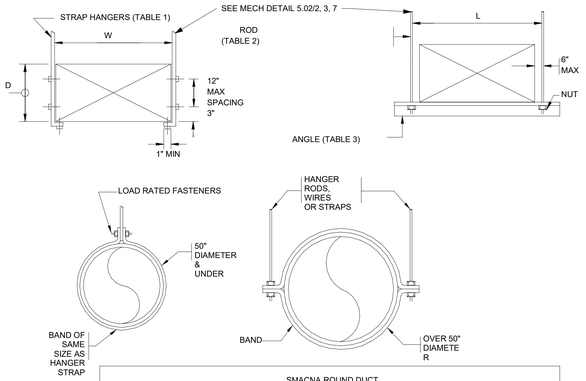
SHEET TITLE

MECHANICAL DETAILS

SHEET NO.

M5.01

ONE INCH = TWENTY FEET 0 10 20 40 60 80
ONE - SIXTEENTH INCH = ONE FOOT 0 4 8 16 32
ONE - EIGHTH INCH = ONE FOOT 0 4 8 16
ONE - QUARTER INCH = ONE FOOT 0 4 8
ONE - HALF INCH = ONE FOOT 0 4
THREE - QUARTERS INCH = ONE FOOT 0 6
ONE INCH = ONE FOOT 0 6
ONE AND ONE - HALF INCH = ONE FOOT 0 6 1



SMACNA ROUND DUCT HANGERS (MINIMUM SIZE)

DIA.	MAXIMUM SPACING	WIRE DIA.	ROD	STRAP
10" DN.	12'	ONE 12 ga.	1/4"	1"X22 ga.
11-18"	12'	TWO 12 ga. OR ONE 8 ga.	1/4"	1"X22 ga.
19-24"	12'	TWO 10 ga.	1/4"	1"X22 ga.
25-36"	12'	TWO 8 ga.	3/8"	1"X20 ga.
37-50"	12'	———	TWO 3/8"	TWO 1"X20 ga.
51-60"	12'	———	TWO 3/8"	TWO 1"X18 ga.
61-84"	12'	———	TWO 3/8"	TWO 1"X16 ga.

NOTES:

1. STRAPS ARE GALVANIZED STEEL; RODS ARE UNCOATED OR GALVANIZED STEEL; WIRE IS BLACK ANNEALED, BRIGHT BASIC OR GALVANIZED STEEL. ALL ARE ALTERNATIVES.
2. TABLE ALLOWS FOR CONVENTIONAL WALL THICKNESS, AND JOINT SYSTEMS PLUS ONE lb./SF OF INSULATION WEIGHT. IF HEAVIER DUCTS ARE TO BE INSTALLED. ADJUST HANGER SIZES TO BE WITHIN THEIR LOAD LIMITS.
3. DESIGNERS: FOR INDUSTRIAL GRADE SUPPORTS, INCLUDING SADDLES, SINGLE POINT TRAPEZE LOADS, LONGER SPANS AND FLANGED JOINT LOADS, SEE SMACNA'S ROUND INDUSTRIAL DUCT CONSTRUCTION STANDARDS.

1 DUCT HANGERS
N.T.S

SMACNA RECTANGULAR DUCT HANGERS (MINIMUM SIZE)

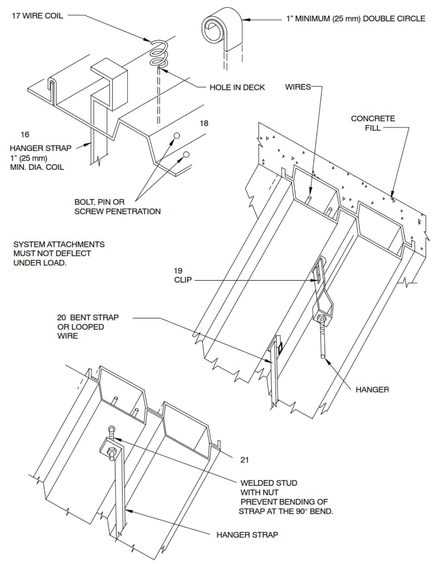
MAXIMUM HALF OF DUCT PERIMETER	PAIR AT 10 FT. SPACING	PAIR AT 8 FT. SPACING	PAIR AT 5 FT. SPACING	PAIR AT 4 FT. SPACING	
	STRAP	WIRE/ STRAP ROD	WIRE/ STRAP ROD	WIRE/ STRAP ROD	WIRE/ ROD
P/2 = 30"	1"x22 ga.	10 ga. (.135") 1"x22 ga.	10 ga. (.135") 1"x22 ga.	12 ga. (.106") 1"x22 ga.	12 ga. (.106")
P/2 = 72"	1"x18 ga.	3/8" 1"x20 ga.	1/4" 1"x22 ga.	1/4" 1"x22 ga.	1/4"
P/2 = 96"	1"x16 ga.	3/8" 1"x18 ga.	3/8" 1"x20 ga.	3/8" 1"x22 ga.	1/4"
P/2 = 120"	1-1/2"X16 ga.	1/2" 1"x16 ga.	3/8" 1"x18 ga.	3/8" 1"x20 ga.	1/4"
P/2 = 168"	1-1/2"X16 ga.	1/2" 1-1/2"X16 ga.	1/2" 1"X16 ga.	3/8" 1"X18 ga.	3/8"
P/2 = 192"		1/2" 1-1/2"X16 ga.	1/2" 1"X16 ga.	3/8" 1"X16 ga.	3/8"
P/2 = 193 UP	SPECIAL ANALYSIS REQUIRED				

WHEN STRAPS ARE LAP JOINTED USE THESE MINIMUM FASTENERS:	SINGLE HANGER MAXIMUM ALLOWABLE LOAD	
	STRAP	WIRE OR ROD (DIA.)
1"X18,20,22 ga. - TWO #10 OR ONE 1/4" BOLT	1"x22 ga. - 260 lbs.	0.106" - 80 lbs.
1"X16 ga. - TWO 1/4" DIA.	1"x20 ga. - 320 lbs.	0.135" - 120 lbs.
1-1/2"X16 ga. - TWO 3/8" DIA.	1"x18 ga. - 420 lbs.	0.162" - 160 lbs.
PLACE FASTENERS IN SERIES, NOT SIDE BY SIDE.	1"x16 ga. - 700 lbs.	1/4" - 270 lbs.
	1-1/2"x16 ga. - 1100 lbs.	3/8" - 680 lbs.
		1/2" - 1250 lbs.
		5/8" - 2000 lbs.
		3/4" - 3000 lbs.

NOTES:

1. DIMENSIONS OTHER THAN GAUGE ARE IN INCHES.
2. TABLE ALLOWS FOR DUCT WEIGHT, 1lb./SF INSULATION WEIGHT AND NORMAL REINFORCEMENT AND TRAPEZE WEIGHT, BUT NO EXTERNAL LOADS!
3. FOR CUSTOM DESIGN OF HANGERS, DESIGNERS MAY CONSULT SMACNA'S RECTANGULAR INDUSTRIAL DUCT STANDARDS, THE AISI COLD FORMED STEEL DESIGN MANUAL AND THE AISI STEEL CONSTRUCTION MANUAL.
4. STRAPS ARE GALVANIZED STEEL; OTHER MATERIALS ARE UNCOATED STEEL.
5. ALLOWABLE LOADS FOR P/2 ASSUME THAT DUCTS ARE 16 ga. MAX., EXCEPT THAT WHEN MAXIMUM DUCT DIMENSION (W) IS OVER 60" THEN P/2 MAXIMUM IS 1.25W.
6. 12,10 OR 8 ga. WIRE IS STEEL OF BLACK ANNEALED, BRIGHT BASIC OR GALVANIZED TYPE.

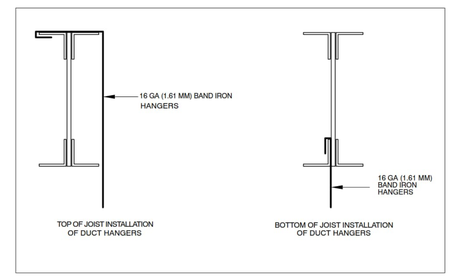
UNLESS OTHERWISE APPROVED ALLOWABLE LOAD ON UPPER ATTACHMENT IS 1/4 OF FAILURE LOAD.



AVOID PENETRATION OF ELECTRICAL ENCLOSURES

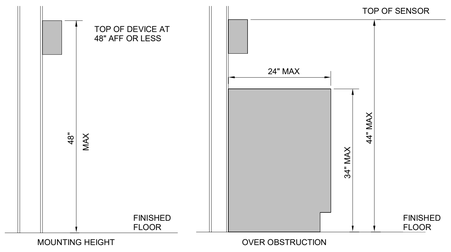
SOURCED FROM SMACNA: HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE. FIGURE 5-4 UPPER ATTACHMENTS - TYPICAL

2 UPPER ATTACHMENTS - TYPICAL
N.T.S

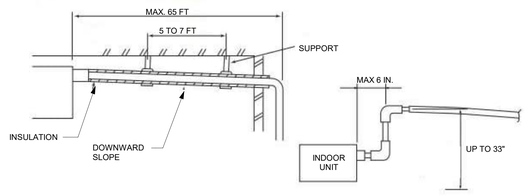


SOURCED FROM SMACNA: HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE. FIGURE 5-3 ALTERNATIVE JOIST ATTACHMENTS

3 ALTERNATE JOIST ATTACHMENTS
N.T.S

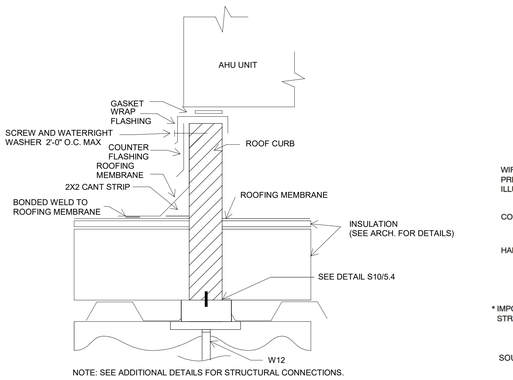


4 MECHANICAL SENSOR MOUNTING DETAIL
N.T.S



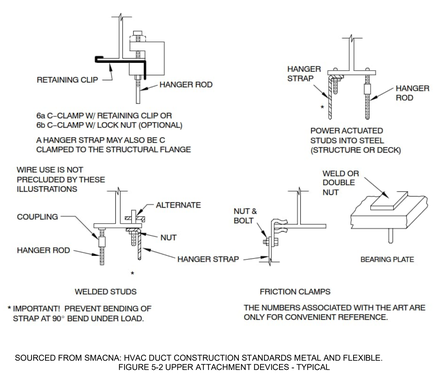
NOTE:
1. SEE MANUFACTURER INSTALLATION MANUAL FOR ADDITIONAL INSTALLATION GUIDLINES AND INSTRUCTIONS.

5 CASSETTE DRAIN PIPING
12" = 1'-0"



NOTE: SEE ADDITIONAL DETAILS FOR STRUCTURAL CONNECTIONS.

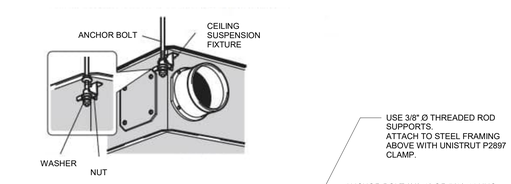
6 ROOF CURB FOR AHU UNIT
N.T.S



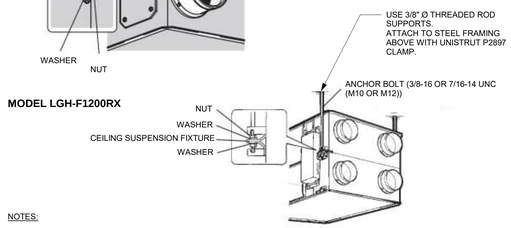
SOURCED FROM SMACNA: HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE. FIGURE 5-2 UPPER ATTACHMENT DEVICES - TYPICAL

7 UPPER ATTACHMENTS DEVICES - TYPICAL
N.T.S

MODEL LGH-F1200RX



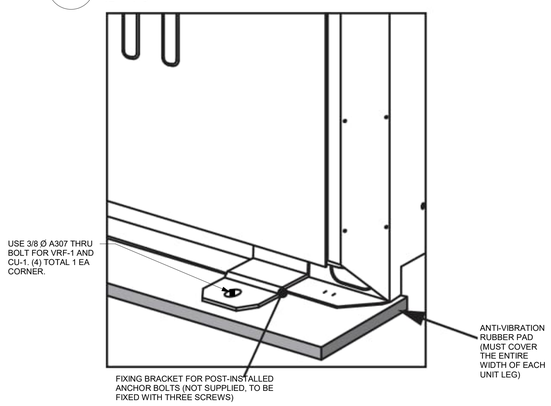
MODEL LGH-F1200RX



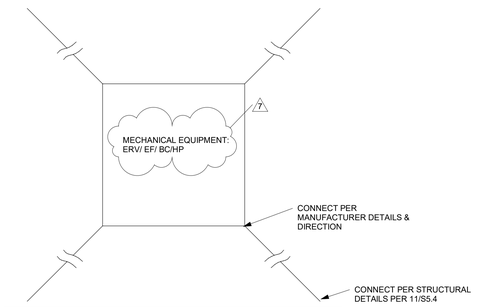
NOTES:

1. SEE MANUFACTURER INSTALLATION MANUAL FOR ADDITIONAL GUIDLINES AND INSTRUCTIONS.

8 ERV LOSSNAY MOUNTING DETAIL
N.T.S

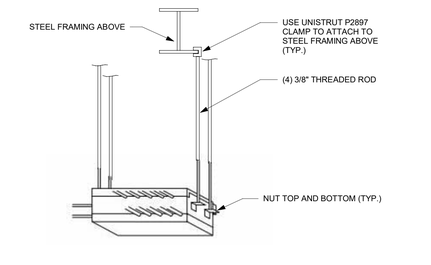


9 MOUNTING DETAIL VRF-1 AND CU-1
N.T.S



EQUIPMENT	EF (INLINE FAN)	ERV	BC
CABLE	1/8" Ø	1/8" Ø	1/8" Ø
MAX ANGLE FROM HORIZONTAL	45-60 DEGREES	45-60 DEGREES	45-60 DEGREES

10 SEISMIC BRACING WIRES
N.T.S



1. ENSURE A PULL OUT STRENGTH OF AT LEAST 133lbs PER BOLT FOR HANGING BOLTS.
2. BE SURE TO INSTALL BC CONTROLLERS LEVEL.
3. SEE MANUFACTURER DETAIL FOR ADDITIONAL INSTALLATION AND OPERATION GUIDLINES.

11 MOUNTING DETAIL BC-1
N.T.S

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DOVER PARKWAY, DELANO

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

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JOB NO. DGS 140724

SHEET TITLE

MECHANICAL DETAILS

SHEET NO.

M5.02

OUTDOOR AIR HANDLER

MARK	MANUFACTURER	MODEL	NOMINAL TONNAGE	TOTAL CFM	OUTSIDE AIR			FAN DATA		COOLING COIL			HEATING CAPACITY	ELECTRICAL						SYSTEM REFRIGERANT	WEIGHT	LOCATION	NOTES
					AIRFLOW (CFM)	SUMMER TEMP		WINTER DB TEMP	FAN POWER (HP)	ESP (IN. WG)	SENSIBLE CAPACITY	TOTAL CAPACITY	ENTERING AIR			FLA	MCA	MCOP	VOLTS	PHASE	HZ	TYPE			
						DB	WB						DB	WB										
AHU-1	AAON	RN-018-3-0-EA0A34B	15	6170	1545 CFM	103 °F	70 °F	63 °F	3.4	1.0	170,000 Btu/h	180,900 Btu/h	80 °F	63 °F	150,000 Btu/h	45.0 A	48	60.0 A	208	3	60	R-410A	3091	ROOF	SIDE RETURN AND SUPPLY, MERV 13 FILTERS, SEE DETAIL M5.02/2, 6

VAV SCHEDULE

Mark	MANUFACTURER	MODEL	SIZE	SUPPLY CFM	MAX CFM	SERVICE AREA	CONTROLS SIDE	SCHEDULE NOTES
VAV 1	TITUS	DESV	7	500	650	ROOM 101, 102	LEFT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 2	TITUS	DESV	5	250	350	ROOM 103	RIGHT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 3	TITUS	DESV	8	750	900	ROOM 106	RIGHT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 4	TITUS	DESV	8	750	900	ROOM 106	LEFT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 5	TITUS	DESV	6	300	500	ROOM 109	RIGHT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 6	TITUS	DESV	14	2100	3000	ROOM 109	RIGHT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 7	TITUS	DESV	6	300	500	ROOM 109	LEFT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS

1. SEE DETAIL M5.02/2, 3, 7

FIRE & SMOKE DAMPER

MARK	COUNT	MODEL	SIZE	RATING
FSD-1	2	FSDR-25 - RUSKIN	6"ø-6"ø	1.5 HRS

7

AIR TERMINAL SCHEDULE

MARK	COUNT	BASICS OF DESIGN		SIZE	MAX FLOW	THROW	NOTES
		MANUFACTURER	MODEL				
ED-1	8	KRUEGER	5120	12"X12"	300 CFM	-	
RD-1	4	KRUEGER	EGC5	24"X24"	1500 CFM	-	
RD-2	1	KRUEGER	EGC5	12"X12"	300 CFM	-	
SD-1	4	KRUEGER	ASPD-12	12"X12"	250 CFM	4 WAY	
SD-2	12	KRUEGER	FDD	10"	50 CFM	4 WAY	SEE DETAIL M5.01/8
SD-3	16	KRUEGER	AFR	32"X8"	250 CFM	1-WAY	SEE DETAIL M5.01/3
SD-4	9	KRUEGER	AFH	24"X48"	250 CFM	4-WAY	
SD-5	3	KRUEGER	AFE	24"x47"	276 CFM	1-WAY	
SD-6	2	KRUEGER	AFR	18"x36"	250 CFM	1-WAY	
SD-7	1	KRUEGER	5880	24"X12"	250 CFM	4-WAY	SEE DETAIL M5.01/3
SD-8	1	KRUEGER	5885	12"X12"	290 CFM	4 WAY	
TG-1	8	KRUEGER	EGC5	12"X12"	775 CFM	-	SEE DETAIL M5.01/7

7

VRF BRANCH CONTROLLER SCHEDULE

MARK	MANUFACTURER	MODEL	ELECTRICAL			WEIGHT	LOCATION	NOTES
			VOLTAGE	PHASE	MCA			
BC-1	MITSUBISHI ELECTRIC	CMB-P1016NU-HA1	208	1	1.3	138	ROOF	SEE DETAIL M5.02/10

VRF CONDENSING UNIT SCHEDULE

MARK	MANUFACTURER	MODEL	NOMINAL TONNAGE	COOLING CAPACITY	HEATING CAPACITY	ELECTRICAL			LOCATION	WEIGHT	NOTES
						VOLTAGE	PHASE	MCA			
VRF-1	MITSUBISHI ELECTRIC	PURY-P72TLMU-A	6	72000	80000	208	3	24	ROOF	444	SEE DETAIL M5.02/9

DX CONDENSING UNIT

MARK	MANUFACTURER	MODEL	NOMINAL TONNAGE	COOLING CAPACITY	HEATING CAPACITY	ELECTRICAL			LOCATION	WEIGHT	NOTES
						VOLTAGE	PHASE	MCA			
CU-1	MITSUBISHI ELECTRIC	PUY-A12NKA7(-BS)	1	12000	0	208	1	11	ROOF	92	SEE DETAIL M5.02/9

VRF EVAPORATOR SCHEDULE

MARK	MANUFACTURER	MODEL	TYPE	SERVICE AREA (ROOM)	RL SIZE (IN)	RS SIZE (IN)	AIRFLOW (CFM)				COOLING (BTU/H)	HEATING (BTU/H)	ELECTRICAL			WEIGHT	NOTES
							OA	LOW	MEDIUM	HIGH			VOLTAGE	PHASE	MCA		
HP-1	Mitsubishi Electric	PKFY-P06NBMU-E	WALL MOUNT	ROOM-116 JANITOR	1/4	1/2	50	170	190	210	6000	6700	208	1	0.19	22	1, 3
HP-2	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-114 CONTROL	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-3	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-115 SEC. STORAGE	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-4	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-113 TURN-IN	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-5	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-112 FIRST AID/LAC.	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-6	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-111 COMM.	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-7	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-110 MATERIAL STG.	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-8	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-120 STAFF-W	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-9	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-121 STAFF-M	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-10	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-122 STORAGE	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-11	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-107 HR OFFICE	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-12	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-117A LOCKERS	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-13	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-125 CORRIDOR	1/4	1/2	100	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-14	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-124 ELECTRICAL	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-15	MITSUBISHI ELECTRIC	PLFY-EP12NEMU-E	CEILING CASSETTE	ROOM-118 EMPLOYEE ROOM	1/4	1/2	200	245	280	335	12000	13500	208	1	0.29	36.6	1, 3
HP-16	MITSUBISHI ELECTRIC	PLFY-EP12NEMU-E	CEILING CASSETTE	ROOM-119 MULTI-PURPOSE	1/4	1/2	225	245	280	335	12000	13500	208	1	0.29	36.6	1, 3
HP-17	Mitsubishi Electric	PKFY-P06NBMU-E	WALL MOUNT	ROOM-111 COMM.	1/4	1/2	50	170	190	210	6000	6700	208	1	0.19	22	2, 3

1. PROVIDE 3D-I-SEE SENSOR AT EACH CEILING CASSETTE.
2. REDUNDANT SYSTEM FOR COMM ROOM, SUBSYSTEM OF CU-1.
3. SEE DETAIL M5.01/1 AND M5.02/2, 3, 5,7

ERV SCHEDULE

MARK	MANUFACTURER	MODEL	AIRFLOW		ENTHALPY RECOVERY EFFICIENCY		LEAVING AIR TEMPERATURE			FAN MOTORS		ELECTRICAL			WEIGHT (LB)	LOCATION	SCHEDULE NOTES
			CFM	ESP	HEATING	COOLING	COOLING DB	COOLING WB	HEATING DB	QUANTITY	FAN HP	VOLTAGE	PHASE	MCA			
ERV-1	Mitsubishi Electric	LGH-F1200RX5-E	1175	0.2	68	56	81 °F	71 °F	64 °F	2	0.52	208 V	1	7 A	265	ROOF	MERV 13 FILTERS, SEE DETAIL M5.02/8, 10

EXHAUST FAN SCHEDULE

MARK	MANUFACTUER	Model	CFM	Count	ESP	Volts	Phase	HZ	MOTOR ENCLOSURE	WEIGHT (LB)	SERVICE AREA	UNIT LOCATION	COMMENTS
EF-1	Greenheck	CUE-090-VG	550	1	0.25	120	1	60	STEEL	37	ROOM 120 & 122 STAFF	ROOF	DIRECT DRIVE, UPBLAST, SEE DETAIL M5.01/9 AND M5.02/5
EF-2	Greenheck	SQ-100-VG	830	1	0.75	120	1	60	STEEL	69	ROOM - 104 JANITOR	ROOM 104	DIRECT DRIVE, INLINE, SEE DETAIL M5.01/4,10
EF-3	Greenheck	CUE-090-E	300	1	0.25	120	1	60	STEEL	31	ROOM - 118 EMPLY ROOM	ROOF	DIRECT DRIVE, UPBLAST, SEE DETAIL M5.01/9 AND M5.02/5
EF-4	Greenheck	CUE-090-VG	200	1	0.25	120	1	60	STEEL	37	ROOM - 116 JANITOR	ROOF	DIRECT DRIVE, UPBLAST, SEE DETAIL M5.01/9 AND M5.02/5

AIR BALANCE SCHEDULE

UNIT TAG	LOCATION	SUPPLY CFM	RETURN CFM	MINIMUM OSA	EXHAUST CFM	NET POSITIVE/NEG CFM
HP 1-17	FRONT OF HOUSE	1225	1200	1225	1020	205
AHU-1	BACK OF HOUSE	6170	4625	1545	830	715
TOTAL		7395	5825	2770	1850	920
					BUILDING IS POSITIVE BY	920

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV

DOVER PARKWAY, DELANO

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REGISTERED PROFESSIONAL ENGINEER
SHANE E. RUSSELL
No. 33415
EXP. JUNE 2024
MECHANICAL
STATE OF CALIFORNIA
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ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

SHEET TITLE

MECHANICAL SCHEDULES

SHEET NO.

M6.01

ONE INCH = TWENTY FEET 0 5 10 20 40 60 80
ONE - SIXTEENTH INCH = ONE FOOT 0 4 8 16 32
ONE - EIGHTH INCH = ONE FOOT 0 4 8 16
ONE - QUARTER INCH = ONE FOOT 0 4 8
ONE - HALF INCH = ONE FOOT 0 4
THREE - QUARTERS INCH = ONE FOOT 0 6 2
ONE INCH = ONE FOOT 0 6
ONE AND ONE - HALF INCH = ONE FOOT 0 6 1

ABBREVIATIONS:

#	NUMBER
AC	ALTERNATING CURRENT
ADN	AREA DISTRIBUTION NODE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLER UNIT
AIC	AMPS INTERRUPTING CURRENT
ALIS	AUTONOMIC LOGISTICS INFORMATION SYSTEM
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AV	AUDIO VISUAL
AWG	AMERICAN WIRE GAUGE
BFC	BELOW FINISHED CEILING
BFF	BELOW FINISHED FLOOR
BFG	BELOW FINISHED GRADE
C	CONDUIT
CEC	CALIFORNIA ELECTRICAL CODE
CCTV	CLOSED CIRCUIT TELEVISION
CAT	CATEGORY
CH	CHILLER
CHWP	CHILLED WATER PUMP
CKT	CIRCUIT
CO	CONDUIT ONLY
COMM	COMMUNICATIONS (TELECOMM)
CRAC	COMPUTER ROOM AIR CONDITIONER
CRI	COLOR RENDITION INDEX
CT	CONDENSER TOWER
CT	CURRENT TRANSFORMER
CU	COPPER
CWP	CONDENSER WATER PUMP
DC	DIRECT CURRENT
DISC	DISCONNECT
(E)	EXISTING
ECC	EMERGENCY COMMUNICATIONS CENTER
EF	EXHAUST FAN
ELEC	ELECTRICAL
EM	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
EPO	EMERGENCY POWER OFF
EUG	ELECTRICAL UNDERGROUND
EVAC	FIRE ALARM EVACUATION CONTROL
EVC	EVAPORATIVE COOLER
(F)	FUTURE
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FATC	FIRE ALARM TERMINATION CABINET
FLA	FULL LOAD AMPS
FLEX	FLEXIBLE METAL CONDUIT
FLMC	LIQUIDTIGHT METALLIC CONDUIT
FO	FIBER OPTIC
G, GND	GROUND
GA	GAUGE
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GRC	GALVANIZED RIGID CONDUIT
HP	HORSE POWER
HID	HIGH INTENSITY DISCHARGE
HVAC	HEATING, VENTILATING & AIR CONDITIONING
HWP	HOT WATER PUMP
IDF	INTERMEDIATE DISTRIBUTION FRAME
IES	INTERNATIONAL ELECTROTECHNICAL STANDARDS
IG	ISOLATED GROUND
INF	INFORMATION
ISP	INSIDE PLANT
ITE	INFORMATION TECHNOLOGY EQUIPMENT
JB	JUNCTION BOX
KVA	KILOVOLT AMPS
LCP	LIGHTING CONTROL PANEL
LED	LIGHT EMITTING DIODE
LV	LOW VOLTAGE
MC	METAL CLAD
MDC	MODULAR DATA CENTER
MDP	MAIN DISTRIBUTION PANEL
MDP	MODULAR DEVICE PANEL
MM	MILLIMETER
MTD	MOUNTED
(N)	NEW
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
N.I.E.S.	NOT IN ELECTRICAL SCOPE
NIPR	NON-CLASSIFIED INFORMATION PROTOCOL ROUTER
N.O.	NORMALLY OPEN
NTS	NOT TO SCALE
OTS	OPEN TO STRUCTURE
PH, ∅	PHASE
PA	PUBLIC ADDRESS SYSTEM
PB	PULL BOX
PDU	POWER DISTRIBUTION UNIT
POP	POST OFFICE PROTOCOL
(R)	REMOVE
RAH	RETURN AIR HANDLER
RF	RADIO FREQUENCY
RFP	REQUEST FOR PROPOSAL
RM	ROOM
RNG	RANDOM NUMBER GENERATOR
RSC	RIGID STEEL CONDUIT
SAH	SUPPLY AIR HANDLER
SAN	STORAGE AREA NETWORK
SEC	SECURITY
SCE	SOUTHERN CALIFORNIA EDISON (UTILITY COMPANY)
SF	SUPPLY FAN
SFD	SMOKE/FIRE DAMPER
SM	SINGLE MODE
SPD	SURGE PROTECTIVE DEVICE
TEL	TELEPHONE
THRU	THROUGH
TMGB	TELECOM MAIN GROUND BUS
TTB	TELECOM TERMINAL BOARD
TX	TRANSFORMER
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
TYP	TYPICAL
UFC	UNIFORM FIRE CODE
UFER	A CONCRETE ENCASED GROUND ELECTRODE METHOD
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORY
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLT
VA	VOLTAMPERES
VDC	VOLTS DIRECT CURRENT
VFD	VARIABLE FREQUENCY DRIVE
WP	WEATHERPROOF
XFMR	TRANSFORMER
XP	EXPLOSIONPROOF

GENERAL NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR ROOM NAME LIST.
2. THE ELECTRICAL SPECIFICATIONS ARE AN INTEGRAL PART OF THE ELECTRICAL CONSTRUCTION DOCUMENTS. THE CONTRACTOR SHALL THOROUGHLY REVIEW ALL INFORMATION PROVIDED IN BOTH THESE DRAWINGS AND THE ASSOCIATED ELECTRICAL SPECIFICATIONS PRIOR TO PREPARING A BID FOR THE ELECTRICAL WORK AND SHALL AFFIRM HAVING DONE SO BY THE SUBMISSION OF A BID FOR STATED WORK.
3. FURNISH AND INSTALL ALL NECESSARY LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED TO INSTALL COMPLETE AND OPERATIONAL ELECTRICAL SYSTEMS ACCORDING TO THE INTENT OF THESE DRAWINGS AND ASSOCIATED SPECIFICATIONS WHETHER ITEMIZED OR NOT.
4. REFER TO THE MECHANICAL DRAWINGS FOR EQUIPMENT AND PROVIDE STARTERS, CIRCUIT BREAKERS,SWITCHES, PUSH BUTTONS AND AUXILIARY DEVICES AS REQUIRED. MAKE ALL ELECTRICAL CONNECTIONS TO PLACE THE EQUIPMENT IN COMPLETE OPERATION.
5. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY EXISTING AND LOCAL CONDITIONS PRIOR TO THE BEGINNING OF ANY WORK. CONTRACTOR SHALL HAVE MADE ALLOWANCE THEREFORE IN PREPARING HIS PROPOSAL. INSPECTING PREVIOUSLY INSTALLED WORK IN ANTICIPATION OF SUBSEQUENT WORK. FAILURE TO VISIT THE SITE SHALL IN NO WAY RELIEVE THE CONTRACTOR FROM ANY RESPONSIBILITY.
6. THE ELECTRICAL DRAWINGS ARE DIAGRAMMATIC AND THE LOCATION OF THE ELECTRICAL DEVICES SHALL BE COORDINATED WITH THE ARCHITECT.
7. IN THE EVENT OF DISCREPANCIES BETWEEN SPECIFICATIONS AND THE DRAWINGS, THE ELECTRICAL CONTRACTOR SHALL BID NEW CONDITIONS, WIRES AND NECESSARY EQUIPMENT IN ORDER TO COMPLETE THE JOB AND PROVIDE A FULLY OPERABLE AND ACCEPTABLE SYSTEM. EXTRAS WILL NOT BE ALLOWED FOR WORK NOT INDICATED OR NOTED ON THE DRAWINGS.
8. ELECTRICAL WORK SHALL COMPLY WITH THE 2019 EDITIONS OF THE CALIFORNIA ELECTRICAL CODE AND ALL APPLICABLE DGS STANDARDS.
9. FIRE SEAL AROUND ALL CONDUIT PENETRATIONS THROUGH FIRE BARRIERS WITH AN APPROVED FIRE SEALANT EQUAL TO THE RATING OF THE SURFACE PENETRATED. FIRE SEAL INSIDE OF CONDUIT AFTER CONDUCTOR INSTALLATION. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATIONS OF FIRE RATED FLOORS AND WALLS.
10. RETURN TO OWNER, AT THEIR DISCRETION, ALL UNUSED ELECTRICAL EQUIPMENT (I.E. FIXTURES, PANELS, ETC).
11. THE TELECOMMUNICATIONS SPECIFICATIONS ARE AN INTEGRAL PART OF THE TELECOMMUNICATIONS CONSTRUCTION DOCUMENTS. THE CONTRACTOR SHALL THOROUGHLY REVIEW ALL INFORMATION PROVIDED IN BOTH THESE DRAWINGS AND THE ASSOCIATED TELECOMMUNICATIONS SPECIFICATIONS PRIOR TO PREPARING A BID FOR THE TELECOMMUNICATIONS WORK AND SHALL AFFIRM HAVING DONE SO BY THE SUBMISSION OF A BID FOR STATED WORK.
12. PROVIDE ALL NECESSARY LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED TO INSTALL COMPLETE AND OPERATIONAL TELECOMMUNICATIONS SYSTEMS ACCORDING TO THE INTENT OF THESE DRAWINGS AND ASSOCIATED SPECIFICATIONS WHETHER ITEMIZED OR NOT.
13. TELECOMMUNICATIONS WORK SHALL COMPLY WITH THE LATEST ENACTED EDITIONS OF BICSI STANDARDS.
14. FOR TELECOMMUNICATIONS PATCH PANELS AND FACEPLATES LABELING ADHERE TO THE DEPOT STANDARD.

ELECTRICAL LEGEND:

- 2' x 2' LED FIXTURE. SHADING INDICATES EMERGENCY FIXTURES ON INVERTER POWER.
- LINEAR LED FIXTURE. SHADING INDICATES EMERGENCY FIXTURES ON INVERTER POWER.
- WALL MOUNTED LED EXTERIOR LIGHT FIXTURE.
- EXIT SIGN WITH DIRECTIONAL ARROWS AS INDICATED, CEILING MOUNTING. SHADING INDICATES FACE DIRECTION.
- DOWNLIGHT LED FIXTURE. SHADING INDICATES EMERGENCY FIXTURES ON INVERTER POWER.
- LV — LOW VOLTAGE ZONE ON/OFF SWITCH MOUNTED AT 42" AFF.
- LVD — LOW VOLTAGE ZONE RAISE/LOWER AND ON/OFF DIMMER SWITCH MOUNTED AT 42" AFF.
- SINGLE POLE WALL SWITCH MOUNTED AT 42" AFF.
- D — WALL MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR AND DIMMING CONTROL
- LOW VOLTAGE CEILING MOUNTED 360° DUAL TECHNOLOGY OCCUPANCY SENSOR. DEVICE TO BE CAPABLE OF BOTH OCCUPANCY AND VACANCY. DEVICE TO BE SET TO OCCUPANCY. VERIFY LAYOUT WITH MANUFACTURER SPACING REQUIREMENTS.
- PC — LOW VOLTAGE CEILING MOUNTED PHOTOCELL VERIFY LAYOUT WITH MANUFACTURER.
  p1 - SKYLIT DAYLIT ZONE
  p1 - PRIMARY SIDELIT DAYLIT ZONE
  p2 - SECONDARY SIDELIT DAYLIT ZONE
- J — JUNCTION BOX, SIZE & TYPE AS INDICATED OR AS REQUIRED
- H — NEMA 6-30 R OUTLET
- 20 AMP 125V 3W DUPLEX RECEPTACLE, @ +18" UON
- IG — 20 AMP 125V 3W DUPLEX RECEPTACLE, WITH IG (ISO GND)
- 20 AMP 125V 3W DUPLEX RECEPTACLE WITH AFCI (ARC FAULT CIRCUIT INTERRUPTER) TYPE, @ +18" UON
- 20 AMP 125V QUAD RECEPTACLE WITH AFCI (ARC FAULT CIRCUIT INTERRUPTER) TYPE, @ +18" UON
- 20 AMP 125V QUAD RECEPTACLE, @ +18" UON
- FLUSH FLOOR BOX SERVICE FOR POWER AND TELECOM. SEE ALSO ASSOCIATED COMM & SECURITY PLAN DRAWING
- FLUSH FLOOR BOX SERVICE FOR POWER AND TELECOM. PROVIDE WITH HALF SWITCHED (CONTROLLED) QUAD REPECTACLE
- G — 20 AMP 120V DUPLEX RECEPTACLE, WITH GFCI, @ +18" UON
- G/WP — 20 AMP 120V DUPLEX RECEPTACLE, WEATHER-PROOF WITH GFCI, @ +18" UON
- RETRACTABLE CORD REEL WITH DUPLEX POWER RECEPTACLE
- COMBINATION BREAKER/STARTER, SIZE PER UNIT LABEL
- NON-FUSED DISCONNECT SWITCH, SIZE PER UNIT LABEL
- FUSED DISCONNECT SWITCH, SIZE PER UNIT LABEL
- EQUIPMENT STARTER, SIZE PER UNIT LABEL
- HALF CONTROLLED DUPLEX RECEPTACLE, @ +18" UON
- HALF CONTROLLED QUAD RECEPTACLE, @ +18" UON
- HALF CONTROLLED DOUBLE DUPLEX FLOOR BOX WITH FLUSH MOUNTED DEVICE
- EV — ELECTRIC VEHICLE CHARGING CONNECTION POINT
- M — MOTOR RATED SWITCH
- WALL STANDARD COMMUNICATION OUTLET
- FLOOR STANDARD COMMUNICATION OUTLET
- TELEVISION OUTLET
- J WAP — WIRELESS COMMUNICATION OUTLET
- BASKET CABLE TRAY
- LADDER TYPE CABLE TRAY
- FIRE ALARM STROBE
- FIRE ALARM STROBE WITH HORN
- FS — FLOW SWITCH
- TS — TAMPER SWITCH
- PS — PULL STATION
- EMERGENCY POWER OFF (EPO) BUTTON (7)
- PUSH BUTTON SWITCH
- MOTOR, N.I.E.S. CONNECT AS REQUIRED, NUMBER INDICATES HP
- PANELBOARD - SURFACE MOUNTED - SEE SCHEDULE
- PANELBOARD - FLUSH MOUNTED - SEE SCHEDULE
- MAIN SWITCHBOARD OR MOTOR CONTROL CENTER, SEE ONE LINE DIAGRAM
- CONDUIT CONCEALED IN CEILING OR WALL. BRANCH CIRCUIT WITHOUT FURTHER DESIGNATION INDICATES #12 AWG WIRE CIRCUIT AND 3/4" CONDUIT. ALL CONDUITS AND RACEWAY MUST HAVE AINSULATED GROUND WIRE SIZED PER NEC 250.122.
- WIRE 'TICK MARKS' INDICATE: 2 #12 AWG + 1 #12 NEUTRAL + GND, UON. (GROUND WIRE NOT SHOWN, BUT REQUIRED FOR ALL CIRCUITS)
- HOMERUN TO RESPECTIVE PANEL OR TERMINAL CABINET - OVERHEAD
- HOMERUN TO RESPECTIVE PANEL OR TERMINAL CABINET - UNDERGROUND
- CONDUIT RISER - UP
- CONDUIT RISER - DOWN
- FLEXIBLE CONDUIT CONECTION
- CONDUIT RUN CONCEALED BELOW FLOOR OR FINISHED GRADE BRANCH CIRCUIT WITHOUT FURTHER DESIGNATION INDICATES #12 AWG WIRE CIRCUIT AND 3/4" CONDUIT. ALL CONDUITS AND RACEWAY MUST HAVE AN INSULATED GROUND WIRE SIZED PER NEC 250.122.
- EF-1 — INDICATES MECHANICAL, EQUIPMENT DESIGNATION TAG.SEE MECHANNICAL SCHEDULES FOR ADDITIONAL INFO. (EXAMPLE: EF-1 = EXHAUST FAN, - UNIT NO. 1)
- A / EC-1 — SECTION DESIGNATION; TOP LETTER INDICATES SECTION, BOTTOM LETTER/NUMBER INDICATES SHEET
- 2 / EC-1 — DETAIL DESIGNATION; TOP NUMBER INDICATES DETAIL, BOTTOM LETTER/NUMBER INDICATES SHEET
- CALL OUT SHEET NOTE REFERENCE TAG
- GROUND ROD
- TESTING GROUND WELL WITH GROUND ROD
- EXOTHERMIC WELD CONNECTION
- TRANSFORMER, MOUNTING AS NOTED

SINGLE LINE LEGEND:

- 60B — INDICATES ELECTRICAL FEEDER SIZE. REFER TO FEEDER SCHEDULE.
- 3 — XXAF / XXAT — CIRCUIT BREAKER. AMP SIZE AND POLES, AS INDICATED
- CURRENT TRANSFORMER
- CIRCUIT SWITCH, SINGLE BREAK
- FUSED BREAKER
- TERMINAL(S)
- DIESEL GENERATOR
- AUTOMATIC TRANSFER SWITCH
- DM — ELECTRICAL METER WITH CURRENT TRANSFORMERS
- POTENTIAL TRANSFORMER
- FUSE
- VOLTAGE TRANSFORMER
- EARTH GROUND
- FEEDER
- EXISTING UNDERGROUND CONDUIT

NOTE:
SYMBOLS INDICATED ABOVE MAY NOT NECESSARILY APPEAR AS PART OF THESE DRAWINGS IF NOT REQUIRED.

AGENCY APPROVAL

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV

Dover Parkway; Delano

California Department of General Services

LICENSED PROFESSIONAL ENGINEER — SARA CULBERTSON — E27311 — ELECTRICAL — STATE OF CALIFORNIA

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ARCHITECT

REVISIONS		
NO.	DESCRIPTION	DATE
7	ADDENDUM 01	05/31/2023

DATE 05/31/2023

JOB NO. DGS 140724

SHEET TITLE

ELECTRICAL LEGEND, NOTES AND ABBREVIATIONS

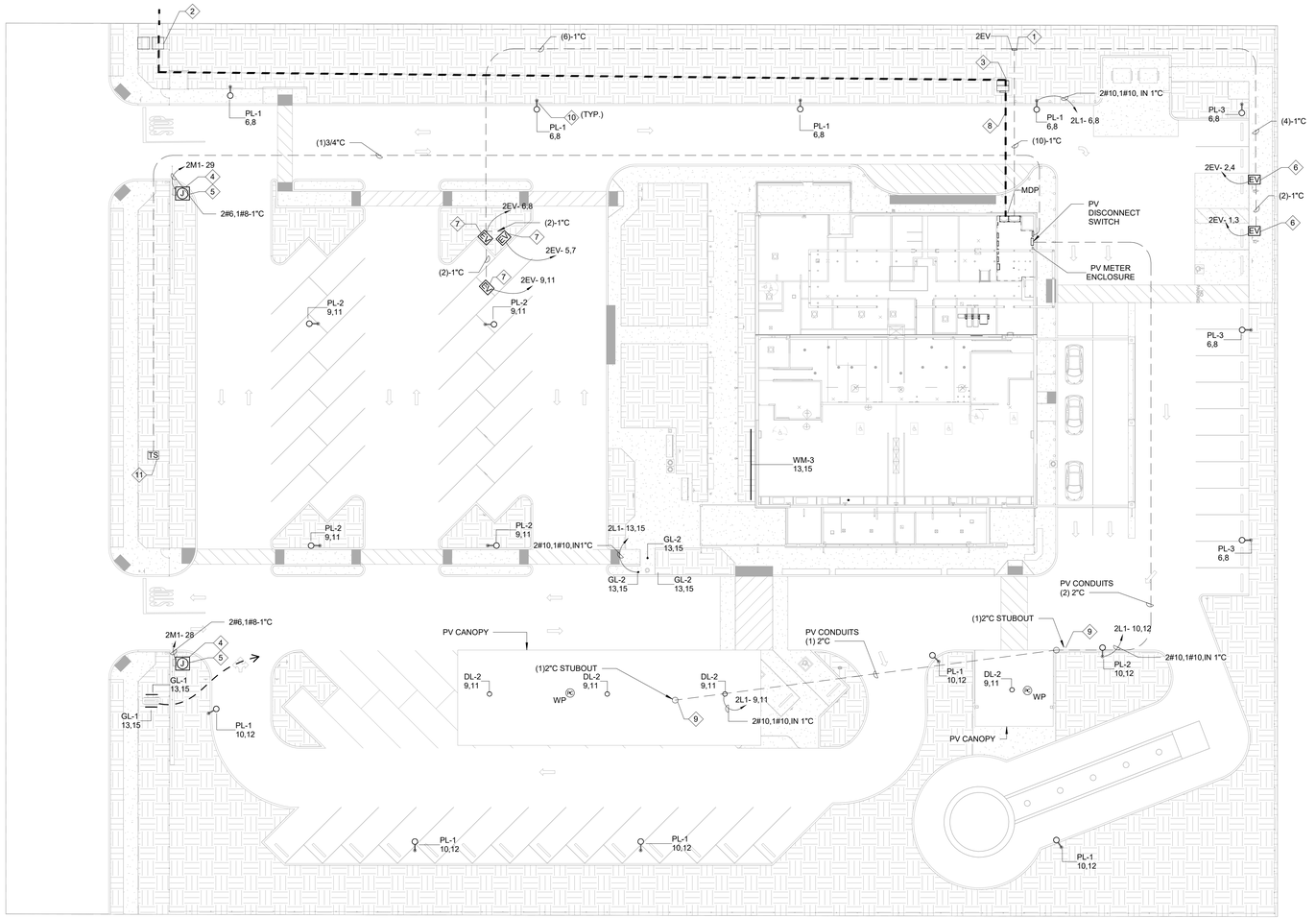
SHEET NO.

E0.01

ONE INCH = TWENTY FEET
ONE-HALF INCH = TEN FEET
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT

GENERAL NOTES

1. FIELD VERIFY ALL CONDITIONS PRIOR TO START OF WORK.
2. THE LIGHTING CONTROL SYSTEM SHALL BE NETWORK-BASED (nLIGHT ACUITY CONTROL OR APPROVED EQUAL). COORDINATE ALL REQUIREMENTS WITH MANUFACTURER AND PROVIDE NECESSARY COMPONENTS FOR A FULLY FUNCTIONAL T24 COMPLIANCE LIGHTING CONTROL SYSTEM. PROVIDE CONNECTION TO ALERTON BMS SYSTEM.
3. ALL OUTDOOR LIGHTING SHALL BE CONTROLLED WITH A PHOTOCELL IN ADDITION TO AN AUTOMATIC TIME-SWITCH CONTROL, OR AN ASTRONOMICAL TIME-SWITCH CONTROL.OUTDOOR LIGHTING SHALL BE CONTROLLED BY EXTERIOR PHOTOCELL THAT AUTOMATICALLY TURNS OFF WHEN SUFFICIENT DAYLIGHT IS AVAILABLE.
4. PROVIDE PV CONDUITS AND PULL BOXES FOLLOWING FINAL APPROVED PV DRAWINGS.
5. PROVIDE A COMPLETE DESIGN AND INSTALLATION OF A LIGHTNING PROTECTION SYSTEM FOR THE BUILDING AS SPECIFIED. SYSTEM SHALL BE DESIGN PER NFPA 780 AND LOCAL REQUIREMENTS. COMPLETED DESIGN SHALL BE SUBMITTED AND APPROVED PRIOR TO INSTALLATION.
6. PROVIDE A CANOPY MOUNTED 70 KW PHOTOVOLTAIC (PV) SYSTEM DESIGN AND INSTALLATION. SYSTEM SHALL BE BASED ON UTILIZING 380KW SOLAR PANEL. DESIGN SHALL BE APPROVED PRIOR TO INSTALLATION.
7. SEE LIGHT FIXTURE SCHEDULE ON SHEET E6.01 FOR FIXTURE TYPE DESCRIPTIONS AND INFORMATION.



1 ELECTRICAL SITE PLAN
1" = 20'-0"

N

KEYNOTES

KEY	DESCRIPTION
1	PROVIDE A FREE STANDING 36"W x 24"D x 36"H NEMA 4 STAINLESS STEEL ENCLOSURE.
2	PROVIDE 3'X5'X4' VAULT PER SOUTHERN CALIFORNIA EDISON REQUIREMENTS. COORDINATE WITH CIVIL.
3	PROVIDE 6'X8'X6" CONCRETE PAD FOR UTILITY TRANSFORMER PER SOUTHERN CALIFORNIA EDISON REQUIRMENTS. COORDINATE WITH CIVIL.
4	PROVIDE J-BOX FOR 120V, 20A CONNECTION IN 1" CONDUIT FOR MOTORIZED GATE. COORDINATE EXACT REQUIREMENT WITH MANUFACTURER BEFORE INSTALLATION. COORDINATE ROUTING WITH CIVIL.
5	PROVIDE J-BOX FOR ASSOCIATED 1" CONDUIT BACK TO THE MAIN COMMUNICATION ROOM AS REQUIRED FOR LOW VOLTAGE CONTROL/SECURITY PROVISIONS. COORDINATE EXACT REQUIREMENT WITH MANUFACTURER BEFORE INSTALLATION. COORDINATE ROUTING WITH CIVIL.
6	DUAL PORT PEDESTAL POS ELECTRICAL VEHICLE CHARGING STATION 208V, 40 AMPS, 2 POLES NEMA 3R, REFER TO MANUFACTURER WRITTEN RECOMMENDATIONS FOR INSTALLATIONS / ANCHORAGE DETAILS AND REQUIREMENTS.
7	PROVIDE A LISTED WET LOCATION SUITABLE JUNCTION BOX FOR FUTURE EV CHARGING STATION. VERIFY LOCATION PRIOR TO ROUGH IN. PROVIDE PERMANENT SIGNAGE AT JUNCTION BOX STATING "EV CAPABLE".
8	PROVIDE 2-4" C FOR INCOMING UTILITY SECONDARY CONDUCTORS FROM VAULT TO MDP PER SOUTHERN EDISON REQUIREMENTS. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH STRUCTURAL REGARDING CONDUITS ENTERING THE BUILDING AND BUILDING FOUNDATION.
9	PROVIDE CONDUIT STUB-OUTS FOR PV SYSTEM CONNECTION. RUN CONDUIT TO PV DISCONNECT. VERIFY LOCATION IN THE FIELD.
10	REFER TO DETAIL #2 ON SHEET E8.02 FOR POLE MOUNTED LUMINAIRE DETAIL.
11	PROVIDE (1)3/4" CONDUIT TO ABOVE GROUND SHUT OFF WITH TAMPER SWITCH FOR FIRE ALARM SUPERVISORY CIRCUIT. COORDINATE LOCATION OF TAMPER SWITCH WITH CIVIL.

AGENCY APPROVAL

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REVISIONS

NO.	DESCRIPTION	DATE
1	SFM REVIEW	07/02/20
4	SFM BACKCHECK REVIEW	12/15/20
5	CITY PLAN CHECK	09/15/21
7	ADDENDUM 01	05/31/2023

DATE 05/31/2023

JOB NO. DGS 140724

SHEET TITLE

ELECTRICAL SITE PLAN

SHEET NO.

E1.01

GENERAL NOTES

1. ALL GENERAL RECEPTACLE AND LIGHTING CIRCUITS SHALL BE FED BY 20A BREAKERS MINIMUM.
2. RECEPTACLES ON OPPOSITE SIDES OF COMMON WALLS SHALL BE HORIZONTALLY OFFSET.
3. ALL CIRCUITS SHALL HAVE DEDICATED GROUND WIRES.
4. ALL CONDUITS SHALL BE 3/4"C MINIMUM.
5. PROVIDE PERMANENT LABEL TO EACH RECEPTACLE, SHOWING PANEL NAME AND CIRCUIT NUMBER USED FOR POWER SOURCE.
6. EACH CIRCUIT SHALL BE PROVIDED WITH ITS OWN DEDICATED NEUTRAL.
7. ALL EXTERIOR RECEPTACLES SHALL BE GFCI, WEATHER RESISTANT TYPE AND HAVE IN - USE WEATHER PROOF COVERS.
8. REFER TO SINGLE LINE DIAGRAM, PANEL SCHEUDLE, AND FLOOR PLANS FOR ADDITIONAL REQUIRMENT AND INFORMATION. COORDINATE WITH ARCHITECTURAL DRAWINGS.
9. ALL JUNCTION BOXES SHALL BE SIZED PER NEC.
10. ALL CONDUITS SHALL BE CONCEALED IN WALLS OR ABOVE CEILING.
11. ALL MOTOR RATED SWITCHES AND DISCONNECTS MUST BE READILY ACCESSIBLE.
12. ALL MOTOR RATED SWITCHES AND DISCONNECTS SERVING MECHANICAL EQUIPMENT TO BE MOUNTED AT SAME ELEVATION AS THE UNIT IT SERVES. COORDINATE ELEVATIONS AND LOCATIONS WITH MECHANICAL PLANS.
13. ALL EXTERIOR EQUIPMENT SHALL BE NEMA 3R WET LISTED SUITIBLE FOR INSTALLATION LOCATION, UNLESS OTHERWISE NOTED.
14. PERMANENT AND DURABLE MARKING FOR CONTROLLED RECEPTACLES OR CIRCUITS TO DIFFERENTIATE THEM FROM UNCONTROLLED RECEPTACLES OR CIRCUITS SHALL BE PROVIDED TO MEET SECTION 130.5(D)(3) OF THE CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS.
15. AUTOMATIC CONTROLLED RECEPTACLES IN WORK AREA SHALL BE CONTROLLED BY BUILDING AUTOMATIC SYSTEM TIME OF DAY SCHEDULE.
16. PROVIDE STEEL KEYED LOCKABLE COVER PLATES ON ALL EXTERIOR RECEPTACLES.
17. ALL BOXES AND CONDUIT INSTALLED IN FIRE-RATED WALLS SHALL BE FIRE SEALED AS REQUIRED TO MAINTAIN THE PARTITION'S FIRE RATING.

KEYNOTES

KEY	DESCRIPTION
1	PROVIDE GFCI WEATHER RESISTANT TYPE RECEPTACLE WITH WHILE IN USE WEATHER PROOF COVER.
2	PROVIDE POWER AS REQUIRED FOR COPIER. INSTALL (1) DEDICATED NEMA 5-20R DUPLEX OUTLET, 120V, 20A, 60HZ, SINGLE PHASE, 3-WIRE, PARALLEL BLADE, WITH ISOLATED GROUND. VERIFY LOCATION PRIOR TO ROUGH IN.
3	PROVIDE POWER AS REQUIRED FOR MAIL MACHINE. VERIFY LOCATION PRIOR TO ROUGH IN.
4	PROVIDE POWER AS REQUIRED FOR TV. VERIFY LOCATION PRIOR TO ROUGH IN.
5	PROVIDE POWER AS REQUIRED FOR DRINKING FOUNTAIN. VERIFY LOCATION PRIOR TO ROUGH IN.
6	PROVIDE POWER AS REQUIRED FOR SELF SERVICE KIOSK. INSTALL (1) DEDICATED NEMA 5-20R DUPLEX OUTLET, 120V, 20A, 60HZ, SINGLE PHASE, 3-WIRE, PARALLEL BLADE, WITH ISOLATED GROUND, LABEL AS "DSST". VERIFY LOCATION PRIOR TO ROUGH IN.
7	PROVIDE POWER AS REQUIRED FOR HAND DRYER. VERIFY LOCATION PRIOR TO ROUGH IN.
8	PROVIDE POWER AS REQUIRED FOR VENDING MACHINE. VERIFY LOCATION PRIOR TO ROUGH IN.
9	PROVIDE POWER AS REQUIRED FOR REFRIGERATOR. VERIFY LOCATION PRIOR TO ROUGH IN.
10	PROVIDE POWER AS REQUIRED FOR MICROWAVE. VERIFY LOCATION PRIOR TO ROUGH IN.
11	PROVIDE POWER AS REQUIRED FOR SHREDDER. VERIFY LOCATION PRIOR TO ROUGH IN.
12	PROVIDE CONVENIENCE RECEPTACLE WITH LOCKABLE COVER.
13	WALL MOUNTED JUNCTION BOXES FOR POWER CONNECTION TO MODULAR FURNITURE SYSTEM. COORDINATE EXACT LOCATION IN THE FIELD WITH FURNITURE VENDOR AND PROVIDE NEW CONDUIT, WIRE, ETC. AS NEEDED TO ACCOMMODATE THE NEW LAYOUT. CIRCUIT MARKED WITH "C" TO BE CONTROLLED VIA LOCAL OCCUPANCY SENSOR. REFER TO DETAIL #8 ON SHEET E8.01 FOR MODULAR FURNITURE WIRING.
14	PROVIDE 60A TOGGLE DISCONNECT SWITCH UNDERNEATH SINK AND CONNECTION TO INSTANTANEOUS WATER HEATER. COORDINATE EXACT LOCATION WITH PLUMBING CONTRACTOR PRIOR TO INSTALLATION.
15	PROVIDE 40A TOGGLE DISCONNECT SWITCH UNDERNEATH SINK AND CONNECTION TO INSTANTANEOUS WATER HEATER. COORDINATE EXACT LOCATION WITH PLUMBING CONTRACTOR PRIOR TO INSTALLATION.
16	PROVIDE POWER AS REQUIRED FOR HARD WIRED FLUSH VALVES.
17	PROVIDE 120V POWER AND CONNECTION TO FIRE SMOKE DAMPERS (FSDs). PROVIDE CONNECTION TO THE IT ROOM'S SMOKE DETECTOR TO SIGNAL THE DAMPERS TO CLOSE IN ACCORDANCE WITH NEC 645.4(2)b.3. COORDINATE FINAL LOCATION AND CONNECTIONS WITH THE MECHANICAL AND FIRE ALARM CONTRACTORS.

1 ELECTRICAL POWER PLAN
3/16" = 1'-0"

AGENCY APPROVAL

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7	ADDENDUM 01	05/31/2023

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JOB NO. DGS 140724

SHEET TITLE

ELECTRICAL POWER PLAN

SHEET NO.

E1.02

2 ELECTRICAL LIGHTING PLAN

3/16" = 1'-0"

N

GENERAL NOTES

1. COORDINATE LOCATIONS OF ALL LIGHT FIXTURES AND DEVICES WITH ARCHITECTURAL PLANS AND ELEVATIONS PRIOR TO INSTALLATION.
2. PROVIDE FAIL-SAFE TYPE OCCUPANCY SENSORS WHERE LIGHTING WILL STAY "ON" IN THE EVENT OF SENSOR FAILURE.
3. ALL RECESSED LIGHT FIXTURES SHALL BE SUPPORTED INDEPENDENTLY OF THE SUSPENDED CEILING GRID. REFER TO LIGHTING FIXTURE FOR MOUNTING DETAILS.
4. THE LIGHTING CONTROL SYSTEM SHALL BE NETWORK BASED (nLIGHT ACUITY CONTROL OR APPROVED EQUAL). REFER TO DETAILS ON SHEET E8.02.
5. ACCEPTANCE TESTER SHALL BE PRESENT DURING COMMISSIONING. ALL LIGHTING FIXTURES AND DEVICES SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
6. LIGHT FIXTURES CONTROLLED BY OCCUPANCY SENSOR SHALL BE TURNED OFF WITHIN A MAXIMUM OF 20 MINUTES OF NOT DETECTING AN OCCUPANT.
7. ALL EMERGENCY LIGHTING SHALL BE PROVIDED WITH A UL924 RELAY TO OVERRIDE CONTROLS AND ALLOW FIXTURE TO GO FULL BRIGHT UPON NORMAL POWER LOSS.
8. PROVIDE UN-SWITCHED CONSTANT HOT FROM NORMAL POWER SOURCE TO ALL EXIT SIGNS AND ALL UL924 RELAYS TO SENSE NORMAL POWER LOSS.
9. IN THE EVENT OF POWER SUPPLY FAILURE AN EMERGENCY ELECTRICAL SYSTEM SHALL ILLUMINATE THE MEANS OF EGRESS SYSTEM FOR A DURATION OF NOT LESS 90 MINUTES IN ACCORDANCE WITH THE PROVISIONS SET FORTH IN CALIFORNIA BUILDING CODE 1008.3 & 1008.3.4.
10. APPROVED EXIT SIGNS SHALL BE LOCATED AS NECESSARY TO CLEARLY INDICATE THE DIRECTION OF EGRESS TRAVEL AS REQUIRED BY CALIFORNIA BUILDING CODE 1013.1; AND SHALL BE INTERNALLY OR EXTERNALLY ILLUMINATED AS REQUIRED BY SECTION 1013.3 IN ACCORDANCE WITH THE PROVISIONS SET FORTH IN SECTIONS 1013.5 AND NOTE: ADDITIONAL EXIT SIGNS MAY BE REQUIRED AT TIME OF FIELD INSPECTION.
11. ALL WALL MOUNTED OCCUPANCY SENSORS SHALL BE EQUIPPED WITH MANUAL ON/OFF SWITCH.
12. COORDINATE ALL LIGHTING CONTROL DEVICE LOCATIONS AND QUANTITIES WITH THE MANUFACTURER AND PROVIDE ALL COMPONENTS REQUIRED FOR A FULLY FUNCTIONAL LIGHTING CONTROL SYSTEM.
13. LIGHT FIXTURES ON THIS FLOOR SHALL BE CIRCUITED TO PANEL '2L1' UNLESS OTHERWISE NOTED. THE CIRCUIT NUMBER AND CONTROL ZONES ARE INDICATED ON THE PLAN.
14. EMERGENCY LIGHT FIXTURES (NOTED WITH 'EM') AND EXIT SIGN FIXTURES ON THIS FLOOR SHALL BE CIRCUITED TO INVERTER 'INV' UNLESS OTHERWISE NOTED.
15. ALL OUTDOOR LIGHTING SHALL BE CONTROLLED WITH A PHOTOCELL IN ADDITION TO AN AUTOMATIC TIME-SWITCH CONTROL, OR AN ASTRONOMICAL TIME-SWITCH CONTROL.OUTDOOR LIGHTING SHALL BE CONTROLLED BY EXTERIOR PHOTOCELL THAT AUTOMATICALLY TURNS OFF WHEN SUFFICIENT DAYLIGHT IS AVAILABLE.
16. LIGHT FIXTURES IN PUBLIC AREA, WORK AREA AND AIR LOCK ROOM SHALL BE CONTROLLED BY BUILDING AUTOMATIC SYSTEM TIME OF DAY SCHEDULE.
17. SEE LIGHT FIXTURE SCHEDULE ON SHEET E6.01 FOR FIXTURE TYPE DESCRIPTIONS AND INFORMATION.

KEYNOTES

KEY	DESCRIPTION
1	LIGHTING ABOVE TRANSLUCENT SOFFIT, REFER TO ARCHITECTURAL PLANS.
2	TO CONTROL LIGHTING FIXTURES ON ROOF.
3	PROVIDE LIGHT SWITCH WITH LOCKABLE COVER.

AGENCY APPROVAL

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DATE 05/31/2023

JOB NO. DGS 140724

SHEET TITLE

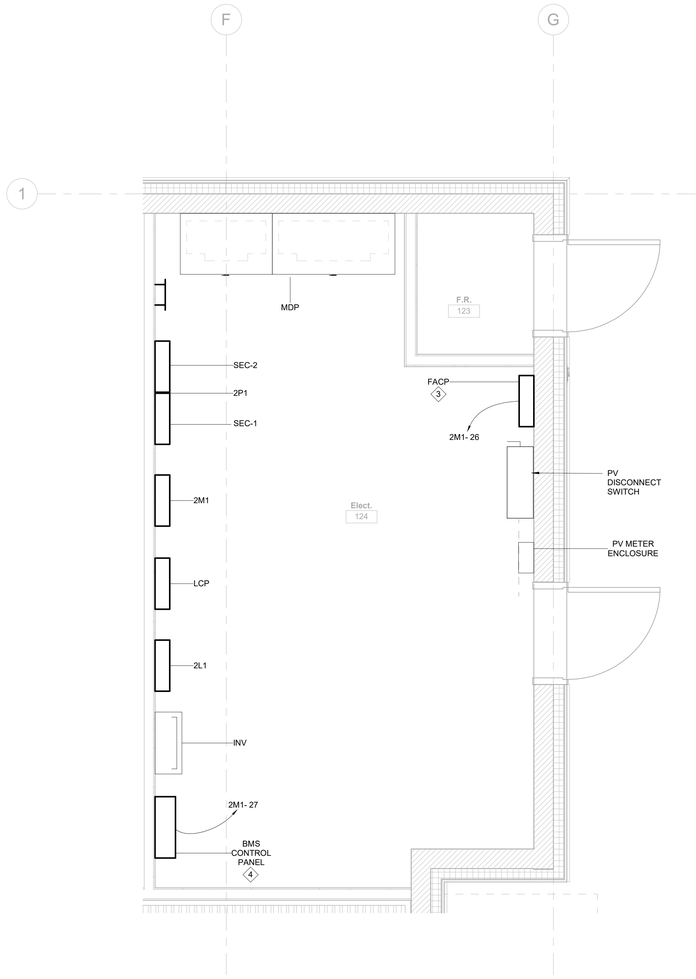
ELECTRICAL LIGHTING PLAN

SHEET NO.

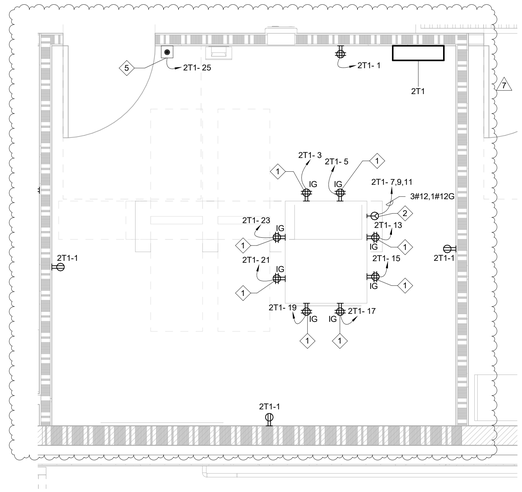
E2.01

GENERAL NOTES

1. ALL GENERAL RECEPTACLE AND LIGHTING CIRCUITS SHALL BE FED BY 20A BREAKERS MINIMUM.
2. RECEPTACLES ON OPPOSITE SIDES OF COMMON WALLS SHALL BE HORIZONTALLY OFFSET.
3. ALL CIRCUITS SHALL HAVE DEDICATED GROUND WIRES.
4. EACH CIRCUIT SHALL BE PROVIDED WITH ITS OWN DEDICATED NEUTRAL.
5. ALL EXTERIOR RECEPTACLES SHALL BE GFCI, WEATHER RESISTANT TYPE AND HAVE IN - USE WEATHER PROOF COVERS.
6. ALL EXTERIOR EQUIPMENT SHALL BE NEMA 3R WET LISTED SUITIBLE FOR INSTALLATION LOCATION, UNLESS OTHERWISE NOTED.
7. PERMANENT AND DURABLE MARKING FOR CONTROLLED RECEPTACLES OR CIRCUITS TO DIFFERENTIATE THEM FROM UNCONTROLLED RECEPTACLES OR CIRCUITS SHALL BE PROVIDED TO MEET SECTION 130.5(D)(3) OF THE CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS.
8. CABLE RUNWAY: PROVIDE ALL PARTS AND PIECES TO CREATE A CONTINUOUS PATHWAY FOR CABLES WITHIN COMM ROOM. PROVIDE PARTS TO SUPPORT CABLE CONTINUOUSLY FROM THE CONDUITS, CONDUIT CORES, AND CONDUIT SLEEVES ENTERING THE COMM ROOMS TO THE EQUIPMENT RACKS AND BACKBOARDS.
9. INSTALL WITH A MINIMUM OF 36" CLEAR ACCESS IN FRONT OF RACK UNLESS OTHERWISE DIRECTED BY DRAWINGS.
10. MINIMUM CLEARANCE BETWEEN END OF ROW AND WALL SHOULD BE 36".
11. ALL BOXES AND CONDUIT INSTALLED IN FIRE-RATED WALLS SHALL BE FIRE SEALED AS REQUIRED TO MAINTAIN THE PARTITION'S FIRE RATING. /7



1 ENLARGED ELECTRICAL PLAN
1/2" = 1'-0" /7



2 ENLARGED PLAN COMM 111
1/2" = 1'-0" /7

KEYNOTES

KEY	DESCRIPTION
1	PROVIDE NEMA 5-20R QUAD PLEX RECEPTACLE MOUNTED ON EACH SIDE PANEL OF THE 4-POST DATA RACK, WITH ISOLATED GROUND.
2	PROVIDE NEMA L6-30R ON THE RIGHT SIDE OF THE 4-POST DATA RACK.
3	PROVIDE POWER AS REQUIRED FOR FIRE ALARM CONTROL PANEL.
4	PROVIDE POWER AS REQUIRED FOR BMS CONTROL PANEL.
5	PROVIDE EPO SWITCH WITH TRANSPARENT COVER AND RATED FOR 120V SINGLE PHASE THAT IS TIED TO PANEL "2T1" MAIN BREAKER SHUNT DEVICE. UPON ACTIVATION OF THE SWITCH, THE SHUNT DEVICE SHALL ACTIVATE AND OPEN THE MAIN BREAKER OF PANEL 2T1, TURNING POWER OFF TO THE ROOM IN ACCORDANCE WITH NEC 645.4(1) AND 645.10. /7

AGENCY APPROVAL

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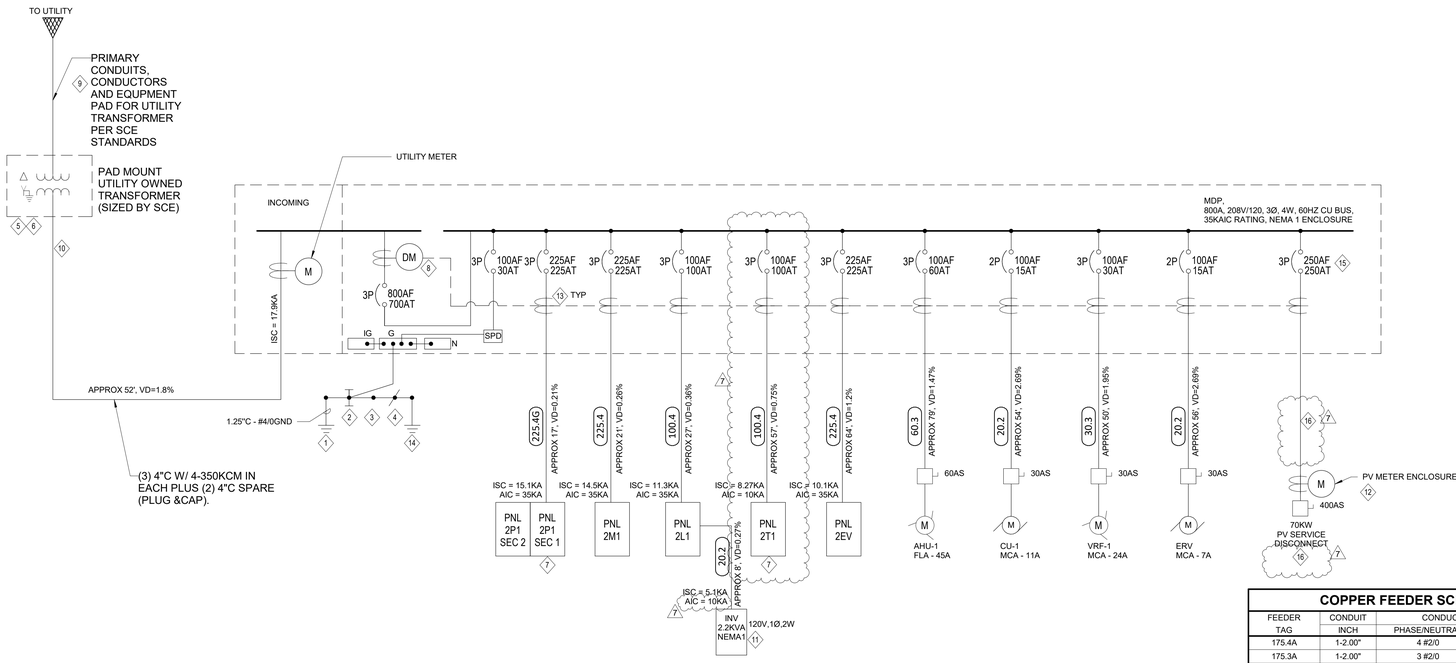
SHEET TITLE

ENLARGED PLANS

SHEET NO.

E4.01

ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT



GENERAL NOTES

1. NO PIPING, DUCTS OR EQUIPMENT FOREIGN TO THE ELECTRICAL EQUIPMENT SHALL BE PERMITTED TO BE LOCATED WITHIN THE DEDICATED SPACE ABOVE THE ELECTRICAL EQUIPMENT PER NEC 110.26(E).
2. SUFFICIENT ACCESS AND WORKING SPACE SHALL BE PROVIDED AND MAINTAINED AROUND ALL ELECTRICAL EQUIPMENT TO PERMIT READY AND SAFE OPERATION AND MAINTENANCE OF SUCH EQUIPMENT PER NEC 110.26.
3. ALL ELECTRICAL EQUIPMENT SHALL BE LISTED AND IDENTIFIED FOR USE WITH 75°C RATED CONDUCTORS.
4. ALL DISTRIBUTION BOARDS SHALL BE FREE STANDING WITH COPPER BUS BARS, FULL NEUTRAL BUS AND SEPARATE GROUND BUS COMPLYING WITH NEMA STANDARDS.
5. ELECTRICAL DISTRIBUTION EQUIPMENT SHALL BE MARKED TO WARN QUALIFIED PERSONS OF POTENTIAL ELECTRIC ARC FLASH HAZARDS. NEC 110.16.
6. ALL ELECTRICAL DISTRIBUTION AND OVER CURRENT PROTECTIVE DEVICES SHALL BE FULLY RATED FOR AVAILABLE FAULT CURRENT, SERIES RATING NOT PERMITTED.
7. CONTRACTOR SHALL PERFORM AN ARC FLASH ANALYSIS IN ACCORDANCE WITH NFPA 70E AND PROVIDE WARNING SIGNS. ARC FLASH ANALYSIS MUST BE SUBMITTED TO THE CONTRACTING OFFICER FOR REVIEW AND APPROVAL PRIOR TO MANUFACTURE AND/OR INSTALL OF SIGNS.
8. OVER CURRENT AND FAULT PROTECTION DEVICES SHALL BE COORDINATED WITH LINE-SIDE AND LOAD-SIDE FUSES OR CIRCUIT BREAKERS TO ISOLATE ANY ELECTRICAL FAULT OR OVERLOAD FROM THE REST OF THE SYSTEM. PROTECTIVE DEVICE COORDINATION STUDY TO BE SUBMITTED TO THE ENGINEER OF RECORD TO APPROVE THAT THE LEVEL OF COORDINATION IS ACCEPTABLE.
9. PROVIDE SERVICE ENTRANCE EQUIPMENT TESTING PER INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA).
10. SWITCHBOARDS WILL BE DEAD-FRONT, FLOOR MOUNTED, FREESTANDING METAL-ENCLOSED WITH COPPER BUSING. MUST BE FRONT ACCESSIBLE AND MUST BE COMPLETELY ISOLATED BETWEEN SECTIONS BY VERTICAL STEEL BARRIERS. SWITCHBOARDS SHALL HAVE HINGED FRONTS.
11. THE BUILDING ELECTRICAL SERVICE SHALL BE PROVIDED WITH A SURGE PROTECTION SYSTEM THAT SHALL CONSIST OF SURGE PROTECTION PACKAGES CONNECTED TO ALL PANELBOARDS AND SWITCHBOARDS. THE DEVICES SHALL BE EXTERNAL UL 1449 4TH EDITION LISTED, TYPE 1 AND 2 SPD.
12. ALL FEEDER LENGTHS INDICATED ARE FOR DESIGN PURPOSES ONLY AND SHALL BE VERIFIED IN THE FIELD. IF FIELD LENGTHS ARE SIGNIFICANTLY GREATER THAN DESIGN LENGTHS, VOLTAGE DROP CALCULATIONS MUST BE COMPLETED FOR NEW LENGTHS TO VERIFY COMPLIANCE.
13. PROVIDE BACNET GATEWAY PROTOCOM-KT BY ELECTRO INDUSTRIES OR APPROVED EQUAL FOR COMMUNICATION BETWEEN METERS AND ALERTON BMS BACNET.

KEYNOTES

7
1. PROVIDE 1-#4/0 STRANDED BARE COPPER BONDING JUMPER IN 3/4" MINIMUM NONMETALLIC RIGID CONDUIT FROM SWITCHBOARD TO TWO 3/4" X 10' GROUND RODS. SEVEN FEET APART MINIMUM. GROUNDING AND BONDING SHALL FOLLOW NEC GUIDELINES. INSTALL GROUND RODS NORTH OF BUILDING MINIMUM 6 FEET FROM SCE TRANSFORMER GROUNDING ELECTRODS IN ACCORDANCE WITH NEC 250.53(B).
2. BOND SERVICE GROUND TO BLDG STEEL WITH 3/4"C -4/0 BARE COPPER GROUND.
3. BOND SERVICE GROUND TO COLD WATER PIPE WITH 3/4"C -4/0 BARE COPPER GROUND.
4. BOND SERVICE GROUND TO ALL METAL PIPING PER NEC.
5. PROVIDE TRANSFORMER GROUNDING PER UTILITY REQUIREMENTS.
6. REFER TO SITE PLAN FOR LAYOUT OF OUTDOOR ELECTRICAL EQUIPMENT.
7. PANEL TO COME EQUIPPED WITH ISOLATED GROUND BUS.
8. PROVIDE POWER METERING AS PART OF THE SWITCHBOARD SUBMITTAL AS SPECIFIED. THE MANUFACTURER SHALL BE SHARK *ENCSHK250-120-60-10-V4-D2-INP100S-PO1S-X* OR APPROVED EQUAL.
9. PROVIDE (1) 4"C FOR PRIMARY UTILITY CONDUCTORS. CONDUCTORS TO BE PROVIDED AND TERMINATED BY SCE.
10. PROVIDE (3) 4"C FOR SECONDARY UTILITY CONDUCTORS. CONDUCTORS TO BE PROVIDED AND TERMINATED BY SCE.
11. PROVIDE FLOOR MOUNT EMERGENCY LIGHTING INVERTER AS REQUIRED PER NEC ARTICLE 700. THE MANUFACTURER SHALL BE MYERS *3-EM-3-S-B-B-20-8* OR APPROVED EQUAL.
12. UTILITY NGOM METER. COORDIANTE METER SOCKET CONFIGURATION WITH UTILITY COMPANY PRIOR TO PURCHASING.
13. PROVIDE POWER METER TO MEET TITLE-24 LOAD DISAGGREGATION AND ADVANCED METERING REQUIREMENT. THE MANUFACTURER SHALL BE SHARK *ENCMP200-Y-6D-10-V4-WIFI-MDLN-X* OR APPROVED EQUAL. DATA CAN BE VIEWED REAL-TIME BY USING COMMEXT SOFTWARE.
14. BOND SERVICE TO CONCRETE-ENCASED ELECTRODE (UFER) WITH 3/4"C-1#4/0. SEE DETAIL 2 ON SHEET E8.01.
15. PV BREAKER SHALL BE LOCATED AT THE OPPOSITE END OF THE BUS FROM THE MAIN OVERCURRENT DEVICE.
7
16. COORDINATE PV FEEDER AND EQUIPMENT RATINGS WITH PV DESIGN DRAWINGS (DEFERRED SUBMITTAL BY CONTRACTOR).

COPPER FEEDER SCHEDULE

FEEDER TAG	CONDUIT INCH	CONDUCTORS (AWG/KCMIL) PHASE/NEUTRAL	GROUND
1200.4	4-4.00"	4 SETS OF 4 #350 KCMIL	1 #3/0 PER SET
1200.3	4-3.00"	4 SETS OF 3 #350 KCMIL	1 #3/0 PER SET
1000.4K	3-4.00"	3 SETS OF 5 #500 KCMIL	1 #2/0 PER SET
1000.4	3-4.00"	3 SETS OF 4 #500 KCMIL	1 #2/0 PER SET
1000.3	3-4.00"	3 SETS OF 3 #500 KCMIL	1 #2/0 PER SET
800.4K	3-3.00"	3 SETS OF 5 #300 KCMIL	1 #1/0 PER SET
800.4	3-3.00"	3 SETS OF 4 #300 KCMIL	1 #1/0 PER SET
800.3	3-2.50"	3 SETS OF 3 #300 KCMIL	1 #1/0 PER SET
760.4	2-4.00"	2 SETS OF 4 #500 KCMIL	1 #2/0 PER SET
760.3	2-4.00"	2 SETS OF 3 #500 KCMIL	1 #2/0 PER SET
600.4K	2-3.50"	2 SETS OF 5 #350 KCMIL	1 #1 PER SET
600.4	2-3.00"	2 SETS OF 4 #350 KCMIL	1 #1 PER SET
600.3	2-3.00"	2 SETS OF 3 #350 KCMIL	1 #1 PER SET
500.4K	2-3.00"	2 SETS OF 5 #250 KCMIL	1 #1 PER SET
500.4	2-3.00"	2 SETS OF 4 #250 KCMIL	1 #1 PER SET
500.3	2-2.50"	2 SETS OF 3 #250 KCMIL	1 #1 PER SET
450.4	2-2.50"	2 SETS OF 4 #4/0	1 #1 PER SET
450.3	2-2.50"	2 SETS OF 3 #4/0	1 #1 PER SET
400.4K	2-2.50"	2 SETS OF 5 #3/0	1 #2 PER SET
400.4	2-2.50"	2 SETS OF 4 #3/0	1 #2 PER SET
400.3	2-2.00"	2 SETS OF 3 #3/0	1 #2 PER SET
350.4	2-2.00"	2 SETS OF 4 #2/0	1 #2 PER SET
350.3	2-2.00"	2 SETS OF 3 #2/0	1 #2 PER SET
300.4A	2-2.00"	2 SETS OF 4 #1/0	1 #2 PER SET
300.3A	2-2.00"	2 SETS OF 3 #1/0	1 #2 PER SET
300.4K	1-3.5"	5 #350 KCMIL	1 #2
300.4	1-3.00"	4 #350 KCMIL	1 #4
300.3	1-3.00"	3 #350 KCMIL	1 #4
250.4A	1-3.00"	4 #250 KCMIL	1 #2
250.3A	1-2.50"	3 #250 KCMIL	1 #2
250.4	1-3.00"	4 #250 KCMIL	1 #4
250.3	1-2.50"	3 #250 KCMIL	1 #4
225.4G	1-2.50"	4 #4/0	2 #4
225.3A	1-2.00"	3 #4/0	1 #2
225.4K	1-3.00"	5 #4/0	1 #4
225.4	1-2.50"	4 #4/0	1 #4
225.3	1-2.00"	3 #4/0	1 #4
200.4A	1-2.50"	4 #3/0	1 #2
200.3A	1-2.00"	3 #3/0	1 #2
200.4	1-2.50"	4 #3/0	1 #6
200.3	1-2.00"	3 #3/0	1 #6

COPPER FEEDER SCHEDULE

FEEDER TAG	CONDUIT INCH	CONDUCTORS (AWG/KCMIL) PHASE/NEUTRAL	GROUND
175.4A	1-2.00"	4 #2/0	1 #3
175.3A	1-2.00"	3 #2/0	1 #3
175.4K	1-2.50"	5 #2/0	1 #6
175.4	1-2.00"	4 #2/0	1 #6
175.3	1-2.00"	3 #2/0	1 #6
150.4A	1-2.00"	4 #1/0	1 #3
150.3A	1-1.50"	3 #1/0	1 #3
150.4K	1-2.00"	5 #1/0	1 #6
150.4	1-2.00"	4 #1/0	1 #6
150.3	1-1.50"	3 #1/0	1 #6
125.4A	1-2.00"	4 #1	1 #2
125.3A	1-1.50"	3 #1	1 #2
125.4K	1-2.00"	4#1+1#4/0	1 #6
125.4	1-2.00"	4 #1	1 #6
125.3	1-1.50"	3 #1	1 #6
100.4A	1-2.00"	4 #1	1 #4
100.3A	1-1.50"	3 #1	1 #4
100.4K	1-2.00"	4#1+1#4/0	1 #8
100.4	1-2.00"	4 #1	1 #8
100.3	1-1.50"	3 #1	1 #8
95.4	1-1.50"	4 #2	1 #8
95.3	1-1.25"	3 #2	1 #8
80.4	1-1.50"	4 #2	1 #8
80.3	1-1.25"	3 #2	1 #8
70.4A	1-1.25"	4 #4	1 #6
70.3A	1-1.25"	3 #4	1 #6
70.4K	1-1.25"	3#4+1#1	1 #8
70.4	1-1.25"	4 #4	1 #8
70.3	1-1.25"	3 #4	1 #8
60.4K	1-1.25"	3#4+1#1	1 #8
60.4	1-1.25"	4 #4	1 #8
60.3	1-1.25"	3 #4	1 #8
60.2	1-1.00"	2 #4	1 #8
50.4A	1-1.00"	4 #6	1 #8
50.3A	1-1.00"	3 #6	1 #8
50.4K	1-1.25"	3#6+1#2	1 #10
50.4	1-1.00"	4 #6	1 #10
50.3	1-1.00"	3 #6	1 #10
50.2	1-0.75"	2 #6	1 #10
40.4A	1-1.00"	4 #8	1 #8
40.3A	1-0.75"	3 #8	1 #8
40.2A	1-0.75"	2 #8	1 #8
40.4K	1-1.00"	3#8+1#4	1 #10
40.4	1-1.00"	4 #8	1 #10
40.3	1-0.75"	3 #8	1 #10
40.2	1-0.75"	2 #8	1 #10
30.7	1-1.00"	7 #10	1 #10
30.6	1-0.75"	6 #10	1 #10
30.5	1-0.75"	5 #10	1 #10
30.4	1-0.75"	4 #10	1 #10
30.3	1-0.75"	3 #10	1 #10
30.2	1-0.75"	2 #10	1 #10
20.3A	1-0.75"	3 #12	1 #10
20.7	1-0.75"	7 #12	1 #12
20.6	1-0.75"	6 #12	1 #12
20.5	1-0.75"	5 #12	1 #12
20.4	1-0.75"	4 #12	1 #12
20.3	1-0.75"	3 #12	1 #12
20.2	1-0.75"	2 #12	1 #12

FEEDER SCHEDULE GENERAL NOTES:

1.CONDUCTORS SHOWN IN THIS SCHEDULE ARE BASED ON COPPER CONDUCTORS WITH THWN OR COMPACT XHHW-2 INSULATION.

2.FEEDERS CONSISTING OF MULTIPLE SETS OF CONDUCTORS AND CONDUITS ARE TO BE PROVIDED WITH THE INDICATED GROUND CONDUCTOR IN EACH CONDUIT.

3.THE FEEDER SCHEDULE IS FOR EMT, RSC AND SCH 40 CONDUIT. USE 1 SIZE LARGER IF SCH 80 PVC CONDUIT ARE TO BE USED.

4. CONDUIT SIZES SHOWN ARE MINIMUM. LARGER CONDUIT CAN BE USED AS CONTRACTOR OPTION OR WHEN REQUIRED BY CODE.

AGENCY APPROVAL

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER SIMON CULBERTSON E22751 ELECTRICAL STATE OF CALIFORNIA

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ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADDENDUM 01	05/31/2023

DATE 05/31/2023

JOB NO. DGS 140724

SHEET TITLE

ELECTRICAL ONE LINE

SHEET NO.

E5.01

ONE INCH = TWENTY FEET ONE-SIXTEENTH INCH = ONE FOOT ONE-EIGHTH INCH = ONE FOOT ONE-QUARTER INCH = ONE FOOT THREE-QUARTERS INCH = ONE FOOT ONE INCH = ONE FOOT ONE AND ONE-HALF INCH = ONE FOOT

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

ITEM	ITEM NO.	DESCRIPTION	VOLTAGE	PHASE	HP	FLA	MCA	MOCP	KVA	PANEL	FEEDER SIZE	DISCONNECT SIZE	DISCONNECT PROVIDED BY	NOTES
AHU-1	1	OUTDOOR AIR HANDLER	208	3	-	45	-	60	-	MDP	(1)1.25"C-3#4+1#8 GND	600V 3P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
VAV 1	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 2	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 3	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 4	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 5	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 6	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 7	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
BC-1	1	VRF BRANCH CONTROLLER	208	1	-	-	1.3	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VRF-1	1	VRF CONDENSING UNIT	208	3	-	-	24	-	-	MDP1	(1)3/4"C-3#10+1#10 GND	600V 3P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
CU-1	1	VRF CONDENSING UNIT	208	1			11	28	-	MDP1	(1)3/4"C-2#10+1#10 GND	600V 2P 30A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
HP-1	1	VRF EVAPORATOR	208	1	-	-	0.19	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-2	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-3	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-4	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-5	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-6	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	2T1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-7	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-8	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-9	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-10	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-11	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-12	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-13	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-14	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-15	1	VRF EVAPORATOR	208	1	-	-	0.29	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-16	1	VRF EVAPORATOR	208	1	-	-	0.29	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-17	1	VRF EVAPORATOR	208	1	-	-	0.19	-	-	2T1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
ERV-1	1	ERV	208	1	-	-	7	-	-	MDP1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
EF-1	1	EXHAUST FAN	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
EF-2	1	EXHAUST FAN	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
EF-3	1	EXHAUST FAN	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
EF-4	1	EXHAUST FAN	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
IWH-1	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 3P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-1	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-1	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-1	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-2	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-2	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
FSD-1	1	FIRE SMOKE DAMPER	120	1	-	-	-	-	0.05	2T1	(1)3/4"C-2#12+1#12 GND	N/A	N/A	
FSD-1	1	FIRE SMOKE DAMPER	120	1	-	-	-	-	0.05	2T1	(1)3/4"C-2#12+1#12 GND	N/A	N/A	

AGENCY APPROVAL

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

LICENSED PROFESSIONAL ENGINEER
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ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADDENDUM 01	05/31/2023

DATE 05/31/2023
JOB NO. DGS 140724
SHEET TITLE

EQUIPMENT SCHEDULE

SHEET NO.

E6.02

Switchboard: MDP

Location: Space 11 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: | **Phases:** 3 | **Mains Type:** MCB
Mounting: Floor | **Wires:** 4 | **Mains Rating:** 800 A
Enclosure: 1 | **MCB Rating:** 800 A

Notes:

CKT	Circuit Description	# of Poles	Frame Size	Trip Rating	Load	Remarks
1	PNL 2P1	3	225 A	225 A	40996 VA	
2	PNL 2M1	3	225 A	225 A	72750 VA	
3	PNL 2L1	3	100 A	100 A	7231 VA	
4	PNL 2T1	3	100 A	100 A	5488 VA	
5	PNL 2EV	3	225 A	225 A	33280 VA	
6	VRF-1	3	100 A	30 A	6912 VA	
7	CU-1	2	100 A	15 A	3168 VA	
8	ERV	2	100 A	15 A	1456 VA	
9	AHU-1	3	100 A	60 A	16200 VA	
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20	PV DISCONNECT	3	250 A	250 A	0 VA	
				Total Conn. Load:	187481 VA	
				Total Amps:	520 A	

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	99726 VA	104.06%	103776 VA		
Power	27896 VA	100.00%	27896 VA	**Total Conn. Load:**	187481 VA
Lighting	7299 VA	125.00%	9124 VA	**Total Est. Demand:**	197036 VA
Receptacle	19280 VA	75.93%	14640 VA	**Total Conn. Current:**	520 A
EV	33280 VA	125.00%	41600 VA	**Total Est. Demand Current:**	547 A

Notes:

Branch Panel: INV

Location: Space 11 | **Volts:** 120 Single | **A.I.C. Rating:** 10KA
Supply From: 2L1 | **Phases:** 1 | **Mains Type:**
Mounting: Surface | **Wires:** 2 | **Mains Rating:**
Enclosure: Type 1

Notes:

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	INTERIOR LIGHTING - NORTH	20 A	1	678	411		1	20 A	INTERIOR LIGHTING - SOUTH	2
3	EXTERIOR LIGHTING	20 A	1		268	0	1	20 A	Spare	4
5	Spare	20 A	1			0				6
7	Spare	20 A	1	0	0		1	20 A	Spare	8
		Total Load:		1089 VA	268 VA	0 VA				
		Total Amps:								

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Lighting	1357 VA	125.00%	1696 VA		
				Total Conn. Load:	1357 VA
				Total Est. Demand:	1696 VA
				Total Conn. Current:	11 A
				Total Est. Demand Current:	14 A

Notes:

Branch Panel: 2M1

Location: Space 11 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 225 A
Enclosure: 1

Notes:

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	BC-1	20 A	2	135 970			2	20 A	HP-1,2,3,4,5,7,11	2
3	--	--	--		135 970		--	--	--	4
5	HP-8,9,10,12,14,15,16	20 A	2			945 200	1	20 A	VAV-1,2,3,4	6
7	--	--	--	945 150			1	20 A	VAV-5,6,7	8
9	EF-1,3,4	20 A	1		150 3600		2	35 A	IWH-1	10
11	IWH-2	50 A	2			4500 3600	--	--	--	12
13	--	--	--	4500 3600			2	35 A	IWH-1	14
15	IWH-2	50 A	2		4500 3600		--	--	--	16
17	--	--	--			4500 3600	2	35 A	IWH-1	18
19	IWH-2	50 A	2	4500 3600			--	--	--	20
21	--	--	--		4500 3600		2	35 A	IWH-1	22
23	IWH-2	50 A	2			4500 3600	--	--	--	24
25	--	--	--	4500 500			1	20 A	FACP	26
27	ALERTEN BMS PANEL	20 A	1		200 1000		1	20 A	OUTDOOR GATE	28
29	OUTDOOR GATE	20 A	1			1000 50	1	20 A	EF-2	30
31	HARD WIRED FLUSH VALVES	20 A	1	400 200			1	20 A	HARD WIRED FLUSH VALVES	32
33										34
35	Spare	20 A	1			0 0	1	20 A	Spare	36
37	Spare	20 A	1	0 0			1	20 A	Spare	38
39	Spare	20 A	1		0 0		1	20 A	Spare	40
41	Spare	20 A	1			0 0	1	20 A	Spare	42
		Total Load:		24000 VA	22255 VA	26495 VA				
		Total Amps:		202 A	185 A	223 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	71450 VA	103.15%	73700 VA		
Power	1300 VA	100.00%	1300 VA		
				Total Conn. Load:	72750 VA
				Total Est. Demand:	75000 VA
				Total Conn. Current:	202 A
				Total Est. Demand Current:	208 A

Notes:

Branch Panel: 2P1

Location: Space 11 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 225 A
Enclosure: 1

Notes: PROVIDE PANEL WITH ISOLATED GROUND BUS.

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	RECEPTACLE - RM 116,125	20 A	1	900 1200			1	20 A	SHREDDER	2
3	RECEPTACLE - RM 120,121	20 A	1		720 1200		1	20 A	HAND DRYER - RM 121	4
5	HAND DRYER - RM 120	20 A	1			1200 480	1	20 A	DRINKING FOUNTAIN - RM 106	6
7	DRINKING FOUNTAIN - RM 125	20 A	1	480 1080			1	20 A	RECEPTACLE - RM 110,122,123,124	8
9	RECEPTACLE - RM 114,115,119	20 A	1		900 1080		1	20 A	RECEPTACLE - RM 112,113	10
11	FURNITURE FEED - RM 119	20 A	1			700 360	1	20 A	DESKTOP MONITORS - RM118	12
13	FURNITURE FEED - RM 119 (C)	20 A	1	360 696			1	20 A	REFRIGERATOR RM 118	14
15	MICROWAVE - RM 118	20 A	1		1200 1200		1	20 A	VENDING MACHINE RM 118	16
17	VENDING MACHINE RM 118	20 A	1			1200 720	1	20 A	RECEPTACLE - RM 118,107	18
19	RECEPT, FURNITURE FEED - RM 107 (C)	20 A	1	350 350			1	20 A	FURNITURE FEED - RM 114	20
21	FURNITURE FEED - RM 107	20 A	1		300 120		1	20 A	FURNITURE FEED - RM 114 (C)	22
23	FURNITURE FEED - RM 109	20 A	1			700 360	1	20 A	FURNITURE FEED - RM 109 (C)	24
25	FURNITURE FEED - RM 109 (C)	20 A	1	120 350			1	20 A	FURNITURE FEED - RM 109	26
27	FURNITURE FEED - RM 109 (C)	20 A	1		720 1200		1	20 A	FURNITURE FEED - RM 109	28
29	FURNITURE FEED - RM 109	20 A	1			1200 1200	1	20 A	FURNITURE FEED - RM 109	30
31	RECEPTACLE - RM 106,109	20 A	1	1440 700			1	20 A	FURNITURE FEED - RM 109	32
33	FURNITURE FEED - RM 109 (C)	20 A	1		360 350		1	20 A	FURNITURE FEED - RM 109	34
35	FURNITURE FEED - TEST STATIONS	20 A	1			840 120	1	20 A	FURNITURE FEED - RM 109 (C)	36
37	FURNITURE FEED - TEST STATIONS	20 A	1	840 350			1	20 A	FURNITURE FEED - RM 109	38
39	FURNITURE FEED - TEST STATIONS	20 A	1		1000 120		1	20 A	FURNITURE FEED - RM 109 (C)	40
41	FURNITURE FEED - TEST STATIONS	20 A	1			840 350	1	20 A	FURNITURE FEED - RM 109	42
43	TV - RM 106	20 A	1	720 120			1	20 A	FURNITURE FEED - RM 109 (C)	44
45	SELF SERVICE KIOSKS	20 A	1		360 720		1	20 A	RECEPTACLE - RM 101,102,103,104	46
47	DESKTOP MONITORS - RM109	20 A	1			720 540	1	20 A	RECEPTACLE - EXTERIOR (EAST+NORTH)	48
49	RECEPTACLE - EXTERIOR (WEST+SOUTH)	20 A	1	540 1200			1	20 A	HAND DRYER - RM 102	50
51	HAND DRYER - RM 103	20 A	1		1200 0		1	20 A	Spare	52
53	MAIL MACHINE	20 A	1			1400 0	1	20 A	Spare	54
55	RECEPTACLE - ROOF	20 A	1	720 0			1	20 A	Spare	56
57	Spare	20 A	1		0 0		1	20 A	Spare	58
59	Spare	20 A	1			0 0	3	30 A	Spare	60
61	Spare	20 A	1	0 0			--	--	--	62
63	Spare	20 A	1		0 0		--	--	--	64
65	Spare	20 A	1			0 1400	1	20 A	COPIER	66
67	COPIER	20 A	1	1400 0			1	20 A	Spare	68
69	Spare	20 A	1		0 0		1	20 A	Spare	70
71	Spare	20 A	1			0 0	1	20 A	Spare	72
73	Spare	20 A	1	0 0			1	20 A	Spare	74
75	Spare	20 A	1		0 0		1	20 A	Spare	76
77	Spare	20 A	1			0 0	1	20 A	Spare	78
79	Spare	20 A	1	0 0			1	20 A	Spare	80
81	Spare	20 A	1		0 0		1	20 A	Spare	82
83	Spare	20 A	1			0 0	1	20 A	Spare	84
		Total Load:		13916 VA	12750 VA	14330 VA				
		Total Amps:		117 A	106 A	121 A				

SECTION - 1

SECTION - 2

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Power	26496 VA	100.00%	26496 VA		
Receptacle	14500 VA	84.48%	12250 VA		
				Total Conn. Load:	40996 VA
				Total Est. Demand:	38746 VA
				Total Conn. Current:	114 A
				Total Est. Demand Current:	108 A

Notes:

Branch Panel: 2L1

Location: Space 11 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: 1

Notes:

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	LIGHTING - RM 113-124	20 A	1	952 933			1	20 A	LIGHTING - RM 107-110	2
3	LIGHTING - RM 106	20 A	1		979 497		1	20 A	LIGHTING - RM 101,102,103,106	4
5	EXTERIOR LTG - DRIVE...	20 A	2			136 323	2	20 A	LIGHTING - EXTERIOR POLES	6
7	--	--	--	136 323			--	--	--	8
9	LTG - EXT. POLES PARKING LOT, PV...	20 A	2		274 309		2	20 A	LIGHTING - EXTERIOR POLES	10
11	--	--	--			274 309	--	--	--	12
13	EXT. LTG - BLD SIGNAGE	20 A	2	296 0			1	20 A	LCP	14
15	--	--	--		0 1089		1	20 A	INV	16
17	LTG-ROOF	20 A	1			133				18
19										20
21										22
23	Spare	20 A	1			0 0	1	20 A	Spare	24
25	Spare	20 A	1	0 0			1	20 A	Spare	26
27	Spare	20 A	1		0 0		1	20 A	Spare	28
29	Spare	20 A	1			0 0	1	20 A	Spare	30
		Total Load:		2640 VA	3148 VA	1443 VA				
		Total Amps:		24 A	28 A	12 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Lighting	7231 VA	125.00%	9039 VA		
				Total Conn. Load:	7231 VA
				Total Est. Demand:	9039 VA
				Total Conn. Current:	20 A
				Total Est. Demand Current:	25 A

Notes:
EXTERIOR LIGHTING TO BE METERED SEPARATELY.

Branch Panel: 2T1

Location: Space 13 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 10KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MCB W/ SHUNT TRIP
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: Type 1 | **MCB Rating:** 100 A

Notes:
PROVIDE MAIN CIRCUIT BREAKER WITH 120V SHUNT TRIP ACCESSORY. SHUNT TRIP SHALL BE ACTIVATED BY THE EPO SWITCH WITHIN THE IT ROOM.
PROVIDE PANEL WITH ISOLATED GROUND BUS.

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	RECEPTACLE - COMM. RM 111	20 A	1	900 0			1	20 A	Spare	2
3	IG RACK RECEPTACLE - COMM. RM 111	20 A	1		360 0		1	20 A	Spare	4
5	IG RACK RECEPTACLE - COMM. RM 111	20 A	1			360 0	1	20 A	Spare	6
7	SPL DATA RACK RECEPTACLE - COMM...	30 A	3	333 0			1	20 A	Spare	8
9	--	--	--		333 0		1	20 A	Spare	10
11	--	--	--			333 0	1	20 A	Spare	12
13	IG RACK RECEPTACLE - COMM. RM 111	20 A	1	360 0			1	20 A	Spare	14
15	IG RACK RECEPTACLE - COMM. RM 111	20 A	1		360 0		1	20 A	Spare	16
17	IG RACK RECEPTACLE - COMM. RM 111	20 A	1			360 0	1	20 A	Spare	18
19	IG RACK RECEPTACLE - COMM. RM 111	20 A	1	360 0			1	20 A	Spare	20
21	IG RACK RECEPTACLE - COMM. RM 111	20 A	1		360 0		1	20 A	Spare	22
23	IG RACK RECEPTACLE - COMM. RM 111	20 A	1			360 0	1	20 A	Spare	24
25	EPO PUSHBUTTON - COMM. RM 111	20 A	1	0 0			1	20 A	Spare	26
27	HP-6,17	20 A	2		270 0		1	20 A	Spare	28
29	--	--	--			270 0	1	20 A	Spare	30
31	FIRE SMOKE DAMPERS - COMM. RM 111	20 A	1	100 0			1	20 A	Spare	32
33	LIGHTING - COMM. RM 111	20 A	1		68 0		1	20 A	Spare	34
35	Spare	20 A	1			0 0	1	20 A	Spare	36
37	Spare	20 A	1	0 0			1	20 A	Spare	38
39	Spare	20 A	1		0 0		1	20 A	Spare	40
41	Spare	20 A	1			0 0	1	20 A	Spare	42
		Total Load:		2053 VA	1751 VA	1683 VA				
		Total Amps:		17 A	15 A	14 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	540 VA	112.50%	608 VA		
Power	100 VA	100.00%	100 VA	**Total Conn. Load:**	5488 VA
Lighting	68 VA	125.00%	85 VA	**Total Est. Demand:**	5573 VA
Receptacle	4780 VA	100.00%	4780 VA	**Total Conn. Current:**	15 A
				Total Est. Demand Current:	15 A

Notes:

Branch Panel: 2EV

Location: | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MCB
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 225 A
Enclosure: 1

Notes:

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	FUTURE EV CHARGING STATION	40 A	2	3328 3328			2	40 A	FUTURE EV CHARGING STATION	2
3	--	--	--		3328 3328		--	--	--	4
5	FUTURE EV CHARGING STATION	40 A	2			3328 3328	2	40 A	FUTURE EV CHARGING STATION	6
7	--	--	--	3328 3328			--	--	--	8
9	FUTURE EV CHARGING STATION	40 A	2		3328					10
11	--	--	--			3328				12
13										14
15										16
17										18
19										20
21										22
23										24
25										26
27										28
29										30
		Total Load:		13312 VA	9984 VA	9984 VA				
		Total Amps:		111 A	83 A	83 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
EV	33280 VA	125.00%	41600 VA		
				Total Conn. Load:	33280 VA
				Total Est. Demand:	41600 VA
				Total Conn. Current:	92 A
				Total Est. Demand Current:	115 A

Notes: 1. Provide branch breakers for EV chargers capable of being locked in the open position.

AGENCY APPROVAL

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

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ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADDENDUM 01	05/31/2023

DATE 05/31/2023

JOB NO. DGS 140724

SHEET TITLE

PANEL SCHEDULES

SHEET NO.

E6.03

ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT

1 LOW VOLTAGE FLOOR PLAN
3/16" = 1'-0"

N

GENERAL NOTES

1. ALL TELECOM CONDUIT STUBS WILL BE MINIMUM 1" EMT. ALL WALL OUTLET BOXES FOR TELECOM TERMINATIONS WILL BE SINGLE GANG DEEP BOXES.
2. ALL HORIZONTAL CABLING WILL BE CATEGORY 6 RATED FOR INSTALLATIONENVIRONMENT.
3. CONTRACTOR TO FIELD VERIFY INSTALLATION CONDITIONS PRIOR TO INSTALLATION. CONTRACTOR SHALL MAKE EVERY EFFORT TO PERFORM INSTALLATION FOLLOWING LATEST GUIDELINES OF TIA-568, -569, AND -607.
4. RJ-45 JACKS WILL BE BLUE FOR DATA, WHITE FOR VOICE, GRAY FOR SECURITY.
5. FACEPLATE COLORS TO BE COORDINATED WITH ARCHITECT BEFORE PURCHASING.
6. ALL CATEGORY 6 CABLES WILL BE TERMINATED ON PATCH PANELS AND TERMINATED IN T568A PIN-OUT CONFIGURATION.

TELECOM KEYNOTES

1. MODULAR SYSTEM FURNITURE OUTLETS TO BE SERVED VIA FLOOR OR WALL DEPENDING ON LOCATION TO FURNITURE OUTLET.
2. SLEEVES INSTALLED IN FIRE-RATED WALLS SHALL BE FIRE SEALED AS REQUIRED TO MAINTAIN PARTITION'S FIRE RATING.

TELECOM LEGEND:

- WALL PHONE - (1) CAT 6 VOICE MOUNTED AT 48" A.F.F.
- 1 OUTLET TYPE 1 - (3) CAT 6 DATA, (1) CAT 6 VOICE
- 2 OUTLET TYPE 2 - (2) CAT 6 DATA
- 3 OUTLET TYPE 3 - (1) CAT 6 DATA
- 4 OUTLET TYPE 4 - (1) CAT 6 DATA, (1) CAT 6 VOICE
- 5 OUTLET TYPE 5 - (4) CAT 6 DATA
- QUEUE MONITOR - (1) CAT 6 DATA
- J WAP — WIRELESS ACCESS POINT - (1) CAT 6 DATA
- BASKET CABLE TRAY
- S — INDOOR SPEAKER
- S — OUTDOOR SPEAKER
- FIXED CCTV IP CAMERA
- DOOR CONTACT SWITCH
- M — INFRARED DETECTOR
- P — WIRELESS PANIC BUTTON
- KP — KEYPAD
- P — INSTALL SINGLE GANG OUTLET BOX WITH 3/4" CONDUIT AND PULL STRING INTO DROP CEILING FOR INTERCOM DEVICE. MOUNT AT 48" AFF.
- I — INSTALL SINGLE GANG OUTLET BOX WITH 3/4" CONDUIT STUBBED INTO DROP CEILING FOR INTERCOM DEVICE. MOUNT AT 48" AFF.

AGENCY APPROVAL

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER Bicsi RCDD SANDRA ERBUR REGISTRATION NO: 753311 EXPIRES 12-31-2023

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REVISIONS

NO.	DESCRIPTION	DATE
7	ADDENDUM 01	05/31/2023

DATE 05/31/2023

JOB NO. DGS 140724

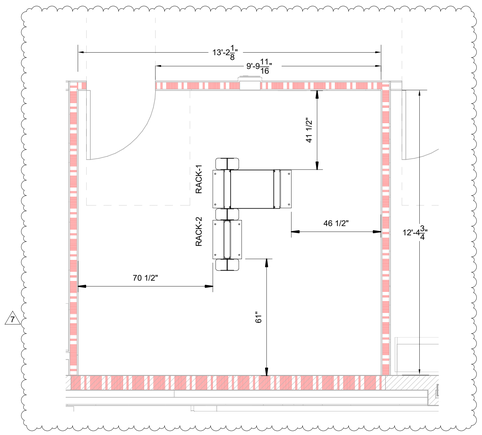
SHEET TITLE

LOW VOLTAGE FLOOR PLAN

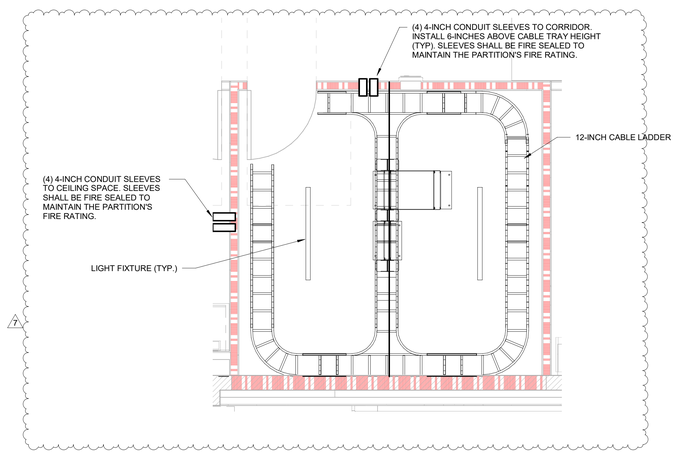
SHEET NO.

LV1.02

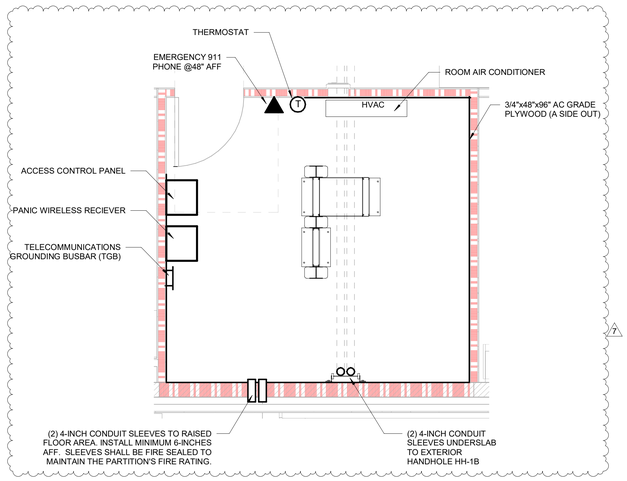
ONE INCH = TWENTY FEET
ONE - SIXTEENTH INCH = ONE FOOT
ONE - EIGHTH INCH = ONE FOOT
ONE - QUARTER INCH = ONE FOOT
THREE - QUARTERS INCH = ONE FOOT
ONE AND ONE - HALF INCH = ONE FOOT



1 COMM ROOM 111 ROOM DIMENSIONS
3/8" = 1'-0"



2 COMM ROOM 111 REFLECTED CEILING PLAN
3/8" = 1'-0"



3 COMM ROOM 111 ROOM LAYOUT
3/8" = 1'-0"

GENERAL NOTES

1. ALL BOXES AND CONDUIT INSTALLED IN FIRE-RATED WALLS SHALL BE FIRE SEALED AS REQUIRED TO MAINTAIN THE PARTITION'S FIRE RATING.

SIDE VIEW

RACK-1

4 EQUIPMENT RACK - 1
3/8" = 1'-0"

RACK-2

5 EQUIPMENT RACK - 2
3/8" = 1'-0"

ONE INCH = TWENTY FEET
ONE - SIXTEENTH INCH = ONE FOOT
ONE - EIGHTH INCH = ONE FOOT
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ONE INCH = ONE FOOT
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AGENCY APPROVAL

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

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7	ADDENDUM 01	05/31/2023

DATE 05/31/2023

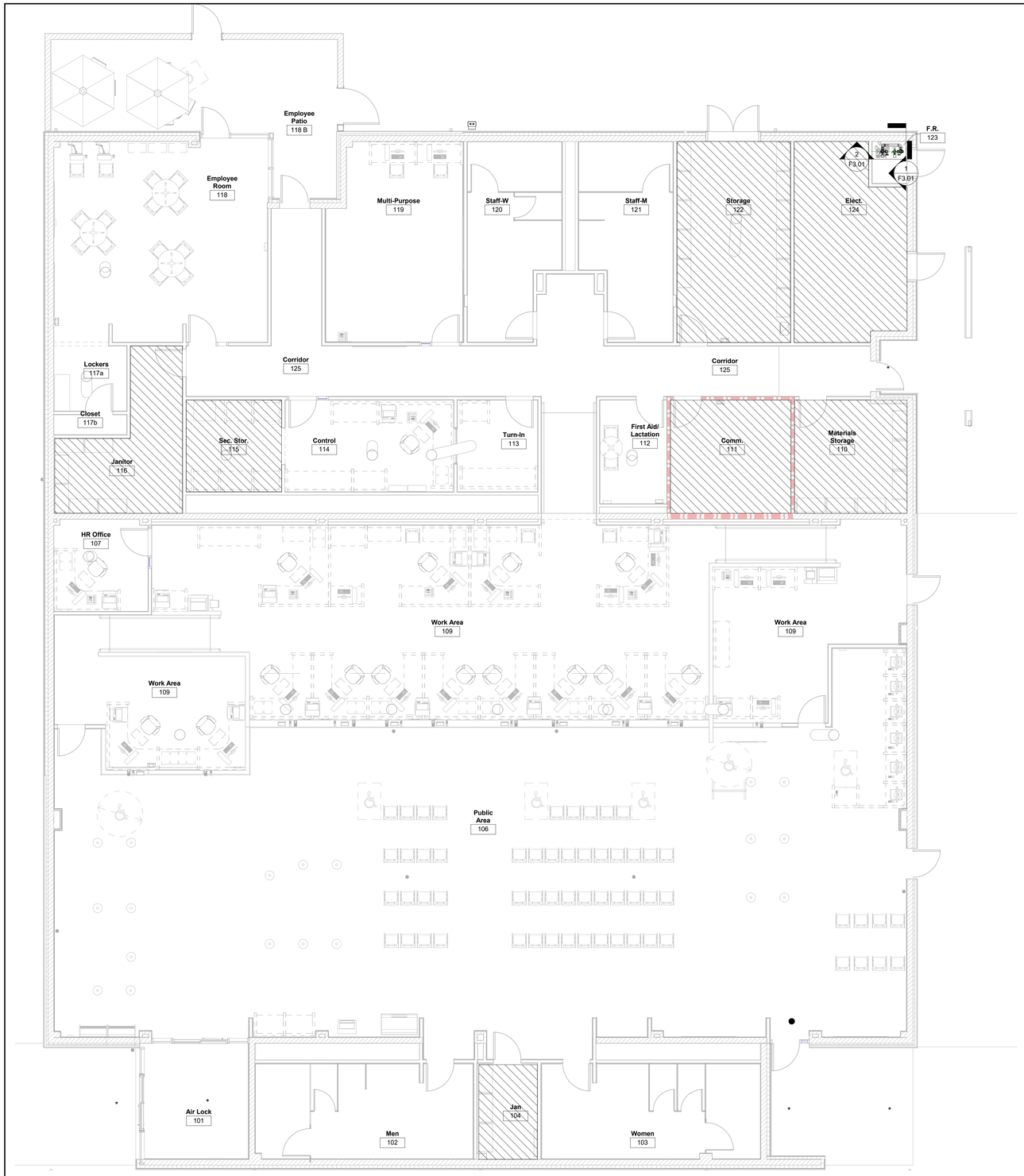
JOB NO. DGS 140724

SHEET TITLE

TELECOM ENLARGED PLANS

SHEET NO.

LV4.01



1 FIRE PROTECTION FLOOR PLAN
3/16" = 1'-0"

LEGEND

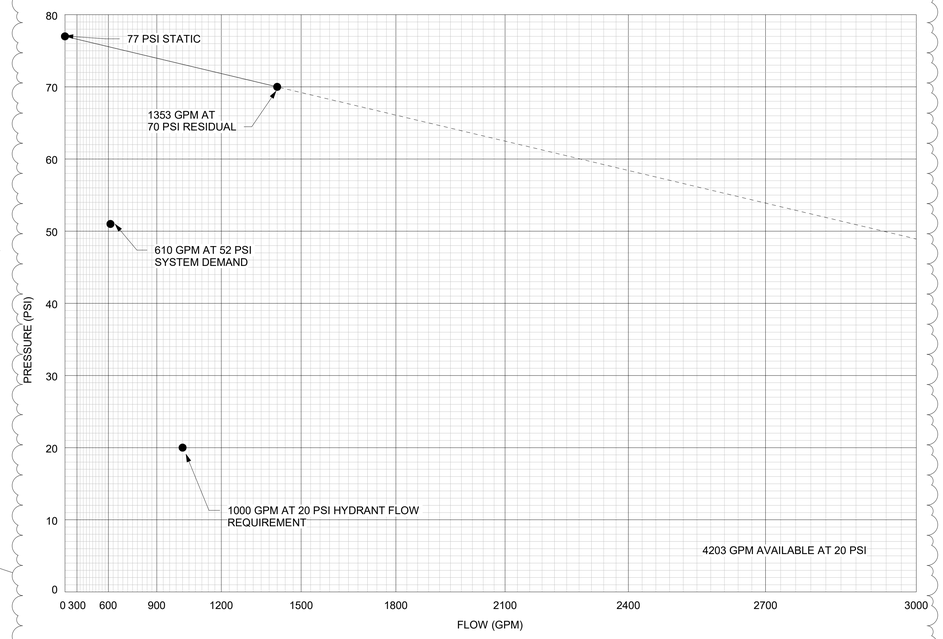
LIGHT HAZARD: DESIGN CRITERIA: 0.10 GPM/FT² OVER 1500 FT²
HOSE STREAM 100 GPM.

ORDINARY HAZARD GROUP 1: DESIGN CRITERIA: 0.15 GPM/FT² OVER
1500 FT², HOSE STREAM 250 GPM.

GENERAL NOTES

1. ALL FIRE PROTECTION SYSTEMS SHALL BE INSTALLED AS REQUIRED BY THESE DRAWINGS AND SPECIFICATIONS. THE DESIGN INTENT IS TO COMPLY WITH THE 2019 CALIFORNIA BUILDING CODE AND THE 2019 CALIFORNIA FIRE CODE.
2. INSTALL WET PIPE SPRINKLER SYSTEM THROUGHOUT THE BUILDING.
3. ALL SPRINKLER SYSTEM PIPING SHALL BE SCHEDULE 40 STEEL PIPING FOR SIZES 2 INCHES AND LESS IN DIAMETER. PROVIDE NO LESS THAN SCHEDULE 10 STEEL PIPING FOR SIZES GREATER THAN 2 INCHES.
4. ALL DEVICES TO BE UL LISTED OR FM APPROVED.
5. PROVIDE ALL HANGERS INCLUDING TRAPEZE HANGERS AS REQUIRED TO COMPLY WITH NFPA 13. HANGERS SHALL BE DESIGNED FOR SEISMIC CONSIDERATIONS.
6. PROVIDE SPARE SPRINKLERS AND SPRINKLER WRENCH IN METAL CABINET PER NFPA 13.
7. PROVIDE A LIST OF THE INSTALLED SPRINKLERS CONTAINING THE FOLLOWING INFORMATION:
   A. SPRINKLER IDENTIFICATION NUMBER (SIN) OR THE MANUFACTURER, MODEL, ORIFICE, DEFLECTOR TYPE, THERMAL SENSITIVITY, AND PRESSURE RATING.
   B. GENERAL DESCRIPTION
   C. QUANTITY OF EACH TYPE TO BE KEPT IN THE CABINET
   D. ISSUE OR REVISION DATE OF THE LIST
1. COORDINATE EXACT LOCATIONS OF SPRINKLERS AND PIPING WITH CEILING, ELECTRICAL, MECHANICAL AND STRUCTURAL ELEMENTS OF BUILDING. PROVIDE SHOP DRAWINGS AS REQUIRED BY NFPA 13 DEPICTING FULFILLMENT OF THESE COORDINATION REQUIREMENTS.
2. PROVIDE ALL DRAINS AND INSPECTION TEST CONNECTIONS REQUIRED TO COMPLY WITH NFPA 13.
3. FLUSH AND TEST SYSTEM IN ACCORDANCE WITH NFPA 13, 24, AND THE CONTRACT SPECIFICATIONS.
4. ALL VALVES WHICH CONTROL FLOW OF WATER SHALL BE EQUIPPED WITH A TAMPER SWITCH CONNECTED TO THE FIRE ALARM SYSTEM.
5. SEAL ALL OPENINGS THROUGH FLOORS, CEILINGS AND PARTITIONS TO RE-ESTABLISH THE FIRE RATING OF THAT FLOOR, CEILING OR PARTITION. SEE ARCHITECTURAL DRAWINGS FOR RATINGS.
6. PROVIDE END CAPS TAPPED WITH A VALVED GAUGE PORT FOR TESTING PRESSURE AND A LOW POINT DRAIN ON ALL PIPES IN TRENCH TO ALLOW DRAINING.
7. PROVIDE ALL EQUIPMENT I.E. CONTROL VALVES, CHECK VALVES WITH A MINIMUM CLEARANCE OF 3 FEET.
8. SPRINKLER PIPE AND FITTINGS MUST BE METAL.
9. PLAIN END FITTINGS WITH MECHANICAL COUPLINGS AND FITTINGS THAT USE STEEL GRIPPING DEVICES TO BITE INTO THE PIPE ARE PROHIBITED. STEEL PIPING WITH WALL THICKNESS LESS THAN SCHEDULE 40 MUST NOT BE THREADED OR CUT GROOVED.
10. SIDE OUTLET TEES USING RUBBER GASKET FITTINGS ARE NOT PERMITTED.
11. THE SAME MANUFACTURER MUST SUPPLY FITTINGS, MECHANICAL COUPLINGS, AND RUBBER GASKETS.
12. ALL SPRINKLER PIPING MUST BE CONCEALED EXCEPT IN SPACES WITHOUT CEILINGS.
13. PROVIDE FITTINGS FOR CHANGES IN DIRECTION OF PIPING AND FOR CONNECTIONS. MAKE CHANGES IN PIPE SIZES THROUGH TAPERED REDUCING PIPE FITTINGS.
14. TERMINATE ALL DRAINAGE AND INSPECTOR TEST CONNECTION PIPING TO THE EXTERIOR OF THE BUILDING SO IT WILL NOT CAUSE DAMAGE. DISCHARGE TO THE EXTERIOR MUST NOT INTERFERE WITH EXITING FROM THE BUILDING. WATER DISCHARGE MUST NOT CROSS AN EXIT OR EXIT DISCHARGE.
15. ANY DRAINS, TEST CONNECTION PIPE, ETC. THAT PENETRATE THE EXTERIOR WALL MUST DO SO NO GREATER THAN 2 FEET ABOVE FINISHED GRADE.
16. THE DRAIN/TEST CONNECTION MUST BE PIPED TO A LOCATION THAT WILL ACCEPT FULL FLOW AND WILL NOT CAUSE PROPERTY DAMAGE WHEN WATER IS DISCHARGING. DISCHARGE TO ANY SINK IS NOT ACCEPTABLE.
17. TO FACILITATE TESTING, PROVIDE A PERMANENTLY PIPED DRAIN/TEST CONNECTION FOR EACH FLOW SWITCH.
18. PROVIDE SPRINKLER HEAD GUARDS FOR SPRINKLERS THAT ARE LESS THAN 7 FEET ABOVE FINISHED FLOOR.
19. HYDRANT FLOW TEST WAS PERFORMED ON 09 FEBRUARY 2023 BY THE CONTROL FIRE PROTECTION. THE TEST WAS TAKEN NEAR THE INTERSECTION OF MORSE STREET AND DOVER PARKWAY. THE RESULTS OF THE TEST WERE 77 PSI STATIC, 70 PSI RESIDUAL WITH 1353 GPM FLOWING.

2 FIRE PROTECTION NOTES
NONE



3 HYDRAULIC GRAPH
NONE

AGENCY APPROVAL

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DOVER PARKWAY, DELANO

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REVISIONS

NO.	DESCRIPTION	DATE
8	ADDENDUM 01	05/31/23

DATE 05/31/2023

JOB NO. DGS 140724

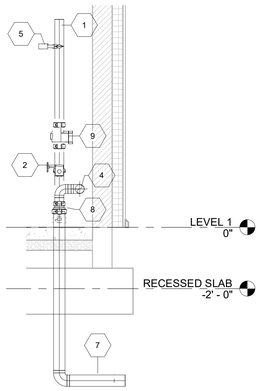
SHEET TITLE

FIRE PROTECTION FLOOR PLAN

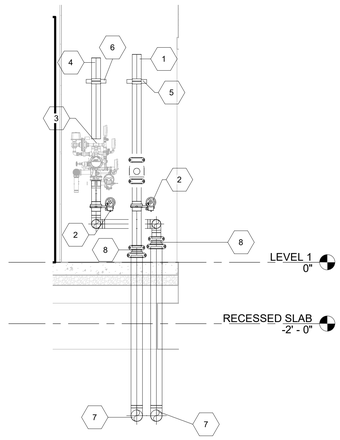
SHEET NO.

F1.01

ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT



1 RISER ELEVATION
1/2" = 1'-0"



2 RISER ELEVATION 2
1/2" = 1'-0"

KEYNOTES

1 TO WET PIPE SPRINKLERS.
2 BUTTERFLY VALVE WITH TAMPER SWITCH.
3 DRY PIPE VALVE.
4 TO DRY PIPE SPRINKLERS UNDER CANOPY.
5 FLOW SWITCH.
6 PRESSURE SWITCH.
7 FROM SUPPLY. SEE CIVIL DRAWINGS FOR DEPTH OF PIPE.
8 CONCENTRIC REDUCER.
9 CHECK VALVE.

AGENCY APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV
DOVER PARKWAY, DELANO

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

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ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
8	ADDENDUM 01	05/31/23

DATE 05/31/2023
JOB NO. DGS 140724
SHEET TITLE

RISER SECTIONS

SHEET NO.

F3.01

ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT

0089

GENERAL NOTES
APPLICABLE TO ALL DRAWINGS UNLESS NOTED OR SHOWN OTHERWISE

GENERAL NOTES
100SN001-1

1. INTERPRETATION OF DRAWINGS & SPECIFICATIONS
   a. WHERE SPECIFICATIONS HAVE BEEN PREPARED FOR THIS PROJECT, THEY ARE ARRANGED IN SEVERAL SECTIONS, BUT SUCH SEPARATION SHALL NOT BE CONSIDERED AS THE LIMITS OF THE WORK REQUIRED OF ANY SEPARATE TRADE. THE TERMS AND CONDITIONS OF SUCH LIMITATIONS ARE WHOLLY BETWEEN THE CONTRACTOR AND HIS SUBCONTRACTORS.
   b. IN GENERAL, THE WORKING DETAILS WILL INDICATE DIMENSIONS, POSITION AND KIND OF CONSTRUCTION, AND THE SPECIFICATIONS, QUALITIES AND METHODS. ANY WORK INDICATED ON THE WORKING DETAILS AND NOT MENTIONED IN THE SPECIFICATIONS, OR VICE VERSA, SHALL BE FURNISHED AS THOUGH FULLY SET FORTH IN BOTH. WORK NOT PARTICULARLY DETAILED, MARKED OR SPECIFIED, SHALL BE IDENTICAL OR SIMILAR TO LIKE CASES OF CONSTRUCTION THAT ARE DETAILED, MARKED OR SPECIFIED. IF CONFLICTS OCCUR ON DRAWINGS AND/OR SPECIFICATIONS, THE MOST EXPENSIVE MATERIALS OR METHODS WILL PREVAIL.
   c. SHOULD AN ERROR APPEAR IN THE WORKING DETAILS OR SPECIFICATIONS OR IN WORK DONE BY OTHERS AFFECTING THIS WORK, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT AT ONCE AND IN WRITING. IF THE CONTRACTOR PROCEEDS WITH THE WORK SO AFFECTED WITHOUT HAVING GIVEN SUCH WRITTEN NOTICE AND WITHOUT RECEIVING THE NECESSARY APPROVAL, DECISION OR INSTRUCTIONS IN WRITING FROM THE OWNER, THEN HE SHALL HAVE NO VALID CLAIM AGAINST THE OWNER, FOR THE COST OF SO PROCEEDING AND SHALL MAKE GOOD ANY RESULTING DAMAGE OR DEFECT. NO VERBAL APPROVAL, DECISION, OR INSTRUCTION SHALL BE VALID OR BE THE BASIS FOR ANY CLAIM AGAINST THE OWNER, ITS OFFICERS, EMPLOYEES OR AGENTS. THE FOREGOING INCLUDES TYPICAL ERRORS IN THE SPECIFICATIONS OR NOTATIONAL ERRORS IN THE WORKING DETAILS WHERE THE INTERPRETATION IS DOUBTFUL OR WHERE THE ERROR IS SUFFICIENTLY APPARENT AS TO PLACE A REASONABLY PRUDENT CONTRACTOR ON NOTICE THAT, SHOULD HE ELECT TO PROCEED, HE IS DOING SO AT HIS OWN RISK.
2. CONSTRUCTION SHALL CONFORM TO ALL APPLICABLE CODES AND REGULATIONS.
3. SHOP DRAWING NOTE:
   a. WHEN NOT ADDRESSED BY DIVISION 1 OF THE SPECIFICATIONS, PAPER FORMAT STRUCTURAL SHOP DRAWINGS SHALL BE SUBMITTED IN THE FORM OF THREE COPIES MINIMUM OF EACH SHEET. WHERE SUBMITTALS ARE ELECTRONIC, FORMAT SHALL BE PDF.
   b. THE PURPOSE OF SHOP DRAWING SUBMITTALS BY THE CONTRACTOR IS TO DEMONSTRATE TO THE STRUCTURAL ENGINEER THAT HE UNDERSTANDS THE DESIGN CONCEPT BY INDICATING WHICH MATERIAL HE INTENDS TO FURNISH AND INSTALL, AND BY DETAILING THE FABRICATION AND INSTALLATION METHODS HE INTENDS TO USE ON A STAND ALONE SET OF DOCUMENTS. DUPLICATION OF DESIGN DOCUMENTS FOR THE PURPOSE OF SHOP DRAWINGS IS NOT ACCEPTABLE.
   c. PRIOR TO FABRICATION, SHOP DRAWINGS SHALL BE SUBMITTED FOR REVIEW BY THE STRUCTURAL ENGINEER. SHOP DRAWING SUBMITTALS SHALL INCLUDE, BUT ARE NOT NECESSARILY LIMITED TO, STRUCTURAL STEEL, REINFORCING STEEL, & GLUE-LAMINATED BEAMS.
   d. PRIOR TO SUBMISSION THE CONTRACTOR SHALL REVIEW ALL SUBMITTALS FOR CONFORMANCE WITH THE CONTRACT DOCUMENTS AND SHALL STAMP SUBMITTALS AS BEING "REVIEWED FOR CONFORMANCE".
   e. SHOP DRAWING SUBMITTALS PROCESSED BY THE STRUCTURAL ENGINEER ARE NOT CHANGE ORDERS.
   f. ANY DETAIL ON THE SHOP DRAWINGS THAT DEVIATES FROM THE CONTRACT DOCUMENTS SHALL CLEARLY BE MARKED WITH THE NOTE "THIS IS A CHANGE".
   g. SHOP DRAWINGS OR CALCULATIONS SUBMITTED FOR REVIEW THAT REQUIRE RESUBMITTAL FOR RE-REVIEW SHALL BE BILLED HOURLY FOR SUCH TIME TO THE GENERAL CONTRACTOR. RE-REVIEW WILL NOT PROCEED WITHOUT WRITTEN APPROVAL FROM THE GENERAL CONTRACTOR FOR ADDITIONAL ENGINEERING REVIEW SERVICES.
4. SAFETY NOTE:
   a. IT IS THE CONTRACTORS RESPONSIBILITY TO COMPLY WITH THE PERTINENT SECTIONS, AS THEY APPLY TO THIS PROJECT, OF THE "CONSTRUCTION SAFETY ORDERS" ISSUED BY THE STATE OF CALIFORNIA LATEST EDITION, AND ALL OSHA REQUIREMENTS.
   b. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATE DESIGN AND CONSTRUCTION OF ALL FORMS AND SHORING REQUIRED. SHORING INDICATIONS (LOCATION, DIRECTION, DURATION, ETC.) ARE ONLY SHOWN ON THE STRUCTURAL DWGS WHEN REQUIRED TO IMPLEMENT THE DESIGN INTENT OF THE FINAL WORK PRODUCT. DETERMINATION WHETHER SHORING IS REQUIRED FOR TEMPORARY OR INTERMEDIATE CONDITIONS DURING CONSTRUCTION IS WHOLLY THE RESPONSIBILITY OF THE CONTRACTOR.
   c. THE OWNER AND THE STRUCTURAL ENGINEER DO NOT ACCEPT ANY RESPONSIBILITY FOR THE CONTRACTOR'S FAILURE TO COMPLY WITH THESE REQUIREMENTS.
5. THE CONTRACTOR SHALL NOTIFY THE STATE WHERE A CONFLICT OR DISCREPANCY OCCURS BETWEEN THE STRUCTURAL DRAWINGS AND ANY OTHER PORTION OF THE CONTRACT DOCUMENTS OR EXISTING FIELD CONDITIONS. SUCH NOTIFICATION SHALL BE GIVEN IN DUE TIME SO AS NOT TO AFFECT THE CONSTRUCTION SCHEDULE. IN CASE OF A CONFLICT BETWEEN STRUCTURAL DRAWINGS AND SPECIFICATIONS THE MORE RESTRICTIVE CONDITION SHALL TAKE PRECEDENCE UNLESS WRITTEN APPROVAL HAS BEEN GIVEN FOR THE LEAST RESTRICTIVE. CONTRACTOR SHALL VERIFY ALL DIMENSIONS WITH ARCHITECTURAL PRIOR TO COMMENCING ANY WORK.
6. WHEN CONSTRUCTION ATTACHES TO OR IS WITHIN AN EXISTING BUILDING, A COMPLETE SET OF DRAWINGS OF THE EXISTING BUILDING SHALL BE KEPT ON THE JOB SITE. CONTRACTOR TO OBTAIN THESE DRAWINGS FROM THE OWNER (IF THEY ARE AVAILABLE).
7. CONTRACTOR SHALL PROVIDE AN ALLOWANCE EQUAL TO 2% OF THE BID FOR STRUCTURAL STEEL, MISC. IRON AND REINFORCING STEEL TO BE USED AT THE DISCRETION OF THE STRUCTURAL ENGINEER. UNUSED AMOUNT TO REVERT TO THE OWNER UPON COMPLETION OF THE JOB.
8. ANY SUBSTITUTIONS FOR STRUCTURAL MEMBERS, HARDWARE OR DETAILS SHALL BE REVIEWED BY THE ARCHITECT AND STRUCTURAL ENGINEER. SUCH REVIEW WILL BE BILLED ON A TIME AND MATERIALS BASIS TO THE GENERAL CONTRACTOR WITH NO GUARANTEE THAT THE SUBSTITUTION WILL BE ALLOWED.
9. DO NOT SCALE DRAWINGS. CONTACT THE ARCHITECT OR STRUCTURAL ENGINEER FOR ANY DIMENSIONS NOT SHOWN.
10. THESE DRAWINGS ARE NOT COMPLETE UNTIL REVIEWED AND ACCEPTED BY LOCAL BUILDING OFFICIALS AND THE OWNER AND SIGNED BY THE STRUCTURAL ENGINEER.

ABBREVIATIONS
100SN003-1

(A) - OCCURS ABOVE
AB - ANCHOR BOLT
ABV - ABOVE
ADDL - ADDITIONAL
AHU - AIR HANDLING UNIT
ALT - ALTERNATE
APPROX - APPROXIMATE
ARCH - ARCHITECTURAL
(B) - OCCURS BELOW
BLDG - BUILDING
BLKG - BLOCKING
BLW - BELOW
BM - BEAM
B.O. - BOTTOM OF
BOF - BOTTOM OF FOOTING
BOTT - BOTTOM
BRCG - BRACING
BRG - BEARING
BTWN - BETWEEN
BYND - BEYOND
CC - CENTER TO CENTER
CG - CENTER OF GRAVITY
CJ - CONSTRUCTION JOINT
CJP - COMPLETE JOINT PENETRATION
℄ - CENTERLINE
CLG - CEILING
CLR - CLEAR
CMU - CONCRETE MASONRY UNIT
COL - COLUMN
CONC - CONCRETE
CONN - CONNECTION
CONT - CONTINUOUS
CONTR - CONTRACTOR
COORD - COORDINATE
CSK - COUNTERSINK
DBL - DOUBLE
DF - DOUGLAS FIR
DIAG - DIAGONAL
DL - DEAD LOAD
DWG - DRAWING
(E) - EXISTING
EA - EACH
EF - EACH FACE OR EDGE FASTENER
EJ - EXPANSION JOINT
ELEV - ELEVATION
EN - EDGE NAILING
EOS - EDGE OF SLAB
EQ - EQUAL
EW - EACH WAY
FB - FACE OF BLOCK/BRICK OR FLAT BAR
FC - FACE OF CONCRETE
FDN - FOUNDATION
FF - FINISH FLOOR
FRMG - FRAMING
FRT - FIRE RETARDANT TREATED
FS - FACE OF STUD OR FAR SIDE
FTG - FOOTING
GA - GAUGE OR GAGE
GALV - GALVANIZED
GLB - GLUED LAMINATED BEAM
GR - GRADE
GYP - GYPSUM
HD - HOLDOWN
HDR - HEADER
HGR - HANGER
HK - HOOK
HORIZ - HORIZONTAL
HSB - HIGH STRENGTH BOLT
HSS - HOLLOW STRUCTURAL SECTION
HT - HEIGHT
JH - JOIST HANGER
LL - LIVE LOAD
LLH - LONG LEG HORIZONTAL
LLV - LONG LEG VERTICAL
LONGIT - LONGITUDINAL
LS - LAG SCREW
LW - LIGHTWEIGHT
MECH - MECHANICAL
MFR - MANUFACTURER
MI - MALLEABLE IRON
Mk - MARK
MTL - METAL
(N) - NEW
NIC - NOT IN CONTRACT
NS - NEAR SIDE
NTS - NOT TO SCALE
NW - NORMAL WEIGHT
O/ - OVER
OH - OPPOSITE HAND
OPNG - OPENING
OSB - ORIENTED STRAND BOARD
PC - PIECE
PERP - PERPENDICULAR
PJP - PARTIAL JOINT PENETRATION
℞ - PLATE
PT - PRESSURE TREATED
PW - PUDDLE WELD
REINF - REINFORCING OR REINFORCEMENT
REQD - REQUIRED
RWD - REDWOOD
SC - SLIP CRITICAL
SCH - SCHEDULE
SEOR - STRUCTURAL ENGINEER OF RECORD
SHTG - SHEATHING
SIM - SIMILAR
SJ - SLAB CONTROL JOINT
SMS - SHEET METAL SCREW
SOG - SLAB-ON-GRADE
SP - STRUCTURAL PANEL
SPCG - SPACING
SQ - SQUARE
STD - STANDARD
STFNR - STIFFENER
STGRD - STAGGERED
STL - STEEL
STRUCT - STRUCTURAL
SW - SHEAR WALL
T&B - TOP & BOTTOM
T&G - TONGUE & GROOVE
THRD - THREADED
TN - TOE NAIL
T.O. - TOP OF
TOC - TOP OF CONCRETE (SLAB UNO)
TOF - TOP OF FOOTING OR TOP OF FRAMING
TOS - TOP OF STEEL
TOW - TOP OF WALL
TRANS - TRANSVERSE
TYP - TYPICAL
UNO - UNLESS NOTED OTHERWISE
VERT - VERTICAL
VIF - VERIFY IN FIELD
WF - WIDE FLANGE
WHS - WELDED HEADED STUD
WP - WORK POINT
WS - WOOD SCREW
WWF - WELDED WIRE FABRIC
XS - EXTRA STRONG
XXS - DOUBLE EXTRA STRONG
Ø - ROUND OR DIAMETER

DESIGN CRITERIA
100SN002-1

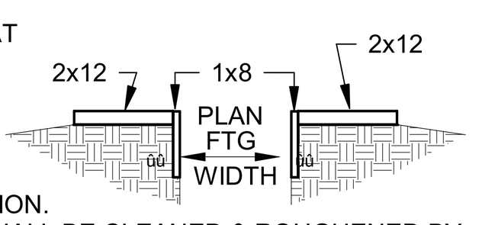
1. CODES AND STANDARDS
   2019 CALIFORNIA BUILDING CODE (CBC)
   ASCE 7-16
   ACI 318-14
   AISC 360-16, 341-16, 358-16
   AISI S100-16, S200-16, S213-07/S1-09 (2016)
   TMS 402-16/ACI 530-16/ASCE 5-16
   TMS 602-16/ACI 530.1-16/ASCE 6-16
   2018 NDS, 2015 SDPWS
2. VERTICAL LOADS
   ROOF LIVE LOAD = 20 PSF
   FLOOR PARTITION LIVE LOAD = 15 PSF
   FLOOR LIVE LOAD = 100 PSF
   FLOOR LIVE LOAD-ACCESS FLOOR = 50 PSF
   LIVE LOADS ARE REDUCED WHERE PERMITTED BY CODE.
3. SOILS VALUES
   ALLOWABLE SOILS PRESSURE
   a. DL 2000 PSF
   b. DL + LL 3000 PSF
   c. DL + LL + SEISMIC 4000 PSF

   FOOTING
   MINIMUM DEPTH = 12"
   MINIMUM WIDTH = 12"
4. LATERAL LOADS
   SEISMIC:
   SITE CLASS D C_S = 0.11
   S_S = 0.760 ; S_{DS} = 0.606
   S_1 = 0.308 ; S_{D1} = 0.366
   R = 5 ; I_E = 1.0
   Ω_O = 2.5 ; C_D = 3.5
   I_P = 1.0 TYPICAL
   I_P = 1.5 PER ASCE 7-16 SECT 13.1.3
   RISK CATEGORY: II
   SEISMIC DESIGN CATEGORY: D
   SEISMIC BASE SHEAR
   = 120 KIPS (NS DIR.)
   = 125 KIPS (EW DIR.)
   SEISMIC FORCE RESISTING SYSTEM: SPECIAL REINFORCED MASONRY SHEAR WALLS

   ANALYSIS PROCEDURE:
   EQUIVLENT LATERAL FORCE
   WIND:
   V_{ULT} = 95 MPH ; V_{ASD} = 75 MPH
   RISK CATEGORY: II
   EXPOSURE CATEGORY: C
   GC_{PI} = 0.18

FOUNDATIONS
200SN001-1

1. ALL FOUNDATION WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF THE SOILS REPORT #E53623.01 by Moore Twining Associates, Inc dated 5/26/23. (1)
2. FOUNDATIONS SHALL BEAR ON ENGINEERED FILL. SEE NOTES AND DETAILS ON SHEET **S5.1**.
3. ALL FILLING, BACKFILLING AND COMPACTION SHALL BE DONE UNDER THE OBSERVATION OF A REPRESENTATIVE OF THE SOILS ENGINEER AND MUST BE COMPACTED TO THE MINIMUM DENSITY SPECIFIED IN ACCORDANCE WITH THE PROCEDURE OUTLINED IN THE SOILS REPORT.
4. BUILDING PAD CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE SOILS REPORT. THE EXTENT AND DEPTH OF OVEREXCAVATION AND PLACEMENT OF ENGINEERED FILL SHALL AT A MINIMUM BE AS SHOWN ON THE PLANS. FINAL DEPTH AND EXTENT OF EXCAVATION AND FILL SHALL BE DETERMINED AT TIME OF CONSTRUCTION BY A REPRESENTATIVE OF THE SOILS ENGINEER. FOUNDATION DEPTHS INDICATED ON PLANS ARE FOR ESTIMATING PURPOSES ONLY.
5. BOTTOMS OF ALL FOUNDATIONS SHALL BE LEVEL. CHANGES IN BOTTOM OF FOUNDATION ELEVATION SHALL BE MADE ACCORDING TO STEPPED FOOTING DETAIL ON THE TYPICAL DETAIL SHEET.
6. FOUNDATION CONCRETE MAY BE PLACED DIRECTLY INTO NEAT EXCAVATIONS PROVIDED THE EXCAVATIONS ARE STABLE (AS DETERMINED BY A REPRESENTATIVE OF THE SOILS ENGINEER). OTHERWISE, FOUNDATIONS SHALL BE FULLY FORMED. USE MINIMUM PLANKING SHOWN TO PROTECT AGAINST SLOUGHING, AS REQUIRED. PLANKING DOES NOT REPLACE FORMWORK REQUIRED TO STABILIZE EXCAVATION.



7. THE SURFACE OF ALL HORIZONTAL CONSTRUCTION JOINTS SHALL BE CLEANED & ROUGHENED BY EXPOSING CLEAN AGGREGATE SOLIDLY EMBEDDED IN MORTAR MATRIX.
8. NOTIFY THE STRUCTURAL ENGINEER 48 HOURS BEFORE CASTING FOUNDATIONS.
9. A REPRESENTATIVE OF THE SOILS ENGINEER SHALL ADVISE THE BUILDING OFFICIAL IN WRITING THAT:
   a. THE BUILDING PAD WAS PREPARED IN ACCORDANCE WITH THE SOILS REPORT.
   b. THE UTILITY TRENCHES HAVE BEEN PROPERLY BACKFILLED AND COMPACTED AND;
   c. THE FOUNDATION EXCAVATION DEPTH AND MATERIAL ARE ADEQUATE TO ACHIEVE DESIGN BEARING CAPACITY; AND FORMING COMPLY WITH THE SOILS REPORT AND APPROVED PLAN.

CONCRETE
300SN001-1

1. STRUCTURAL CONCRETE SHALL ATTAIN 28 DAY COMPRESSIVE STRENGTH AS REQUIRED IN NOTE #28. MAXIMUM SLUMP SHALL NOT EXCEED 4 INCHES.
2. CONCRETE MIX DESIGNS SHALL BE PREPARED BY A REGISTERED CIVIL ENGINEER, REVIEWED BY OWNER'S TESTING LABORATORY AND SUBMITTED TO THE STRUCTURAL ENGINEER FOR REVIEW.
3. CEMENTITIOUS MATERIALS:
   CEMENT SHALL CONFORM TO ASTM C-150 TYPE II OR V.
   FLY ASH SHALL CONFORM TO ASTM C-618. MAX. QUANTITY OF FLY ASH SHALL BE 25% OR AS GIVEN IN SPECS.
4. CONCRETE AGGREGATES SHALL CONFORM TO ASTM C-33 FOR NORMAL WEIGHT CONCRETE AND ASTM C-330 FOR LIGHTWEIGHT CONCRETE.
5. NON-SHRINK GROUT OR DRYPACK SHALL CONSIST OF A PREMIXED NONMETALLIC FORMULA.
6. REINFORCING STEEL SHALL CONFORM TO ASTM A-615 GRADE 60 UNO. REINFORCING STEEL TO BE WELDED SHALL CONFORM TO ASTM A-706 GRADE 60. CONTRACTOR SHALL SUBMIT REBAR MILL CERTIFICATES. REINFORCING STEEL IN SPECIAL REINFORCED SHEAR WALLS OR MOMENT FRAMES, EXCEPT TIES AND HOOPS, SHALL CONFORM TO ASTM A-706.
7. ALL PREHEATING AND WELDING OF REINFORCING BARS SHALL BE DONE IN ACCORDANCE WITH AWS D1.4 LATEST EDITION AND SHALL BE CONTINUOUSLY INSPECTED BY A QUALIFIED LABORATORY. CONTRACTOR SHALL FURNISH WPS FOR ALL REBAR WELDING TO THE LABORATORY.
8. REINFORCING STEEL SHALL BE FABRICATED ACCORDING TO "MANUAL OF STANDARD PRACTICE FOR REINFORCED CONCRETE CONSTRUCTION".
9. WIRE FABRIC SHALL CONFORM TO ASTM A-185.
10. DIMENSIONS SHOWN FOR LOCATION OF REINFORCING ARE TO THE FACE OF BARS LISTED AND DENOTE CLEAR COVERAGE. NON-PRESTRESSED, CAST-IN-PLACE CONCRETE COVERAGE SHALL BE AS FOLLOWS, UNO:
    CONCRETE DEPOSITED DIRECTLY AGAINST GROUND (EXCEPT SLABS)------- 3"
    CONCRETE EXPOSED TO GROUND OR WEATHER BUT PLACED IN FORMS:
    #5 AND SMALLER-- 1-1/2"
    #6 AND LARGER--- 2"
    BEAMS & COLUMNS (TIES)------------------------------------ 1-1/2"
    BEAMS & COLUMNS (MAIN REINFORCING)------------------------ 2"
    CAST-IN-PLACE WALLS (EXTERIOR FACE & SOIL SIDE)--------- SEE ABOVE
    CAST-IN-PLACE WALLS (INTERIOR FACE-#11 & SMALLER)--------- 3/4"
    TILT-UP WALLS-- SEE DETAILS
    SLABS (ON FORMS)-- 3/4"
    SLABS (ON GROUND)-- 2" CLEAR FROM TOP UNO
11. SPLICES IN CONTINUOUS REINFORCEMENT SHALL BE LAPPED UNO, SEE SCHEDULE THIS SHEET. SPLICES IN ADJACENT BARS SHALL BE GREATER THAN 5'-0" APART. SPLICE CONTINUOUS BARS IN SOIL-BEARING GRADE BEAMS, STRUCTURAL SLABS ON GRADE AND MAT FOUNDATIONS AS FOLLOWS UNO: TOP BARS AT CENTERLINE OF SUPPORT; BOTTOM BARS AT MID-SPAN. SPLICE CONTINUOUS BARS IN ELEVATED SLABS AND BEAMS, ETC. AS FOLLOWS UNO: TOP BARS AT MID-SPAN; BOTTOM BARS AT CENTERLINE OF SUPPORT. ALL BARS SIZE #14 AND LARGER SHALL BE CONTINUOUS FOR FULL LENGTH SHOWN OR SPLICED WITH MECHANICAL COUPLERS AS NOTED IN DETAILS. SPLICES IN WWF SHALL BE 1-1/2 MESHES WIDE.
12. THE MINIMUM CLEAR SPACING BETWEEN PARALLEL BARS IN A LAYER SHALL NOT BE LESS THAN THE LARGER OF BAR DIAMETER, 1", OR 33% GREATER THAN THE MAXIMUM AGGREGATE SIZE (NOMINAL), WHICHEVER IS GREATEST. THIS REQUIREMENT ALSO APPLIES TO THE CLEAR SPACING BETWEEN DIFFERENT LAYERS OF PARALLEL BARS AND TO THE CLEAR DISTANCE BETWEEN A CONTACT LAP SPLICE AND ADJACENT SPLICES OR BARS.
13. ALL HOOKS SHALL BE STANDARD HOOKS UNLESS OTHERWISE SHOWN OR NOTED. AT WALLS, PROVIDE HOOKS AT ENDS OF ALL REINFORCING AT ENDS, CORNERS AND INTERSECTIONS, UNO.
14. CONSTRUCTION JOINTS SHALL BE MADE ROUGH AND ALL LAITANCE REMOVED FROM THE SURFACE. CONCRETE MAY BE ROUGHENED BY CHIPPING THE ENTIRE SURFACE, SAND BLASTING, OR RAKING THE SURFACE TO PROVIDE 1/4" DEEP DEFORMATIONS.
15. REMOVE ALL DEBRIS FROM FORMS BEFORE CASTING ANY CONCRETE.
16. REINFORCING, DOWELS, BOLTS, ANCHORS, SLEEVES, ETC. TO BE EMBEDDED IN CONCRETE SHALL BE SECURELY POSITIONED BEFORE PLACING CONCRETE.
17. ANCHOR BOLTS (AB'S) CAST IN CONCRETE FOR WALL SILL AND LEDGER APPLICATIONS SHALL BE HEADED BOLTS WITH CUT THREADS CONFORMING TO ASTM A307, UNO. REFER TO "WOOD" NOTES FOR ADDITIONAL REQUIREMENTS FOR BOLTS IN CONTACT WITH PRESSURE TREATED OR FIRE RETARDANT MATERIAL. REFER TO 'STRUCTURAL STEEL' NOTE FOR REQUIREMENTS FOR ANCHOR RODS (AR'S) CAST IN CONCRETE FOR COLUMN BASE PLATE AND STEEL EMBED APPLICATIONS.
18. WALLS SHALL BE CAST IN HORIZONTAL LAYERS OF 2'-0" MAXIMUM DEPTH.
19. CONCRETE IN WALLS, PIERS OR COLUMNS SHALL SET AT LEAST 2 HOURS BEFORE PLACING CONCRETE IN BEAMS, SPANDRELS, OR SLABS SUPPORTED THEREON.
20. HORIZONTAL WALL BARS IN MULTI-CURTAIN CAST IN PLACE WALLS SHALL BE STAGGERED.
21. DOWEL ALL VERTICAL REINFORCING IN WALLS AND COLUMNS FROM FOUNDATION WITH SAME SIZE BAR.
22. CONSOLIDATE CONCRETE PLACED IN FORMS BY MECHANICAL VIBRATING EQUIPMENT SUPPLEMENTED BY HAND-SPADING, RODDING OR TAMPING. USE EQUIPMENT AND PROCEDURES FOR CONSOLIDATION OF CONCRETE IN ACCORDANCE WITH THE RECOMMENDED PRACTICES OF ACI 309 TO SUIT THE TYPE OF CONCRETE AND PROJECT CONDITIONS. CONCRETE SHALL NOT BE DROPPED THROUGH REINFORCING STEEL (AS IN WALLS) SO AS TO CAUSE SEGREGATION OF AGGREGATES. IN SUCH CASES HOPPERS AND CHUTES OR TRUNKS OF VARIABLE LENGTHS SHALL BE USED SO THAT THE FREE UNCONFINED FALL OF CONCRETE SHALL NOT EXCEED 6 FEET.
23. NO WOOD SPREADERS ALLOWED. NO WOOD STAKES ALLOWED IN AREAS TO BE CONCRETED.
24. ADDITIONAL REINFORCING IN PRECAST OR TILT-UP PANELS REQUIRED FOR LIFTING STRESSES SHALL BE SUPPLIED BY CONTRACTOR.
25. PROVIDE #5 X 4'-0" DIAGONAL REINFORCING AT TOP AND BOTTOM OF SLAB AT ALL RE-ENTRANT CORNERS TYPICAL. THIS APPLIES TO SLAB ON GRADE, CONCRETE OVER METAL DECK, AND ELEVATED STRUCTURAL SLAB CONDITIONS.
26. ALL SAW CUTTING SHALL BE DONE AFTER INITIAL SET HAS OCCURRED TO AVOID TEARING OR DAMAGE BY THE SAW BLADE, BUT BEFORE INITIAL SHRINKAGE HAS OCCURRED.
27. NOTIFY STRUCTURAL ENGINEER A MINIMUM OF 48 HOURS BEFORE PLACING ANY CONCRETE.
28. CONCRETE STRENGTHS & MIX PROPERTIES:

	ITEM	F'C @ 28 DAYS	MAX AGGR. SIZE	WEIGHT	MAX W/CM* RATIO
a.	FOUNDATIONS, ELEVATOR PITS, TIE BEAMS	3000 PSI	1-1/2"	NW	0.58
b.	SLAB ON GRADE	3500 PSI	1"	NW	0.45
	SITE & MISCELLANEOUS - SEE CIVIL OR ARCH'L DRAWINGS				

* W/CM = WATER : CEMENTITIOUS MATERIAL RATIO

REINFORCEMENT LAP SPLICE SCHEDULE
300SN002-1
(ALL LENGTHS SHOWN ARE IN INCHES.)
ACI 318 CBC/IBC

SPLICE CLASS	REINF LOCATION	#3	#4	#5	#6	#7	#8	#9	#10	#11
fc' = 3000 PSI CONC										
B	TOP	28	37	47	56	81	93	105	118	131
B	OTHER	22	29	36	43	63	72	81	91	101
fc' = 3500 PSI CONC										
B	TOP	26	35	43	52	75	86	97	109	121
B	OTHER	20	27	33	40	58	66	75	84	93
fc' = 4000 PSI CONC										
B	TOP	24	32	40	48	70	80	91	102	113
B	OTHER	19	25	31	37	54	62	70	79	87
fc' = 5000 PSI CONC										
B	TOP	22	29	36	43	63	72	81	91	101
B	OTHER	17	22	28	33	49	55	63	70	78

NOTES:
1. SCHEDULE APPLIES TO NORMAL WEIGHT CONCRETE WITH UNCOATED, GRADE 60 REINFORCING STEEL FOR #3 BARS AND LARGER.
2. TOP REINFORCEMENT IS HORIZONTAL REINFORCEMENT LOCATED SUCH THAT MORE THAN 12 INCHES OF FRESH CONCRETE IS CAST IN THE MEMBER BELOW THE SPLICE.
3. WHEN LIGHTWEIGHT CONCRETE IS USED, MULTIPLY LAP LENGTHS BY 1.30.
4. WHERE CLEAR SPACING OF BARS BEING SPLICED IS LESS THAN 2 BAR DIA. OR WHERE CLEAR COVER OF BARS BEING SPLICED IS LESS THAN 1 BAR DIA., MULTIPLY LAP LENGTHS BY 1.50, UNO.
5. WHERE NOTES #3 AND #4 OCCUR, MULTIPLY LAP LENGTHS BY 2.00, UNO.
6. WHERE CLASS A LAP SPLICE IS NOTED IN DETAIL, DIVIDE LENGTHS ABOVE BY 1.30.

STRUCTURAL STEEL
500SN001-1

1. FABRICATION, ERECTION AND MATERIALS SHALL CONFORM WITH THE AISC SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, THE AISC SEISMIC PROVISIONS FOR STRUCTURAL STEEL BUILDINGS, AND THE CALIFORNIA BUILDING CODE, LATEST EDITIONS UNO IN THE DESIGN CRITERIA NOTES.
2. STRUCTURAL STEEL WIDE FLANGE SHAPES SHALL CONFORM WITH ASTM A992. ALL OTHER STRUCTURAL STEEL ROLLED SHAPES (CHANNELS, ANGLES, ETC) AND PLATES SHALL CONFORM WITH ASTM A36, UNO.
3. STEEL PIPE SHALL CONFORM TO ASTM A53, TYPES E OR S, GRADE B.
4. ALL HOLLOW STRUCTURAL SECTIONS (HSS) SHALL CONFORM TO ASTM A500, GRADE B.
5. ALL STRUCTURAL STEEL SHALL RECEIVE A MINIMUM OF ONE SHOP COAT OF RED PRIMER PAINT. DO NOT PAINT AREAS TO BE FIELD WELDED, FIREPROOFED, GALVANIZED, TO RECEIVE SLIP-CRITICAL HIGH STRENGTH BOLTS, OR TO BE EMBEDDED IN CONCRETE. PROVIDE ADDITIONAL PAINTING AS NOTED IN THE SPECIFICATIONS.
6. ALL STRUCTURAL STEEL SHALL BE ERECTED PLUMB AND TRUE TO LINE. TEMPORARY BRACING SHALL BE INSTALLED AND SHALL BE LEFT IN PLACE UNTIL OTHER MEANS ARE PROVIDED TO ADEQUATELY BRACE THE STRUCTURE. CONTRACTOR RESPONSIBLE FOR REVIEWING ALL BASE PLATE AND SUPPORT CONDITIONS DURING ERECTION AND BRACING AS REQUIRED. SEE AISC AND OSHA REQUIREMENTS.
7. PLACE NON-SHRINK GROUT UNDER ALL BASE PLATES BEFORE ADDING VERTICAL LOAD.
8. STRUCTURAL STEEL BELOW GRADE SHALL HAVE 3 INCHES MINIMUM OF CONCRETE COVER.
9. BOLTED CONNECTIONS:
   a. BOLTED CONNECTIONS SHALL CONSIST OF UNFINISHED BOLTS CONFORMING TO ASTM A307 UNO. WHERE HIGH STRENGTH BOLTS ARE INDICATED, BOLTS CONFORMING TO ASTM A325 OR ASTM A490 AS SPECIFIED SHALL BE PROVIDED. ANCHOR RODS CAST IN CONCRETE OR MASONRY SHALL BE HEADED BOLTS WITH CUT THREAD, FULL DIAMETER BODY STYLE CONFORMING TO ASTM F1554 GR. 36, 55 (WELDABLE PER S1 SUPPLEMENTARY REQUIREMENTS), OR 105 AS INDICATED ON DRAWINGS. IN LIEU OF HEADED ANCHOR BOLTS, THREADED ROD CONFORMING TO THE ABOVE SPECIFICATION MAY BE USED WITH A SINGLE NUT WELDED TO THE ROD OR DOUBLE NUTS TIGHTENED TO PREVENT ROTATION. ANCHOR ROD PROJECTION ABOVE TOP OF FOUNDATION SHALL BE AS NOTED ON THE DRAWINGS.
   b. BOLTED CONNECTIONS SHALL HAVE WASHERS CONFORMING TO ASTM F436 UNO. WASHERS MAY BE OMITTED AT SNUG-TIGHTENED AND SLIP-CRITICAL CONNECTIONS, EXCEPT WHERE REQUIRED BY THE RCSC SPECIFICATION FOR STRUCTURAL JOINTS, LATEST EDITION.
   c. BASE PLATES SHALL HAVE NUTS AND WASHERS AT TOP AND BOTTOM OF PLATE. WASHERS FOR BASE PLATES SHALL BE A36 SQUARE OR CIRCULAR PLATE UNLESS ASTM F844 WASHERS ARE PERMITTED. SEE BASE PLATE DETAILS FOR PLATE SIZE AND PERMISSIBLE WASHER TYPE.
10. ADDITIONAL REQUIREMENTS FOR "SLIP-CRITICAL" BOLTED CONNECTIONS:
    a. "SLIP-CRITICAL" CONNECTIONS (A325SC DESIGN VALUES WITH SPECIAL INSPECTION) ARE REQUIRED AT ALL BRACED FRAME CONNECTIONS, AT ALL CONNECTIONS ALONG CHORD LINES AND DRAG LINES (AS NOTED ON PLANS), AND UNO, AT ALL BOLTS IN OVERSIZED OR SLOTTED HOLES.
    b. THE SPECIAL INSPECTOR MUST BE PRESENT DURING INSTALLATION AND TIGHTENING OPERATION OF "SLIP-CRITICAL" CONNECTIONS.
11. PROVIDE 3/4" DIAMETER STITCH BOLTS AND RING FILLS, SPACED AT NOT MORE THAN 2'-0" ON CENTER FOR ALL DOUBLE ANGLE MEMBERS UNO.
12. AT WOOD TO STEEL PARALLEL CONTACT, BOLT WITH 1/2" DIAMETER BOLTS AT MAXIMUM 24"CC.
13. HOLES FOR UNFINISHED BOLTS SHALL BE OF THE SAME NOMINAL DIAMETER OF THE BOLT PLUS 1/16". USE STANDARD AISC GAGE AND PITCH FOR BOLTS EXCEPT AS NOTED OTHERWISE.
14. WELDING SHALL BE DONE BY THE ELECTRIC ARC PROCESS IN ACCORDANCE WITH AMERICAN WELDING SOCIETY STANDARDS, USING ONLY CERTIFIED WELDERS. ALL GROOVE WELDS SHALL HAVE COMPLETE PENETRATION UNLESS NOTED OTHERWISE. ALL EXPOSED WELDS SHALL BE GROUND SMOOTH. ALL ELECTRODES FOR WELDING SHALL COMPLY WITH AWS CODE, E70 SERIES MINIMUM.
15. WELD LENGTHS CALLED FOR ON PLANS ARE THE NET EFFECTIVE LENGTHS REQUIRED.
16. MINIMUM FILLET WELDS: 3/16" @ T < 1/2"
    1/4" @ T < 3/4"
    5/16" @ T > 3/4"
17. WELDING PROCEDURE SPECIFICATIONS (WPS) FOR SHOP AND FIELD PREQUALIFIED WELD JOINTS AND WELD JOINTS QUALIFIED BY TEST SHALL BE PREPARED FOR REVIEW PRIOR TO FABRICATION. ALL WELDING PROCEDURE ITEMS SUCH AS BASE METALS, WELDING PROCESSES, FILLER METALS AND JOINT DETAILS THAT MEET THE REQUIREMENTS OF AWS D1.1 SECTION 3 SHALL BE CONSIDERED AS PREQUALIFIED. ANY CHANGE OR SUBSTITUTION THAT IS BEYOND THE RANGE OR TOLERANCE OR REQUIREMENTS FOR PREQUALIFICATION SHALL BE QUALIFIED BY TEST PER AWS D1.1 SECTION 4 PART B. QUALIFICATION TESTING IS REQUIRED FOR PARTIAL PENETRATION AND COMPLETE PENETRATION WELDS.
18. FOR NONDESTRUCTIVE TESTING OF WELDED CONNECTIONS EXCLUDING PRIMARY MEMBERS OF MOMENT RESISTING FRAMES:
    a. WELDED CONNECTIONS SHALL BE TESTED BY NONDESTRUCTIVE METHODS FOR COMPLIANCE WITH AISC N5.5, AND JOB SPECIFICATIONS. ULTRASONIC TESTING SHALL BE IN ACCORDANCE WITH AWS D1.1, ASTM E164 AND ASME SECTION V. RADIOGRAPHY SHALL BE IN ACCORDANCE WITH AWS D1.1, ASTM E94 AND E99, AND ASME SECTION V. THIS TESTING SHALL BE PART OF THE SPECIAL INSPECTION REQUIREMENTS OF CBC SECTION 1705 PERFORMED BY AN APPROVED INDEPENDENT TESTING LABORATORY AS FOLLOWS:
       1. BASE METAL THICKER THAN 1-1/2 INCH WHEN SUBJECT TO THROUGH THICKNESS WELD SHRINKAGE STRAINS.
       2. ALL COMPLETE JOINT PENETRATION GROOVE OR BUTT WELDS.
       3. ALL PARTIAL JOINT PENETRATION GROOVE WELDS WHEN USED IN COLUMN SPLICES.
    b. ANY MATERIAL DISCONTINUITIES SHALL BE ACCEPTED OR REJECTED ON THE BASIS OF DEFECT RATING IN ACCORDANCE WITH THE (LARGER REFLECTOR) CRITERIA OF AISC N5.5.

METAL DECK NOTES
530SN001-1

1. PROVIDE METAL DECKING OF TYPE AND GAUGE AS SHOWN ON PLANS.
2. METAL FLOOR DECK SHALL BE COMPOSITE TYPE, CONFORMING TO ASTM A653, STRUCTURAL QUALITY, WITH MINIMUM YIELD STRENGTH OF 38 KSI AND SHALL BE ZINC COATED PER ASTM A653, G60 COATING DESIGNATION.
3. METAL ROOF DECK SHALL CONFORM TO ASTM A653, STRUCTURAL QUALITY, WITH MINIMUM YIELD STRENGTH OF 38 KSI AND SHALL BE ZINC COATED PER ASTM A653, G60 COATING DESIGNATION.
4. PRIOR TO FABRICATION, THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR THE METAL DECKING, SHOWING DECK GAUGE, SIZE AND LAYOUT AS WELL AS CLOSURE CONDITIONS, WELDS TO SUPPORTS AND SIDE LAP DETAILS.
5. CONNECTION AND WELDING OF DECKING TO STRUCTURAL SUPPORTS AND DECK SIDE SEAMS SHALL BE AS SPECIFIED IN THE STRUCTURAL DRAWINGS. ALL ELECTRODES FOR WELDING SHALL COMPLY WITH AWS CODE, E60 SERIES MINIMUM.
6. ALL REINFORCED OPENINGS IN METAL DECK SHALL BE INSTALLED BY METAL DECK SUBCONTRACTOR.
7. AT METAL DECKS TO RECEIVE CONCRETE, ABSOLUTELY NO CONDUIT OR PIPING OF ANY TYPE IS TO BE PLACED HORIZONTALLY WITHIN THE DEPTH OF THE CONCRETE ABOVE THE METAL DECK.
8. AT METAL DECK WITHOUT CONCRETE FILL THE FOLLOWING MAY BE ATTACHED WITHOUT SPECIFIC APPROVAL OF THE STRUCTURAL ENGINEER: ACOUSTICAL TILE AND GYPSUM BOARD CEILINGS ONLY; NO PIPING, DUCTING OR CONDUIT. MAXIMUM CEILING WEIGHT - 3.5 PSF. MAXIMUM WIRE HANGER LOAD = 60#.
9. WHERE SUSPENSION OR HANGER WIRES ARE REQUIRED BY OTHERS, VERIFY AND COORDINATE LOCATIONS, PATTERNS, SPACINGS, ETC. WITH THE APPROPRIATE TRADE. DRILL OR PUNCH HOLES AT BOTTOM OF DECK FLUTES OF SUFFICIENT SIZE TO PASS SUPPORT WIRES. WIRE SUPPORTS SHALL BE LOOPED AND SECURED WITH A MINIMUM OF THREE (3) TIGHT TURNS AROUND A MINIMUM 1-1/2" X 12" LONG FURRING CHANNEL OR NO. 3 X 12" LONG REINFORCING BAR CENTERED ABOVE THE HOLE AND LAID IN THE DECK FLUTES.

EXTERIOR CURTAIN WALL SYSTEM - DESIGN CRITERIA
100SN040-1

1. EXTERIOR WALL SYSTEMS TO BE ROBERTSON FORMAWALL 1000H SERIES SUPPORTED BY COLD-FORMED METAL STUD FRAMING, AS SPECIFIED IN SECTION 07400 'COMPOSITE METAL BUILDING PANELS'.
2. WALL SYSTEM MANUFACTURER SHALL SUBMIT COMPLETE DESIGN DRAWINGS AND CALCULATIONS FOR ALL WALL PANELS, SUPPORTS, AND CONNECTIONS. DRAWINGS AND CALCULATIONS SHALL BE PREPARED, STAMPED AND SIGNED BY A CIVIL ENGINEER LICENSED IN THE STATE IN WHICH THE PROJECT IS LOCATED.
3. ALL WALL PANELS SHALL BE DESIGNED FOR ALL VERTICAL AND LATERAL LOADS AS REQUIRED BY THE CALIFORNIA BUILDING CODE. WIND LOADS SHALL BE DERIVED USING:
   ULTIMATE WIND SPEED = 95 MPH, EXPOSURE CATEGORY C .
4. ALL PANEL AND SUPPORT CONNECTIONS SHALL BE FASTENED BY MEANS OF MECHANICAL CONNECTIONS AND FASTENERS IN ACCORDANCE WITH ASCE 7-10 SECTION 13.3.
5. DETAILS PROVIDED IN THESE DRAWINGS ARE FOR REFERENCE ONLY. WALL SYSTEM MANUFACTURER SHALL DESIGN AND SUPPLY ALL CONNECTION MATERIALS (INCLUDING EMBEDDED ITEMS, DIAGONAL BRACING ANGLES, BRACKETS, OUTRIGGERS, ETC.) AS REQUIRED FOR THE SUPPORT OF THE WALL PANEL SYSTEM. EMBEDDED ITEMS SHALL BE INSTALLED BY THE GENERAL CONTRACTOR.
6. SEE ARCHITECTURAL DRAWINGS FOR PANEL ELEVATIONS, DETAILS AND DIMENSIONS.

DEFERRED APPROVALS
100SN007-1

1. THE FOLLOWING ITEMS REQUIRE DEFERRED APPROVAL FROM THE ENFORCEMENT AGENCY:
   a. SKYLIGHTS
   b. WINDOW WALL/STORE FRONT SYSTEMS
   c. FIRE SPRINKLER SUPPORT
   d. STEEL OPEN WEB JOISTS, SEE **S0.2**
2. THE DESIGN OF THE ABOVE ITEMS IS BY THE CONTRACTOR/MANUFACTURER. CONTRACTOR/MANUFACTURER MUST PREPARE ALL NECESSARY CALCULATIONS AND DRAWINGS PER THE CALIFORNIA BUILDING CODE UNDER THE SUPERVISION OF A CIVIL ENGINEER, REGISTERED IN CALIFORNIA, AND SHALL OBTAIN ALL NECESSARY PLAN CHECK APPROVALS FROM THE ENFORCEMENT AGENCY.
3. INSTALLATION OF THE ABOVE ITEMS SHALL NOT BE STARTED UNTIL DETAILED PLANS, SPECIFICATIONS AND ENGINEERING CALCULATIONS HAVE BEEN REVIEWED BY THE ARCHITECT OR STRUCTURAL ENGINEER OF RECORD, AND APPROVED BY THE ENFORCEMENT AGENCY.

CONCRETE MASONRY UNITS (CMU)
410SN001-1

1. ALL MASONRY SHALL BE MANUFACTURED AND PLACED IN ACCORDANCE WITH TMS 402, "BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES", AND TMS 602 "SPECIFICATION FOR MASONRY STRUCTURES".
2. MASONRY UNITS AND COMPONENTS THAT ARE DAMAGED ARE NOT TO BE INSTALLED IN THIS PROJECT. REINFORCEMENTS AND ACCESSORIES ARE NOT TO BE STORED ON THE GROUND AND ARE TO BE PROTECTED FROM PERMANENT DISTORTIONS.
3. WHEN THE AMBIENT AIR TEMPERATURE IS BELOW 40°F, THE COLD WEATHER PROCEDURES FROM TMS 602, ARTICLE 1.8C ARE TO BE IMPLEMENTED. WHEN THE AMBIENT AIR TEMPERATURE IS ABOVE 90°F, THE HOT WEATHER PROCEDURES FROM TMS 602, ARTICLE 1.8D ARE TO BE IMPLEMENTED.
4. CONCRETE BLOCK UNITS SHALL CONFORM TO ASTM C90 . F'M = 2000 PSI. F'M SHALL BE VERIFIED IN ACCORDANCE WITH TMS 602, ARTICLE 1.4 B.2. CONCRETE BLOCK UNITS SHALL BE MEDIUM WEIGHT. ALL MASONRY CONSTRUCTION IS TO BE GROUTED SOLID.
5. MORTAR SHALL BE TYPE S PER ASTM C270.
6. GROUT SHALL BE PROPORTIONED TO ATTAIN A 28 DAY COMPRESSIVE STRENGTH EQUAL TO THE SPECIFIED F'M VALUE NOTED ABOVE. NOT MORE THAN 5% OF THE PEA GRAVEL SHALL PASS THE NO. 8 SIEVE AND 100% SHALL PASS THE 3/8" SIEVE. WHEN REQUIRED, GROUT STRENGTH SHALL BE VERIFIED IN ACCORDANCE WITH ASTM C1019. GROUT MIX SHALL HAVE APPROXIMATELY 1 LB OF SIKAGROUT AID, OR APPROVED EQUAL, PER 100 LBS OF CEMENTITIOUS MATERIAL.
7. REINFORCING STEEL SHALL CONFORM TO ASTM A615 GRADE 60 UNO. REINFORCING STEEL TO BE WELDED SHALL CONFORM TO ASTM A706 GRADE 60. CONTRACTOR SHALL SUBMIT REBAR MILL CERTIFICATES.
8. LOCATE BARS AT ALL CORNERS, WALL ENDS, INTERSECTIONS, JAMBS AND AT EACH SIDE OF A WALL JOINT. LOCATE BARS OR ADD ADDITIONAL BARS DIRECTLY UNDER FRAMING MEMBERS SUCH AS BEAMS, JOISTS, GIRDERS, AND TRUSSES WHERE CENTER TO CENTER SPACING OF FRAMING MEMBERS EXCEED 48" CC. DOWELS WITH STANDARD 90° HOOKS INTO THE FOUNDATION SHALL MATCH AND LAP VERTICAL REINFORCING, TYPICAL, UNLESS NOTED OTHERWISE.
9. INTERMEDIATE HORIZONTAL REINFORCING SHALL BE LOCATED AT THE CENTER OF THE MASONRY WALL, UNO. LOCATE TWO (2) #5 HORIZONTAL BARS AT ALL ELEVATED FRAMING ASSEMBLIES, SUCH AS ROOFS, FLOORS, AND STAIRS. ALSO, LOCATE ONE #5 HORIZONTAL BAR AT TOPS OF PARAPETS, TOPS OF FREE-STANDING WALLS, AT THE BOTTOM OF ALL WALLS, AND ALIGNED WITH THE SLAB-ON-GRADE. PLACE A #5 BAR AT EACH FACE OF THE MASONRY WALL ABOVE AND BELOW ALL WALL OPENINGS, UNO. EXTEND THESE BARS A MINIMUM OF A LAP LENGTH PAST THE EDGE OF THE OPENING. WHERE EXTENSION CAN NOT BE ACHIEVED, BEND BARS UP OR DOWN FOR A DISTANCE EQUAL TO THE SPECIFIED LAP LENGTH.
10. PLACE ALL HORIZONTAL BARS IN BOND BEAM UNITS. WHEN 2 BARS ARE USED, STAGGER LAPS MINIMUM OF 5'-0".
11. MINIMUM REBAR CLEARANCE TO FACE SHELL IS ONE BAR DIAMETER OR 1/2", WHICHEVER IS GREATER. WHERE WALLS ARE EXPOSED TO EARTH OR WEATHER, A MINIMUM COVER FOR THE REINFORCING BARS OF 2" SHALL BE MAINTAINED.
12. BEFORE BLOCK IS PLACED ON CONCRETE, THOROUGHLY CLEAN CONCRETE OF ALL LAITANCE AND ALL LOOSE MATERIAL. ROUGHEN AS IN A CONCRETE CONSTRUCTION JOINT.
13. CONCRETE BLOCK MASONRY SHALL BE BUILT TO PRESERVE THE UNOBSTRUCTED VERTICAL CONTINUITY OF THE CELLS. ALL HEAD AND END JOINTS SHALL BE SOLIDLY FILLED WITH MORTAR FOR A DISTANCE IN FROM THE FACE OF THE WALL OR UNIT NOT LESS THAN THE THICKNESS OF THE LONGITUDINAL FACE SHELLS. BOND SHALL BE PROVIDED BY LAPPING SUCCESSIVE COURSES OR BY EQUIVALENT MECHANICAL ANCHORAGE.
14. VERTICAL CELLS SHALL HAVE VERTICAL ALIGNMENT SUFFICIENT TO MAINTAIN A CLEAR UNOBSTRUCTED CONTINUOUS VERTICAL CELL.
15. GROUT PLACEMENT SHALL CONFORM TO TMS 602 SECTION 3.5.
16. CLEAN OUT OPENINGS SHALL BE PROVIDED AT THE BOTTOMS OF ALL CELLS TO BE FILLED AT EACH LIFT OR POUR OF GROUT WHERE SUCH LIFT OR POUR OF GROUT IS IN EXCESS OF 5'-4" IN HEIGHT, IN ACCORDANCE WITH TMS 602 SECTION 3.2F. ANY OVERHANGING MORTAR OR OTHER OBSTRUCTION OR DEBRIS SHALL BE REMOVED FROM INSIDE OF SUCH CELLS. THE CLEAN OUTS SHALL BE SEALED AFTER INSPECTION AND BEFORE GROUTING. MECHANICALLY VIBRATE ALL GROUT POURS.
17. REINFORCEMENT IS TO BE SUPPORTED IN PLACE TO PREVENT DISPLACEMENTCAUSED BY PLACEMENT OF GROUT AND MORTAR OR BY CONSTRUCTION LOADS.
18. THOROUGHLY CLEAN ALL CELLS AND BOND BEAMS OF MORTAR BEFORE GROUTING.
19. ALL CELLS SHALL BE FILLED SOLIDLY WITH GROUT. ALL GROUTING SHALL BE DONE UNDER THE OBSERVATION OF A QUALIFIED INSPECTOR. REFER TO SPECIAL STRUCTURAL INSPECTION SECTION OF THESE NOTES FOR FREQUENCY OF GROUTING INSPECTION.
20. WHEN GROUTING IS STOPPED FOR ONE HOUR OR LONGER, HORIZONTAL CONSTRUCTION JOINTS, OR KEYS, SHALL BE FORMED BY STOPPING THE POUR OF GROUT 1-1/2" BELOW THE TOP OF THE UPPERMOST UNIT.
21. EVERY VERTICAL BAR IN WALLS SHALL BE LAPPED PER THE TABLE BELOW WITH A DOWEL OF THE SAME SIZE EXTENDING FROM THE FOUNDATION. CARRY EACH DOWEL TO WITHIN 3" OF THE BOTTOM OF THE FOUNDATION AND TERMINATE WITH 90 DEGREE HOOK. DOWELS SHALL BE STRAIGHT AND PLUMB.
22. ALL EMBEDDED ITEMS (BOLTS, STRAPS, ETC.) SHALL BE SECURED IN PLACE PRIOR TO GROUTING. CUT A HOLE IN THE FACE SHELL TO ATTAIN A MINIMUM OF 1/2" GROUT ALL AROUND EMBEDDED ITEMS AT THE FACE SHELL. WITHIN THE CELL OF THE UNIT, PROVIDE A MINIMUM OF 8" OF GROUT AROUND EMBEDDED ITEMS. AT HORIZONTAL ANCHOR INSTALLATIONS, MAINTAIN A MINIMUM CLEAR DISTANCE OF 1/2" BETWEEN END OF ANCHOR AND FACE SHELL OF UNIT.
23. SINGLE CONDUITS (3/4" MAX) MAY BE PLACED IN VERTICAL CELLS NOT CONTAINING VERTICAL. REBAR. NO HORIZONTAL CONDUITS ALLOWED IN WALL CONSTRUCTION.
24. ANCHOR BOLTS CAST IN MASONRY SHALL BE HEADED BOLTS WITH CUT THREADS CONFORMING TO ASTM F1554 GRADE 36, OR ASTM A307 GRADE A, UNO. BENT BAR ANCHOR BOLTS ARE NOT PERMITTED.
25. USE OPEN END BLOCK FOR ALL CONSTRUCTION NOT LAID IN RUNNING BOND.
26. ALL REBAR SHALL BE LAP SPLICED AND DEVELOPED AS FOLLOWS (UNO). WHERE EPOXY COATED REBAR IS USED, MULTIPLY LAP LENGTHS BY 1.5. BARS LARGER THAN #8 ARE TO BE LAPPED WITH MECHANICAL SPLICES THAT DEVELOP AT LEAST 125 PERCENT OF THE YIELD STRENGTH OF THE BAR.

CMU SPLICE & DEVELOPMENT LENGTHS (f'm = 2000 PSI)

BAR SIZE	fy (KSI)	γ	6" CMU CENTER	6" CMU E.F.	8" CMU CENTER	8" CMU E.F.	10" CMU CENTER	10" CMU E.F.	12" CMU CENTER	12" CMU E.F.
#3	60	1.0	12"	-	12"	12"	12"	13"	12"	12"
#4	60	1.0	18"	-	13"	24"	13"	22"	13"	21"
#5	60	1.0	28"	-	20"	37"	20"	35"	20"	33"
#6	60	1.3	53"	-	38"	54"	38"	54"	38"	54"
#7	60	1.3	-	-	52"	-	52"	63"	52"	63"
#8	60	1.5	-	-	-	-	72"	-	72"	72"

POST-INSTALLED ANCHORS
305SN001-1

1. FOR CONCRETE CONSTRUCTION, ADHESIVE ANCHORS SHALL BE HILTI HIT-HY 200 PER ESR-3187, HILTI HIT-RE500 V3 PER ESR-3814, SIMPSON SET-XP PER ESR-2508, OR DEWALT/POWERS PURE 110 PER ESR-3298 FOR THRD ROD & REBAR. EXPANSION ANCHORS SHALL BE HILTI KB-TZ PER ESR-1917, SIMPSON STRONG-BOLT 2 PER ESR-3037, OR DEWALT/POWERS POWER-STUD+ SD2 PER ESR-2502. SCREW ANCHORS SHALL BE HILTI KWIK HUS-EZ (KH-EZ) PER ESR-3027, SIMPSON TITEN HD PER ESR-2713, OR DEWALT/POWERS SCREWBOLT+ PER ESR-3889.
2. FOR MASONRY CONSTRUCTION, ADHESIVE ANCHORS SHALL BE HILTI HIT-HY 70 PER ESR-2682, SIMPSON SET PER ESR-1772, OR DEWALT/POWERS AC100+ GOLD PER ESR-3200 FOR THRD ROD & REBAR. EXPANSION ANCHORS SHALL BE HILTI KWIK BOLT 3 (KB3) PER ESR-1385, SIMPSON WEDGE-ALL PER ESR-1396, OR DEWALT/POWERS POWER-STUD+ PER ESR-2966. SCREW ANCHORS SHALL BE HILTI KWIK HUS-EZ (KH-EZ) PER ESR-3056, SIMPSON TITEN HD PER ESR-1056, OR DEWALT/POWERS WEDGEBOLT+ PER ESR-1678.
3. ANCHOR TYPE, SIZE & EMBEDMENT SHALL BE INDICATED IN DRAWINGS. POST-INSTALLED ANCHORS FOR REPAIR SHALL BE EVALUATED ON A CASE BY CASE BASIS. NOTIFY STRUCTURAL ENGINEER FOR REPAIRS.
4. ANCHORS SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS GIVEN IN THE EVALUATION REPORT.
5. PROVIDE SPECIAL INSPECTION AS INDICATED IN THE STATEMENT OF STRUCTURAL SPECIAL INSPECTIONS AND TESTING.
6. WHEN INSTALLING POST-INSTALLED ANCHORS IN EXISTING CONCRETE OR MASONRY, USE CARE AND CAUTION TO AVOID CUTTING OR DAMAGING EXISTING REINFORCING BARS. DO NOT INSTALL ANCHORS IN PRESTRESSED CONCRETE ELEMENTS.
7. ANCHORS INSTALLED FROM THE BOTTOM INTO METAL DECK WITH CONCRETE SHALL BE INSTALLED IN THE CENTER OF THE LOW FLUTE OF THE DECKING UNLESS NOTED OTHERWISE IN EVALUATION REPORT. THE DECKING SHALL HAVE A MINIMUM THICKNESS OF 20 GAUGE. THE MINIMUM THICKNESS OF THE CONCRETE ABOVE THE HIGH FLUTE OF THE METAL DECK SHALL BE AS INDICATED IN THE EVALUATION REPORT. SEE EVALUATION REPORT FOR ADDITIONAL REQUIREMENTS, INCLUDING MINIMUM DIMENSIONS FOR FLUTE WIDTH AND DEPTH.
8. ADHESIVE ANCHORS SHALL BE INSTALLED IN CONCRETE HAVING A MINIMUM AGE OF 21 DAYS AT THE TIME OF ANCHOR INSTALLATION PER ACI 318, CHAPTER 17.
9. INSTALLER CERTIFICATION AND INSPECTION IS REQUIRED FOR HORIZONTAL AND UPWARDLY INCLINED ADHESIVE ANCHORS SUBJECTED TO SUSTAINED TENSION LOADING IN ACCORDANCE WITH ACI 318, CHAPTER 17.
10. THE INSPECTION OF THE ANCHORS SHALL BE DONE BY A QUALIFIED INSPECTION AGENCY AND A REPORT OF THE INSPECTION RESULTS SHALL BE SUBMITTED TO THE GOVERNING AGENCY AND ARCHITECT/STRUCTURAL ENGINEER.

POWDER ACTUATED FASTENERS (SHOT PINS)
100SN016-1

1. THESE NOTES GOVERN ALL CONDITIONS CALLED OUT ON THE PLANS AS 'SHOT PINS' UNLESS SPECIFICALLY NOTED OTHERWISE.
2. ALL SHOT PINS SHALL BE X-U UNIVERSAL KNURLED SHANK FASTENERS WITH SHANK DIAMETER OF 0.157" AS MANUFACTURED BY HILTI INCORPORATED IN ACCORDANCE WITH ICC ESR-2269 AND THE CURRENT EDITION OF THE HILTI 'PRODUCT TECHNICAL GUIDE.'
3. ALL SHOT PINS SHALL INCLUDE STANDARD HILTI STEEL WASHERS.
4. SHOT PINS DRIVEN INTO STEEL BASE MATERIAL SHALL MAINTAIN A MINIMUM EDGE DISTANCE AT ALL STEEL ELEMENTS OF 1/2" AND MINIMUM FASTENER SPACING SHALL BE 1". LENGTH OF PIN SHALL BE AS REQUIRED TO PENETRATE THRU STEEL MEMBER UNO. AT 3/4" THICK STEEL, PENETRATION NEED NOT EXCEED 1/2".
5. SHOT PINS DRIVEN INTO CONCRETE BASE MATERIAL SHALL MAINTAIN A MINIMUM EDGE DISTANCE AT ALL CONCRETE ELEMENTS OF 3" AND MINIMUM FASTENER SPACING SHALL BE 4". PINS SHALL HAVE 1 1/4" PENETRATION UNO. MINIMUM CONCRETE THICKNESS SHALL BE 3 TIMES THE PENETRATION DEPTH. CONCRETE SHALL ATTAIN FULL DESIGN STRENGTH PRIOR TO INSTALLING SHOT PINS.
6. SHOT PINS DRIVEN INTO 3 1/4" MINIMUM LIGHT WEIGHT CONCRETE FILL OVER 3"X 20GA MINIMUM METAL DECK MAY BE INSTALLED FROM THE TOP OR FROM THE BOTTOM IN EITHER THE HIGH OR LOW FLUTE. PINS INSTALLED FROM THE TOP SHALL BE SPACED AS NOTED ABOVE FOR TYPICAL CONCRETE ELEMENTS. PINS INSTALLED FROM THE BOTTOM IN THE HIGH FLUTES SHALL BE INSTALLED WITHIN 1" OF FLUTE CENTER. PINS INSTALLED FROM THE BOTTOM IN THE LOW FLUTES SHALL BE INSTALLED WITHIN 1" OF THE FLUTE CENTER AND SHALL BE NO CLOSER THAN 1 1/8" TO THE EDGE OF THE LOW FLUTE. PINS INSTALLED FROM THE BOTTOM SHALL BE SPACED NO CLOSER THAN 5 1/2" PARALLEL TO THE FLUTES. PINS SHALL HAVE 1" PENETRATION INTO CONCRETE UNO. CONCRETE SHALL ATTAIN FULL DESIGN STRENGTH PRIOR TO INSTALLING SHOT PINS.
7. SHOT PINS MAY BE DRIVEN INTO 8" NOMINAL MINIMUM THICKNESS FULLY GROUTED NORMAL-WEIGHT CMU WITH TYPE S MORTAR AND MINIMUM F'M = 1500 PSI AT TIME OF INSTALLATION. SHOT PINS MAY BE INSTALLED INTO THE FACE SHELLS, HORIZONTAL MORTAR JOINTS OR VERTICALLY CENTERED IN THE TOP OF GROUTED CELLS. SHOT PINS SHALL NOT BE INSTALLED IN VERTICAL MORTAR JOINTS OR WITHIN 1" OF VERTICAL MORTAR JOINTS. NO MORE THAN ONE SHOT PIN MAY OCCUR IN AN INDIVIDUAL MASONRY UNIT CELL AND MUST BE INSTALLED A MINIMUM OF 4" FROM THE EDGE OF THE WALL. SHOT PINS IN MORTAR JOINTS MUST BE A MINIMUM OF 8" FROM THE END OF THE WALL AND SHALL HAVE A MINIMUM SPACING OF 8".
8. SHOT PIN INSTALLERS SHALL BE CERTIFIED BY HILTI AND HAVE A CURRENT HILTI ISSUED OPERATORS LICENSE. SHOT PIN INSTALLATION SHALL MEET ALL OSHA REQUIREMENTS.

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DATE: 10/01/2020

AGENCY APPROVAL

OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY
CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
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12/07/21
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CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
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REGISTERED PROFESSIONAL ENGINEER
LAWRENCE E. JONES
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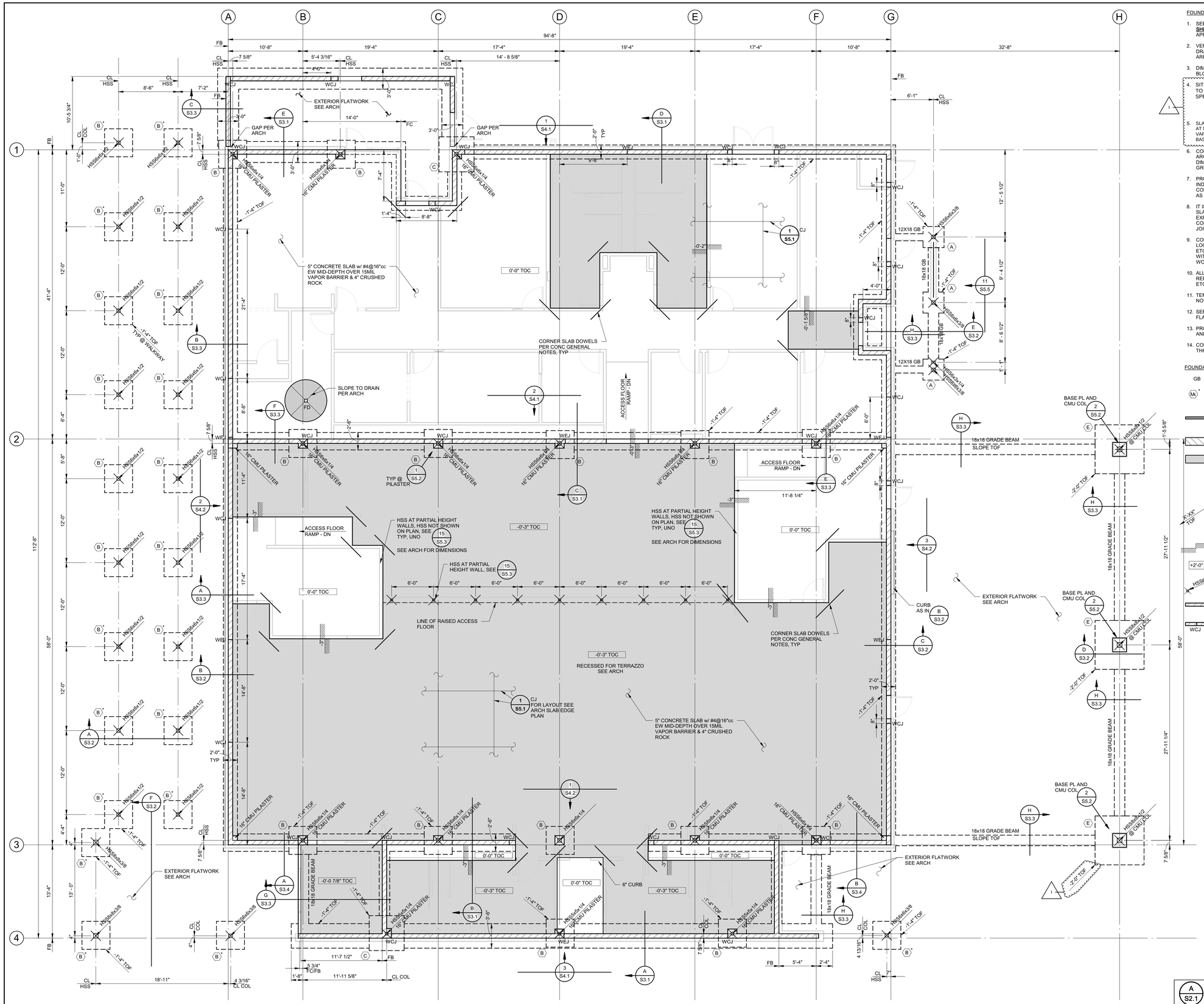
1	ADDENDUM 01	06/01/23

DATE 04/08/2020
JOB NO. DGS 140724
SHEET TITLE
GENERAL NOTES
SHEET NO.
S0.1

V3



FOUNDATION PLAN NOTES

1. SEE **SHEETS S0.1** THRU **S0.2** FOR GENERAL NOTES & **SHEETS S5.1** THRU **S5.3** TYPICAL DETAILS WHICH ARE APPLICABLE TO ALL DRAWINGS UNO.
2. VERIFY ALL BUILDING DIMENSIONS AND ELEVATIONS w/ ARCH DRAWINGS. NOTIFY THE ARCHITECT IMMEDIATELY IF THERE ARE ANY CONFLICTS w/ DIMENSIONS SHOWN.
3. DIMENSIONS SHOWN ARE TO THE CL OF COLUMN OR FACE OF BLOCK UNO.
4. SITE PREPARATION AND BUILDING PAD CONSTRUCTION TO BE DONE IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
5. SLAB ON GRADE SHALL BE 5" THICK CONCRETE w/ #4 @ 16"CC EW AT MID-DEPTH. CONCRETE SHALL BE INSTALLED OVER 15 MIL VAPOR RETARDER OVER 4" UNRECYCLED CLASS 2 AGGREGATE BASE. TOP OF CONCRETE SLAB IS 0'-0" UNO. DATUM ELEV = +305.3'.
6. CONTRACTOR SHALL SUBMIT AN EDGE OF SLAB PLAN TO ARCHITECT & SEOR FOR REVIEW. SUBMITTAL SHALL BE DIMENSIONED AND LOCATED RELATIVE TO STRUCTURAL GRIDS.
7. PROVIDE SLAB ON GRADE CONTROL JOINTS (SJ) AS INDICATED **PER 1/ S5.1** TYP AT ALL INTERIOR SLABS. CONSTRUCTION JOINTS (CJ) MAY REPLACE CONTROL JOINTS AS REQUIRED.
8. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE SLAB CONTROL JOINTS WITH ANY ARCHITECTURALLY EXPOSED SLAB AREAS OR THE LOCATION OF TILE CRACK CONTROL JOINTS. VERIFY SPECIAL CONDITION CONTROL JOINTS WITH ARCH DRAWINGS.
9. CONTRACTOR TO COORDINATE EXACT DIMENSIONS AND LOCATIONS OF THICKENED SLABS, HOUSEKEEPING PADS, ETC. WITH ALL OTHER DISCIPLINE'S DRAWINGS AS WELL AS WITH THE EQUIPMENT PROVIDED, PRIOR TO COMMENCING WORK.
10. ALL DEPRESSIONS, SLOPES, CURBS, ETC. ARE SHOWN FOR REFERENCE ONLY. FOR EXACT DEPTHS, SLOPES, EXTENTS, ETC. SEE OTHER DISCIPLINES' DRAWINGS.
11. TEMPORARY LOADS APPLIED DURING CONSTRUCTION HAVE NOT BEEN CONSIDERED IN SLAB ON GRADE DESIGN.
12. SEE ARCH & CIVIL DRAWINGS FOR ALL EXTERIOR CURBS, FLATWORK, PLANTERS, RAMPS, ETC.
13. PROVIDE 3" MIN. CONCRETE COVER AT STRUCTURAL STEEL AND ANCHOR BOLTS BELOW GRADE, TYP.
14. CONTINUE ALL REINFORCING IN CONTINUOUS FOOTINGS THROUGH SPREAD FOOTINGS, TYP UNO.

FOUNDATION LEGEND

- GB — GRADE BEAM SEE **H/ S3.3**
- (Mk)* — FOOTING PER SCHEDULE **A/ S2.1**, *"T&B" INDICATES ADDITIONAL TOP REINFORCING AS NOTED IN SCHEDULE SHALL BE PLACED @ 2" CLR OF TOP OF FOOTING.
- CONCRETE CURB. FOR CURBS BELOW NON-STRUCTURAL WALLS **SEE 2/ S5.1** & **13/ S5.1**, VERIFY EXACT EXTENT w/ ARCH DWGS.
- CONCRETE OVERBUILD AREA PER **11/ S5.1**. SEE ARCH FOR EXTENT.
- SLOPED AND/OR DEPRESSED SLAB. DEPRESS BUILDING PAD AND PROVIDE FULL SLAB AND BASE THICKNESS. WHERE DEPRESSION IS GREATER THAN 2" AND ADJACENT TO BUILDING FOUNDATION ELEMENT IT MAY BE NECESSARY TO STEP FOOTING IN ORDER TO MAINTAIN MINIMUM FOOTING EMBEDMENT PER SECTIONS. CONTRACTOR TO COORDINATE IN FIELD. SEE **8/ S5.1** & **12/ S5.1**.
- X'-XX" TOF — TOP OF FOOTING ELEVATION WITH RESPECT TO REFERENCE TOP OF CONCRETE (0'-0"). THE BOTTOM OF ALL FOOTINGS SHALL BE AT LEAST 24" BELOW ADJACENT MINIMUM PREPARED BUILDING PAD ELEVATION (ON ALL SIDES), TYP UNO OR AS SHOWN ON SECTIONS.
- SLAB STEP PER **6/ S5.1** & **12/ S5.1**. VERIFY DEPTH W/ ARCH
- +2'-0" — TOP OF CONCRETE SLAB ELEVATION RELATIVE TO REFERENCED TOP OF CONCRETE 0'-0".
- HSS6x6x1/2 — HSS COLUMN & SIZE. FOR BASE PLATE, SEE **1/ S5.3** TYP UNO.
- 8" CMU WALL. FOR REINFORCING, **SEE 5/ S5.2** AND CMU GENERAL NOTES. CONDUITS IN CMU TO BE PER CMU GENERAL NOTES.
- WCJ — WALL CONTROL JOINT **PER 6/ S5.2**.

FOOTING SCHEDULE

A S2.1

Mk	SIZE	REINFORCING
A	3'-0" x 3'-0" x 1'-6" DEEP	(4) #5 EW (B)
B	4'-0" x 4'-0" x 2'-0" DEEP	(5) #5 EW (B)
C	5'-0" x 5'-0" x 2'-0" DEEP	(7) #5 EW (B)
E	7'-0" x 7'-0" x 2'-6" DEEP	(10) #6 EW (B)

NOTE:
1. PLACE BOTTOM OF STEEL 3" CLEAR FROM BOTTOM OF FOOTING.
2. PLACE TOP OF STEEL 2" CLEAR FROM TOP OF FOOTING.

FOUNDATION PLAN — 3/16" = 1'-0"

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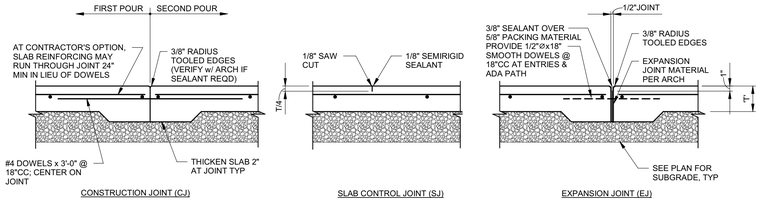
FOUNDATION PLAN

SHEET NO.

S2.1

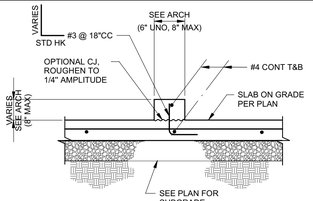
V3



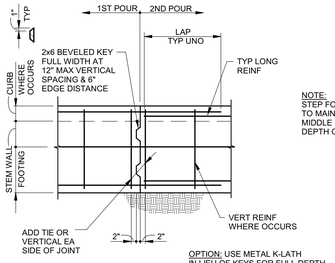
CONSTRUCTION JOINT (CJ) | SLAB CONTROL JOINT (SJ) | EXPANSION JOINT (EJ)

NOTE:
1. CONSTRUCTION JOINTS AND CONTROL JOINTS SHALL DIVIDE SLAB INTO AREAS NOT EXCEEDING 225 SQ FT WITHOUT REENTRANT CORNERS AND WITH LENGTH TO WIDTH RATIOS NOT EXCEEDING 1 1/2 TO 1. JOINT SPACING SHALL NOT EXCEED 15 FEET IN EITHER DIRECTION.
2. CONTRACTOR SHALL SUBMIT LAYOUT PLAN SHOWING PROPOSED CONTROL AND CONSTRUCTION JOINT LOCATIONS TO ARCHITECT & STRUCTURAL ENGINEER FOR REVIEW & APPROVAL.
3. SEMIRIGID SEALANT TO BE EUCLID EUCO #700 OR EQUAL.

DETAIL 1/S5.1 — SLAB ON GRADE JOINTS — NO SCALE



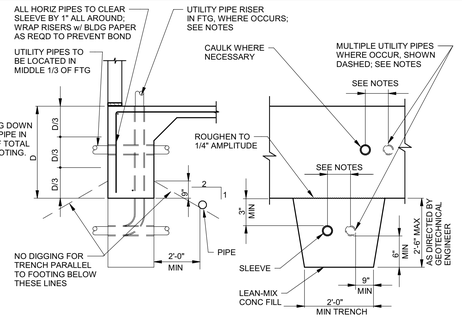
DETAIL 2/S5.1 — CURB AT SLAB ON GRADE — NO SCALE



NOTE: STEP FOOTING DOWN TO MAINTAIN PIPE IN MIDDLE 1/3 OF TOTAL DEPTH OF FOOTING.

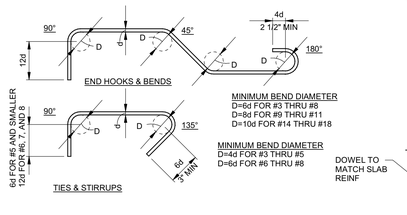
OPTION: USE METAL K-LATH IN LIEU OF KEYS FOR FULL DEPTH OF FOUNDATION AT UNEXPOSED FOUNDATIONS ONLY.

DETAIL 3/S5.1 — TYPICAL FOUNDATION CONSTRUCTION JOINT — NO SCALE



NOTES:
1. THE PROVISIONS HEREIN ARE APPLICABLE TO CONTINUOUS FOOTINGS AND GRADE BEAMS.
2. NO PIPES SHALL BE PLACED BELOW ISOLATED SPREAD FOOTINGS OR WITHIN 2 TO 1 BEARING ZONE AROUND SPREAD FOOTINGS.
3. REINFORCING SHALL NOT BE INTERRUPTED, CUT OR DISPLACED BY PLACEMENT OF UTILITY PIPE.
4. LEAN MIX CONCRETE FILL TO BE PLACED BEFORE FOOTING IS CAST (MONO-POUR FOOTING CONC OPTIONAL.) MAKE SAME WIDTH AS FOOTING AND FULL WIDTH OF PIPE TRENCH.
5. STEP FOOTING IF PIPE OCCURS IN LOWER THIRD OF ORIGINAL FOOTING DEPTH.
6. IF PIPE IS IN PLACE PRIOR TO CASTING CONCRETE, WRAP PIPE w/ 1" STYROFOAM INSULATION IN LIEU OF SLEEVE.
7. UTILITY PIPES ARE NOT ALLOWED PARALLEL IN FOOTING.
8. MULTIPLE UTILITY PIPES (TWO OR MORE) MAY BE INSTALLED AS SHOWN, PROVIDED THEY ARE SPACED A MINIMUM OF (4) PIPE/CONDUIT DIAMETERS ON CENTER WITH A MINIMUM OF 3" OF CONCRETE BETWEEN. PIPE DIAMETER INDICATED IS THE ROUGH HOLE SIZE THRU FOOTING.
9. UTILITY PIPE RISERS MAY OCCUR IN CONTINUOUS FOOTINGS PROVIDED THEY ARE NO LARGER THAN (FOOTING WIDTH/6) AND OCCUR WITHIN THE MIDDLE 1/2 OF THE FOOTING WIDTH. MULTIPLE RISERS MAY OCCUR IF SPACED AS NOTED ABOVE.
10. UTILITY PIPES PERPENDICULAR TO FOOTINGS AND MORE THAN 2'-0" BELOW BOTTOM OF FOOTINGS DO NOT REQUIRE LEAN-MIX CONCRETE ENCASEMENT, SUBJECT TO ACCEPTANCE BY THE GEOTECHNICAL ENGINEER.
11. CONDITIONS NOT CONFORMING TO THE PARAMETERS NOTED ABOVE SHALL BE REVIEWED ON A CASE-BY-CASE BASIS.

DETAIL 4/S5.1 — CONCRETE FOOTINGS AT UTILITY PIPES AND CONDUIT — NO SCALE

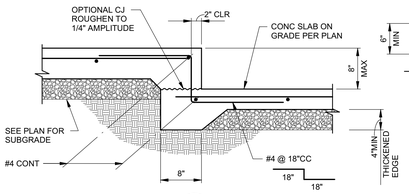


MINIMUM BEND DIAMETER
D=6d FOR #3 THRU #8
D=8d FOR #9 THRU #11
D=10d FOR #14 THRU #18

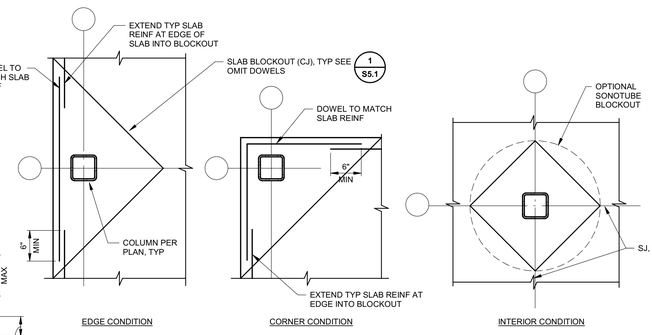
MINIMUM BEND DIAMETER
D=4d FOR #3 THRU #5
D=6d FOR #6 THRU #8

NOTE: ALL HOOKS SHALL BE 90° OR 180° STANDARD HOOKS UNLESS OTHERWISE SHOWN OR NOTED.

DETAIL 5/S5.1 — STANDARD REBAR HOOKS AND BENDS — NO SCALE

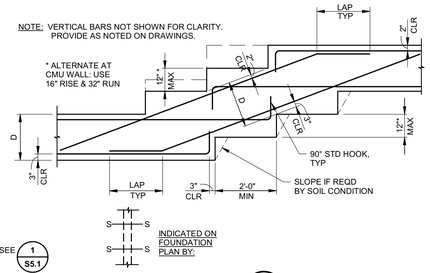


DETAIL 6/S5.1 — STEP IN SLAB — NO SCALE

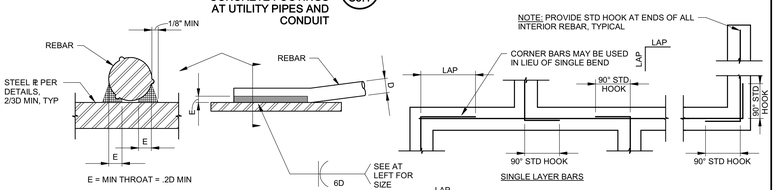


NOTE:
1. SLAB BLOCKOUT SHALL NOT EXTEND BEYOND FOOTING.
2. AT EXPOSED CONCRETE CONDITIONS, COORDINATE BLOCKOUT SHAPE AND SIZE w/ ARCH DWGS.

DETAIL 7/S5.1 — SLAB BLOCKOUT — NO SCALE

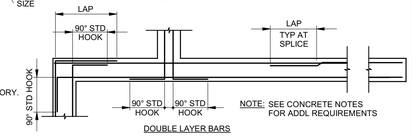


DETAIL 8/S5.1 — TYPICAL FOOTING STEP — NO SCALE



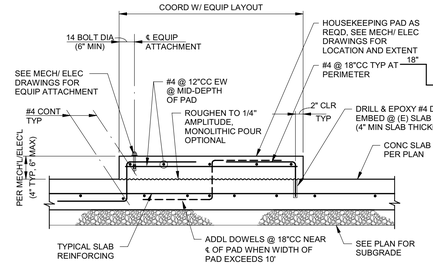
NOTES:
1. REINFORCING TO BE WELDED, EXCEPT ASTM A706, SHALL CONFORM TO THE MATERIAL PROPERTY REQUIREMENTS OF ANSI/AWS D1.4, NEWEST EDITION.
2. ALL PREHEATING AND WELDING SHALL BE DONE IN ACCORDANCE WITH ANSI/AWS D1.4, NEWEST EDITION.
3. ALL WELDING SHALL BE CONTINUOUSLY INSPECTED BY A QUALIFIED LABORATORY.

DETAIL 9/S5.1 — REBAR WELDING — NO SCALE

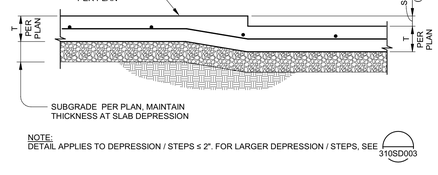


NOTE: SEE CONCRETE NOTES FOR ADDL REQUIREMENTS

DETAIL 10/S5.1 — CORNER REINFORCING AT CONCRETE FTGS — NO SCALE

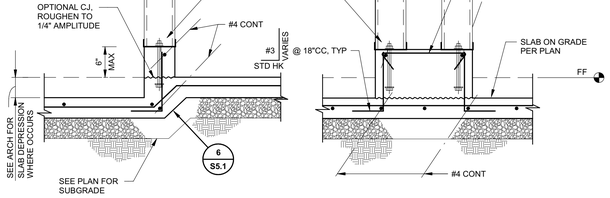


DETAIL 11/S5.1 — HOUSEKEEPING PAD AT SLAB ON GRADE — NO SCALE

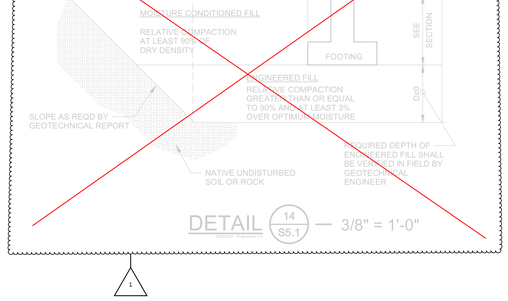


NOTE: DETAIL APPLIES TO DEPRESSION / STEPS ≤ 2". FOR LARGER DEPRESSION / STEPS, SEE 310SD003

DETAIL 12/S5.1 — SLAB DEPRESSION — NO SCALE



DETAIL 13/S5.1 — CURB AT SLAB DEPRESSION — NO SCALE



DETAIL 14/S5.1 — 3/8" = 1'-0"

1

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CONCRETE DETAILS

SHEET NO.

S5.1

V3

State of California • Department of General Services • Gavin Newsom, Governor
REAL ESTATE SERVICES DIVISION
Project Management and Development Branch
Architecture and Engineering Sections 1 & 2
707 Third St., Suite 4-105 • West Sacramento, California 95605-2811

ADDITIONAL DETAILED INSTRUCTIONS

ADI: 001

PROJECT: DMV Delano Field Office **DATE: June 29, 2022**

CLIENT AGENCY: California Department of Motor Vehicles
LOCATION: 448 Dover Parkway Delano, CA **WORK ORDER:**
CONTRACT:

CONTRACTOR:	**PROJECT DIRECTOR:**
Bernards **555 First Street** **San Fernando, CA 91340** Tel: (818) 898 1521 Fax: (818) 361 9208	**Ryan Beck** State of California, DGS, RESD, PMDB 707 Third St., Suite 04-105 West Sacramento, CA 95605 Tel: (916) 628-8192 Fax:

SUBJECT:	**REFERENCE DOCUMENTS:**
Steel and Miscellaneous Metal Revisions	See Below

Description:
S2.2 – Add (8) C8 members between joists at low roof per attached drawing.

S2.3 – Add detail references at grid F and G on grid line 2; Add C5x6.7 blocking above W12x26 between Grids G an H south of Grid 2 and just north of grid 3 along with welding notation; Add Detail reference 9/A5.6 at column at Grid 3/F; Add Detail Reference 10/A5.6 at Grid 3/G; Add detail reference 9/S5.6 at columns at Grids 2/B and 3/B; Add (14) C8 blocking between 2- joist bays East of grid B between Grids 2, and 3; Add C12 x20.7 ledgers along grid line 2 between grids A & B and between grid lines F&G, and along grid line 3 between grids A&B and between grids F&G.

S3.3 – At Detail D clarified C5 location (shown in floor plan); At Detail E clarified C12 location added at framing plan; At Detail clarified C12 location added at framing plan.

S3.4 -At Detail A clarified location of C12 x 20.7 (added at framing plan) and added attachment notes and detail 9/S5.6 reference.; At Detail B clarified C12 location (added at framing plan)

S4.1 – At Elevation 2, Between Grids A&B and between grids F&G add reference to C12 (added at framing plan)

S4.2 – At Elevation 1, Between Grids A&B and between grids F&G add reference to C12 and a reference to detail 9/A5.6 (added at framing plan)

S5.6 – Revised details 9, and 10

A7.50 – At Keynotes, Add: "29 COUTERTOP SUPPORT. SEE DETAIL 12/A8.40; At Elevation 2 Add: callout for keynote 29 identifying support post at corner of writing counter west of the exit door; At Elevation 5 Add keynote 29 callout to added support post east end of solid surface counter.; At Elevation 6 added keynote 29 callout at support posts at east and west ends of Start Here counter and Camera Counters.

A8.40 – Added Detail 12 Counter Support Post @ Exposed Corners; At Detail 6: Added dimensioning references and removed welded angle.

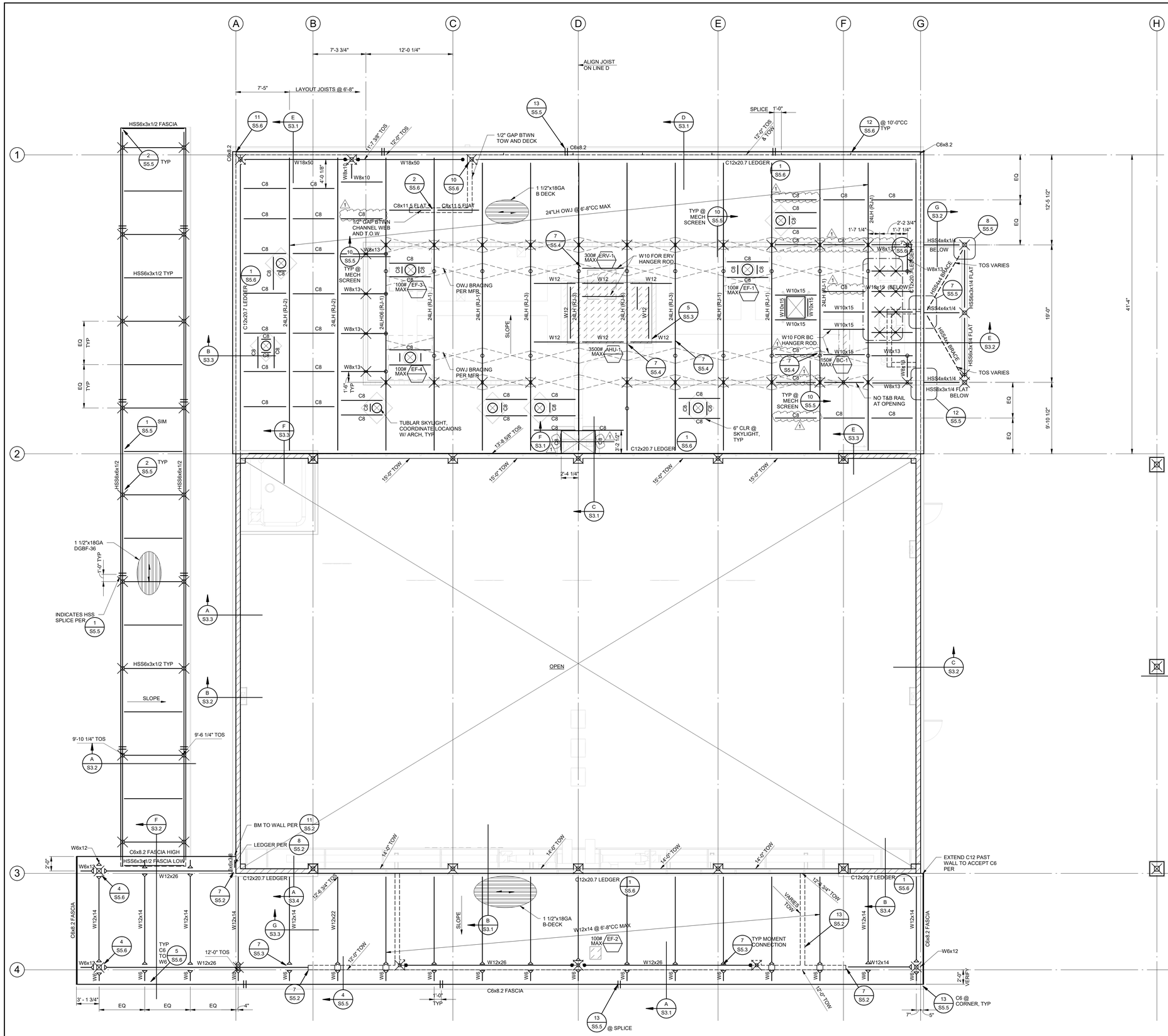
The Work shall be carried out in accordance with these supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. **Proceeding with Work in accordance with these instructions indicates acceptance without change in the Contract Amount or Contract Duration.** It is the Contractor's responsibility to inform subcontractors, vendors and staff of these remarks to the design and/or construction.

Signed: _____ Date: _____

Ryan Beck
State of California, DGS, RESD, PMDB
707 Third St., Suite 04-105
West Sacramento, CA 95605

Tel: (916) 628-8192 Fax:

cc:



LOW ROOF FRAMING PLAN — 3/16" = 1'-0"

ROOF FRAMING PLAN NOTES:

1. SEE **SHEETS S0.1** THRU **S0.2** FOR GENERAL NOTES **SHEETS S5.1** THRU **S5.3** FOR TYPICAL DETAILS WHICH ARE APPLICABLE TO ALL DRAWINGS UNO.
2. VERIFY ALL BUILDING DIMENSIONS AND ELEVATIONS w/ ARCH DRAWINGS. NOTIFY THE ARCHITECT IMMEDIATELY IF THERE ARE ANY CONFLICTS w/ DIMENSIONS SHOWN.
3. DIMENSIONS SHOWN ARE TO CL OF COLUMN OR FACE OF BLOCK.
4. FOR TYPICAL STEEL DETAILS, SEE **SHEETS S5.3** THRU **S5.4**.
5. CONTRACTOR SHALL SUBMIT AN EDGE OF SLAB PLAN TO ARCHITECT & SEOR FOR REVIEW. SUBMITTAL SHALL BE DIMENSIONED AND LOCATED RELATIVE TO STRUCTURAL GRIDS.
6. ALL BEAMS SHALL BE EQUALLY SPACED BETWEEN DIMENSIONED COLUMNS, GRIDS, OR BEAMS WHERE OCCURS, TYP UNO.
7. FOR TYPICAL BEAM TO BEAM CONNECTION, SEE **5/ S5.3** OR **6/ S5.3** UNO.
8. FOR TYPICAL BEAM TO COLUMN CONNECTION, SEE **3/ S5.3**
9. ALL WELDS AT CONNECTIONS INDICATED AS ▶ ● ●● ◆ ◆◆ SHALL BE MADE w/ FILLER METALS IN ACCORDANCE w/ AWS D1.8 CLAUSES 6.1, 6.2, & 6.3. FOR DEMAND CRITICAL WELD REQUIREMENTS, SEE NOTES ON FRAME DETAIL **SHEET S5.5**.
10. VERIFY ALL ROOF OPENINGS, LOCATIONS, & DIMENSIONS WITH ARCH DWGS PRIOR TO FABRICATION AND DETAILING. ALL FLOOR OPENINGS SHALL BE REINFORCED AS SHOWN ON TYPICAL METAL DECK **SHEET S5.3 AND S5.4**. ADDL W/ BLKG MAY BE REQD AT FLOOR OPNGS AS SHOWN ON PLAN OR WHERE OPNGS EXCEED PROVISIONS OF TYPICAL DETAILS.
11. CONTRACTOR TO COORDINATE EXACT LOCATION OF FRAMING MEMBERS SUPPORTING MECHANICAL UNITS & SIMILAR ITEMS NOT DIMENSIONED ON PLANS.
12. ALL VISUALLY EXPOSED STEEL SHALL MEET "ARCHITECTURALLY EXPOSED STRUCTURAL STEEL" REQUIREMENTS. SEE ARCH DWGS AND SPECS.

ROOF FRAMING LEGEND

- ROOF OPENING. LOCATE OPENING PER AMEP DRAWINGS. FOR SUPPORT SEE **11/ S5.3**. OR SEE PLANS FOR OPENING FRAMING.
- X'-XX" TOS — ELEVATION OF TOP OF STEEL FRAMING AND BOTTOM OF METAL DECK.
- BARE METAL DECK (2 SPAN MIN). ORIENTATION AS SHOWN ON PLAN. PROVIDE DECK WELDING TO ALL BEAMS PER **D/ S5.3**.
- W6 — W6x12 TYP, UNO.
- W10 — W10x12 TYP, UNO.
- W12 — W12x14 TYP, UNO.
- W14 — W14x22 TYP, UNO.
- C8 — C8x11.5 TYP, UNO.
- C12 — C12x20.7 TYP, UNO.
- C5 — C5x9 TYP, UNO.
- L4 — L4x4x1/4 TYP, UNO
- ▷ — WF NON-FRAME MOMENT CONNECTION, SEE **7/ S5.3**.
- ● ●● — SINGLE (●) OR DOUBLE (●●) ROW 'SLIP-CRITICAL' BOLTED CONNECTION PER **9/ S5.5**.
- HSS COLUMN. SIZE INDICATED AT BASE LEVEL OF COLUMN ONLY.
- MECHANICAL UNIT. ALL BLOCKING BEAMS SHALL BE W10x12 UNO AND SHALL BE LOCATED DIRECTLY BELOW UNIT EDGES AND/OR CURBS. SEE MECHANICAL UNIT SCHEDULE FOR WEIGHTS AND ATTACHMENT OF UNIT/CURBS TO STRUCTURE. FOR ADDITIONAL INFORMATION, SEE MECHANICAL DRAWINGS.
- XX# AHU Mk — MECHANICAL UNIT TYPE MARK w/ MAX OPERATING WEIGHT INDICATED.
- SOLID GROUTED CMU WALL. SEE FOUNDATION PLAN
- SOLID GROUTED CMU WALL BELOW.
- XX'-XX" TOW — TOP OF WALL ELEVATION ABOVE REFERENCE TOP OF CONCRETE (0'-0").
- INDICATEDS TYPICAL FASCIA SPLICE LOCATION, SEE **13/ S5.5**
- INDICATES OWJ X-BRIDGING TO BE PROVIDED BY JOIST MFR.

A/S2.2 MECHANICAL EQUIPMENT SCHEDULE

ID	MAX WEIGHT	DETAIL
AHU-1	3500#	6/M5.02
BC-1	150#	10/M5.02
CU-1	250#	9/M5.02
EF-1	100#	9/M5.01
EF-2	100#	9/M5.01
EF-3	100#	9/M5.01
EF-4	100#	9/M5.01
ERV-1	300#	8/M5.02
VRF-1	450#	9/M5.02

AGENCY APPROVAL

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DELANO, CA

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

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Reviewed by:

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ARCHITECT

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NO.	DESCRIPTION	DATE
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DATE 04/08/2020

JOB NO. DGS 140724

SHEET TITLE

LOW ROOF FRAMING PLAN

SHEET NO.

S2.2

ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT

ROOF FRAMING PLAN — 3/16" = 1'-0"

ROOF FRAMING PLAN NOTES:

1. SEE **SHEETS S0.1** THRU **S0.2** FOR GENERAL NOTES **SHEETS S5.1** THRU **S5.3** FOR TYPICAL DETAILS WHICH ARE APPLICABLE TO ALL DRAWINGS UNO.
2. VERIFY ALL BUILDING DIMENSIONS AND ELEVATIONS w/ ARCH DRAWINGS. NOTIFY THE ARCHITECT IMMEDIATELY IF THERE ARE ANY CONFLICTS w/ DIMENSIONS SHOWN.
3. DIMENSIONS SHOWN ARE TO CL OF COLUMN OR FACE OF BLOCK.
4. FOR TYPICAL STEEL DETAILS, SEE **SHEETS S5.3** THRU **S5.4** .
5. CONTRACTOR SHALL SUBMIT AN EDGE OF SLAB PLAN TO ARCHITECT & SEOR FOR REVIEW. SUBMITTAL SHALL BE DIMENSIONED AND LOCATED RELATIVE TO STRUCTURAL GRIDS.
6. ALL BEAMS SHALL BE EQUALLY SPACED BETWEEN DIMENSIONED COLUMNS, GRIDS, OR BEAMS WHERE OCCURS, TYP UNO.
7. FOR TYPICAL BEAM TO BEAM CONNECTION, SEE **5/ S5.3** OR **6/ S5.3** UNO.
8. FOR TYPICAL BEAM TO COLUMN CONNECTION, SEE **3/ S5.3** .
9. ALL WELDS AT CONNECTIONS INDICATED AS ▶ ● ●● ◆ ◆◆, SHALL BE MADE w/ FILLER METALS IN ACCORDANCE w/ AWS D1.8 CLAUSES 6.1, 6.2, & 6.3. FOR DEMAND CRITICAL WELD REQUIREMENTS, SEE NOTES ON FRAME DETAIL **SHEET S5.5** .
10. VERIFY ALL ROOF OPENINGS, LOCATIONS, & DIMENSIONS WITH ARCH DWGS PRIOR TO FABRICATION AND DETAILING. ALL FLOOR OPENINGS SHALL BE REINFORCED AS SHOWN ON TYPICAL METAL DECK **SHEET S5.3 AND S5.4** . ADDL WF BLKG MAY BE REQD AT FLOOR OPNGS AS SHOWN ON PLAN OR WHERE OPNGS EXCEED PROVISIONS OF TYPICAL DETAILS.
11. CONTRACTOR TO COORDINATE EXACT LOCATION OF FRAMING MEMBERS SUPPORTING MECHANICAL UNITS & SIMILAR ITEMS NOT DIMENSIONED ON PLANS.
12. ALL VISUALLY EXPOSED STEEL SHALL MEET "ARCHITECTURALLY EXPOSED STRUCTURAL STEEL" REQUIREMENTS. SEE ARCH DWGS AND SPECS.

ROOF FRAMING LEGEND

- ROOF OPENING. LOCATE OPENING PER AMEP DRAWINGS. FOR SUPPORT SEE **11/ S5.3** , OR SEE PLANS FOR OPENING FRAMING.
- X'-XX" TOS — ELEVATION OF TOP OF STEEL FRAMING AND BOTTOM OF METAL DECK.
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- W6 — W6x12 TYP, UNO.
- W10 — W10x12 TYP, UNO.
- W12 — W12x14 TYP, UNO.
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- C8 — C8x11.5 TYP, UNO.
- C12 — C12x20.7 TYP, UNO.
- C5 — C5x9 TYP, UNO.
- L4 — L4x4x1/4 TYP, UNO
- ▷ — WF NON-FRAME MOMENT CONNECTION, SEE **7/ S5.3.**
- ● ●● — SINGLE (●) OR DOUBLE (●●) ROW 'SLIP-CRITICAL' BOLTED CONNECTION PER **9/ S5.5.**
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- AHU Mk — XX# — MECHANICAL UNIT TYPE MARK w/ MAX OPERATING WEIGHT INDICATED.
- SOLID GROUTED CMU WALL. SEE FOUNDATION PLAN
- SOLID GROUTED CMU WALL BELOW.
- +XX'-X" TOW — TOP OF WALL ELEVATION ABOVE REFERENCE TOP OF CONCRETE (0'-0").
- INDICATEDS TYPICAL FASCIA SPLICE LOCATION, SEE **13/ S5.5**
- INDICATES OWJ X-BRIDGING TO BE PROVIDED BY JOIST MFR.

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Reviewed by:

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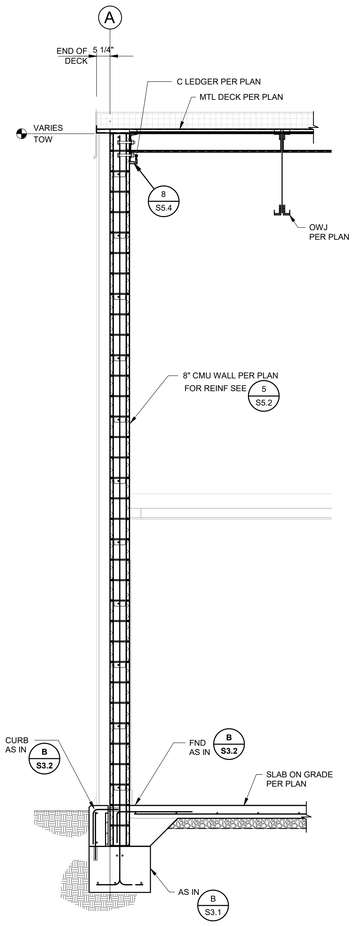
SHEET TITLE

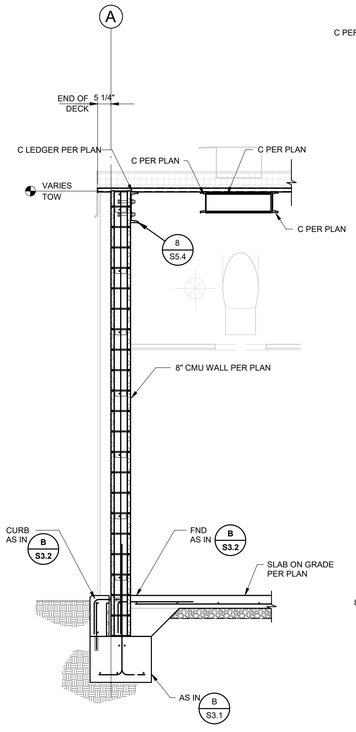
ROOF FRAMING PLAN

SHEET NO.

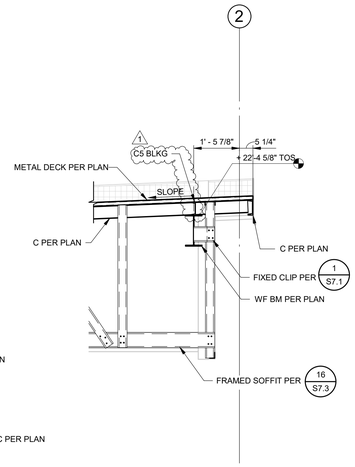
S2.3



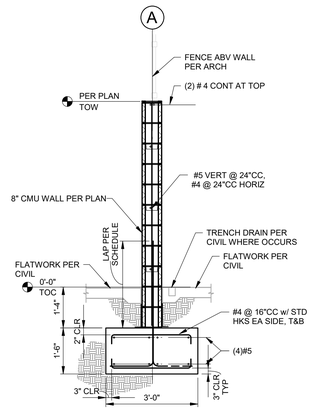
SECTION A S3.3 1/2" = 1'-0"



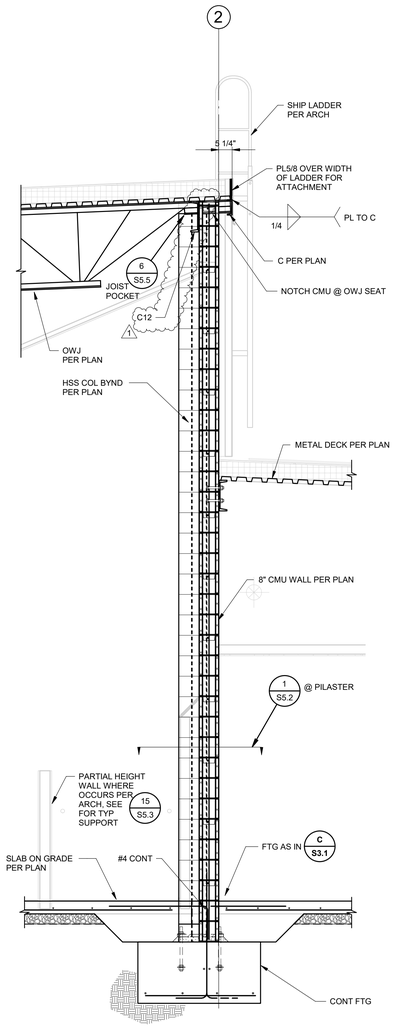
SECTION B S3.3 1/2" = 1'-0"



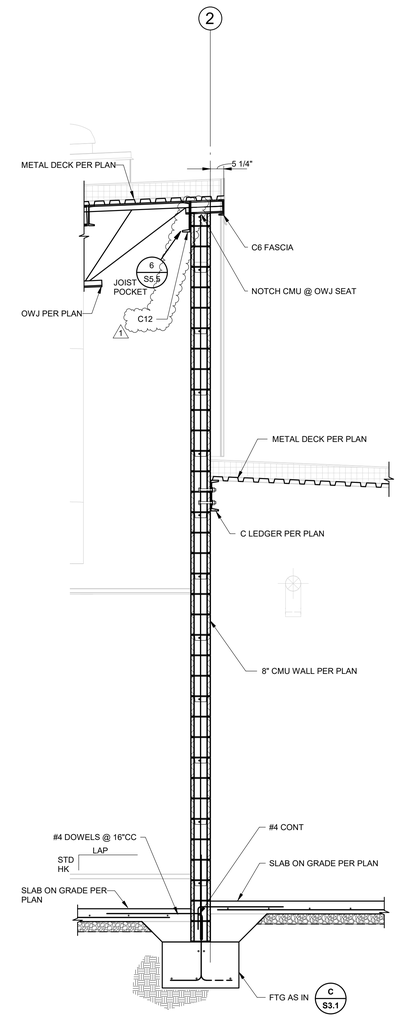
SECTION D S3.3 1/2" = 1'-0"



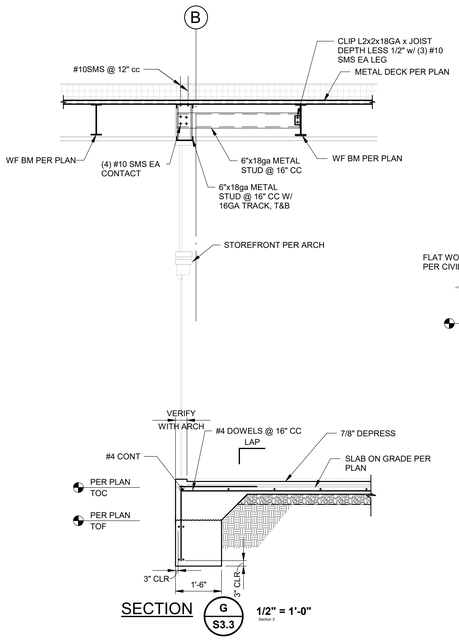
SECTION C S3.3 1/2" = 1'-0"

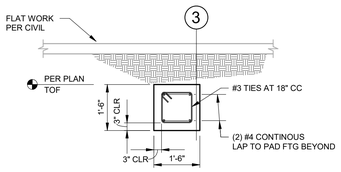


SECTION E S3.3 1/2" = 1'-0"



SECTION F S3.3 1/2" = 1'-0"





SECTION H S3.3 — 1/2" = 1'-0"

SECTION G S3.3 1/2" = 1'-0"

AGENCY APPROVAL

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DELANO, CA

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Reviewed by:

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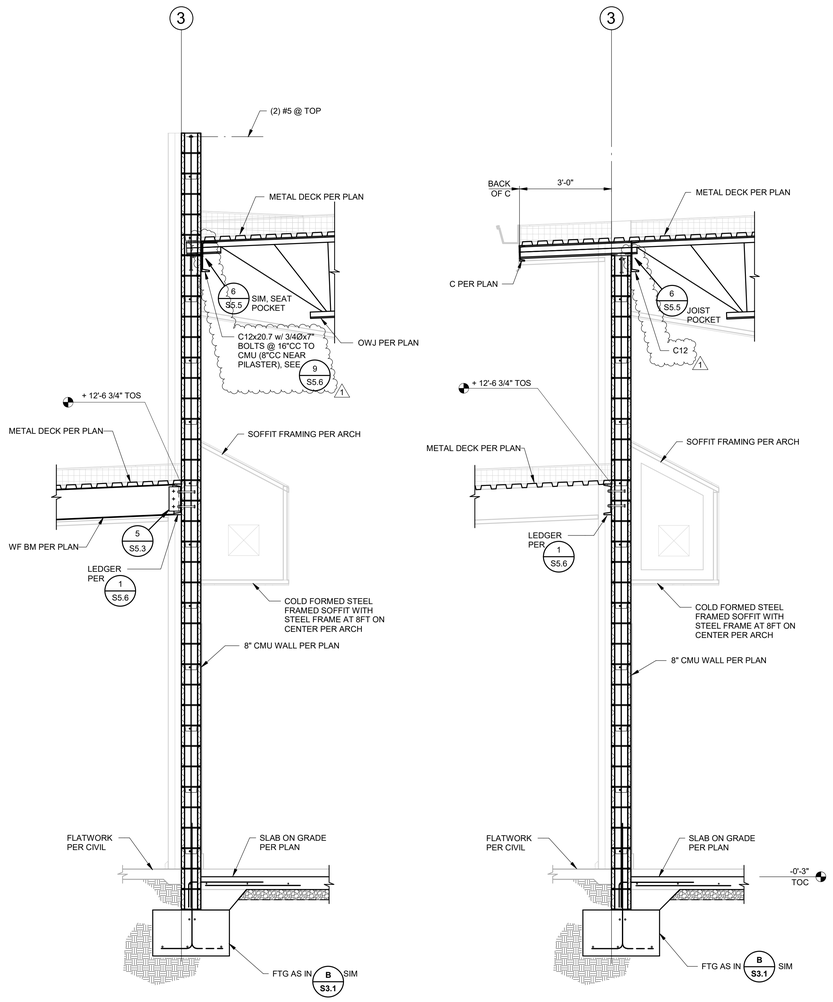
SHEET TITLE

SECTIONS

SHEET NO.

S3.3



SECTION A S3.4 1/2" = 1'-0"

SECTION B S3.4 1/2" = 1'-0"

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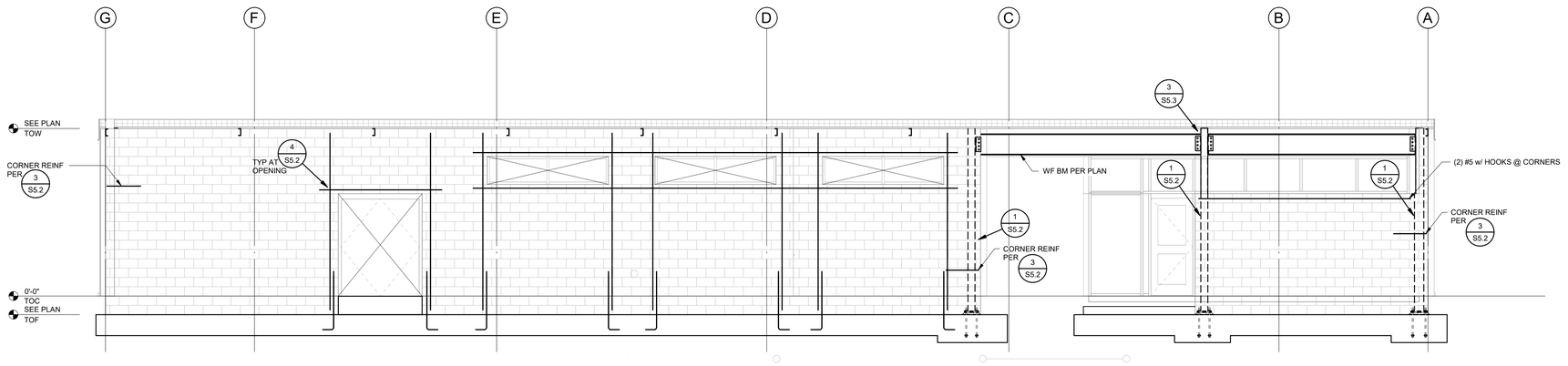
SHEET TITLE

SECTIONS

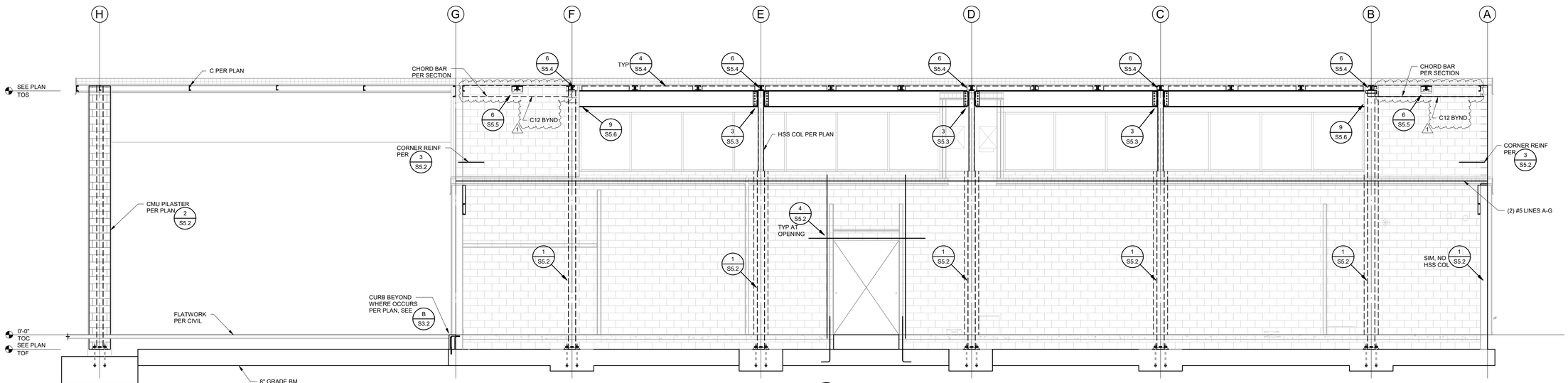
SHEET NO.

S3.4

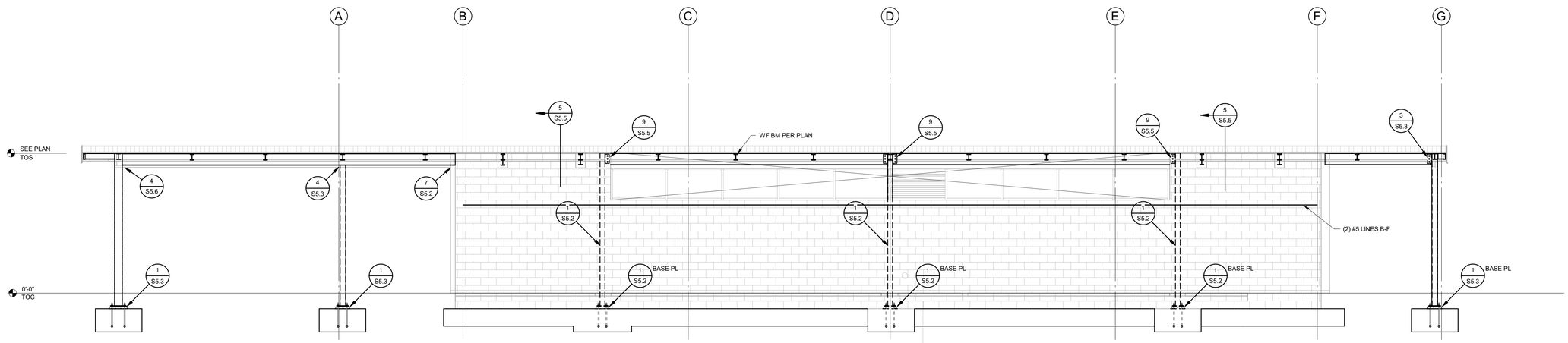
ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT



ELEVATION 1 S4.1 — 1/4" = 1'-0"



ELEVATION 2 S4.1 — 1/4" = 1'-0"



ELEVATION 3 S4.1 — 1/4" = 1'-0"

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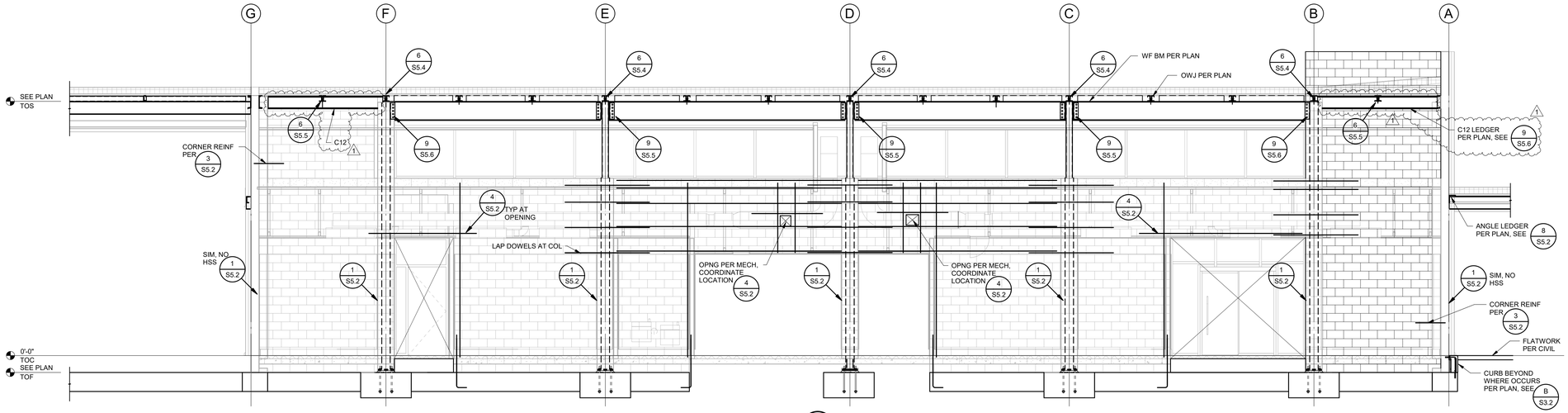
ELEVATIONS

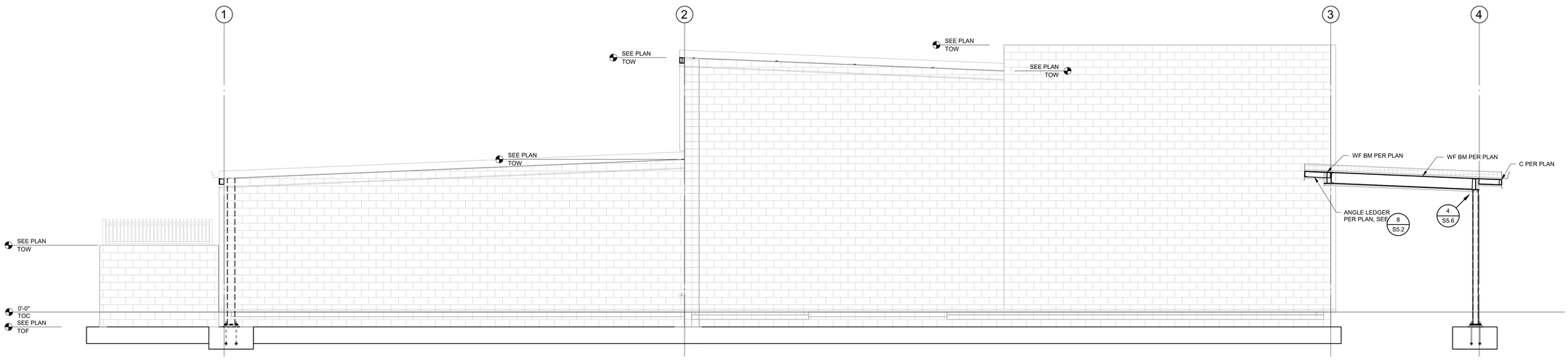
SHEET NO.

S4.1

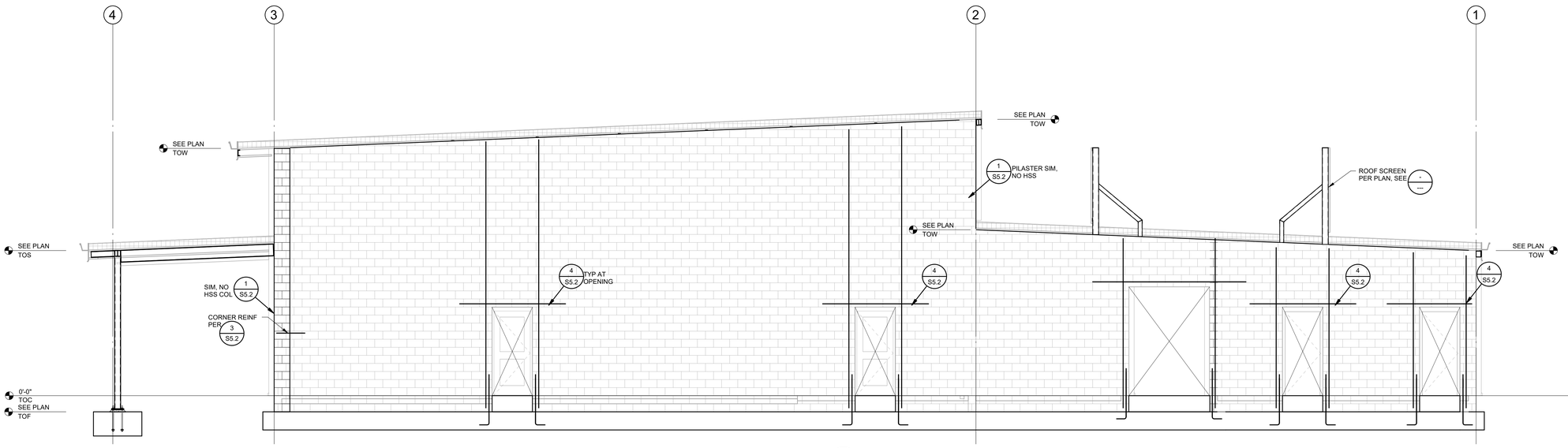
ONE INCH = TWENTY FEET
ONE-HALF INCH = TEN FEET
ONE-QUARTER INCH = FIVE FEET
ONE-EIGHTH INCH = TWO AND ONE-HALF FEET
ONE-SIXTEENTH INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT



ELEVATION 1 S4.2 — 1/4" = 1'-0"



ELEVATION 2 S4.2 — 1/4" = 1'-0"



ELEVATION 3 S4.2 — 1/4" = 1'-0"

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REGISTERED PROFESSIONAL ENGINEER LAWRENCE B. JONES No. 3138 STRUCTURAL STATE OF CALIFORNIA

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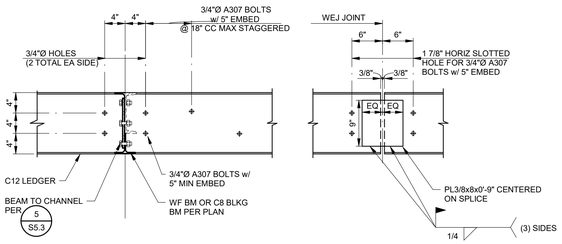
SHEET TITLE

ELEVATIONS

SHEET NO.

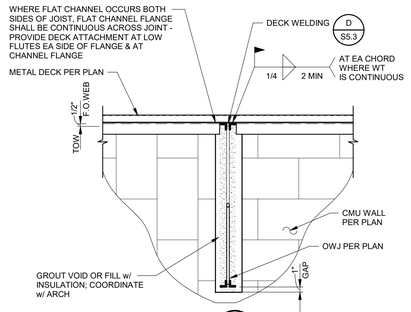
S4.2

ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT

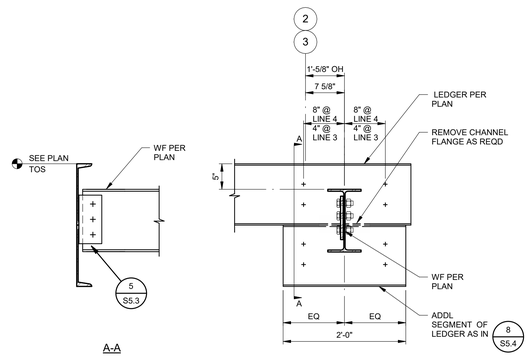


WF TO C12 LEDGER TYP

DETAIL 1 S5.6 — 1" = 1'-0"

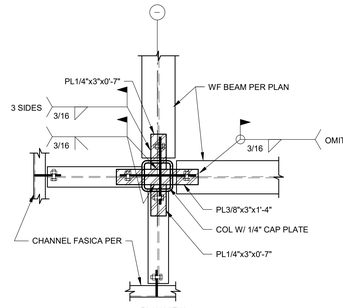


DETAIL 2 S5.6 — 1" = 1'-0"

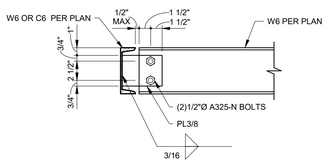


A-A

DETAIL 3 S5.6 — 1" = 1'-0"

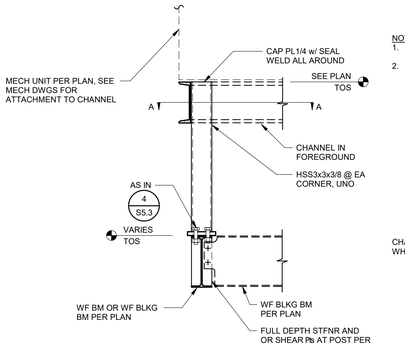


DETAIL 4 S5.6 — 1" = 1'-0"



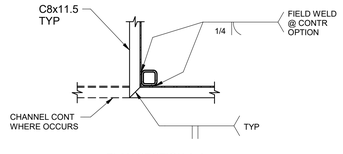
TYPICAL W6 TO C6 CONNECTION

DETAIL 5 S5.6 — 1 1/2" = 1'-0"

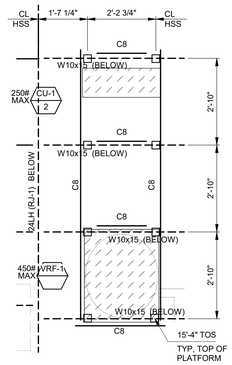


DETAIL 8 S5.6 — NO SCALE

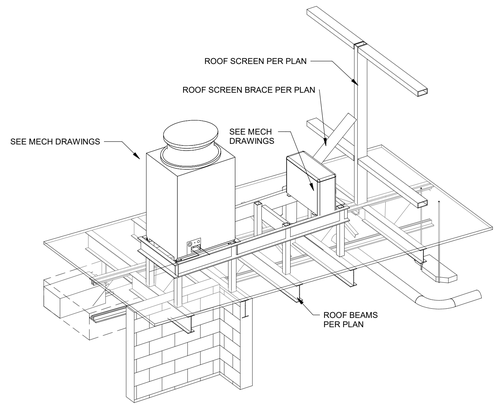
NOTES:
1. CONTRACTOR TO COORD LOCATION OF MECH UNITS, SUPPORT FRAMES & BLKG BEAMS.
2. ALL EXPOSED STEEL SHALL BE GALVANIZED.



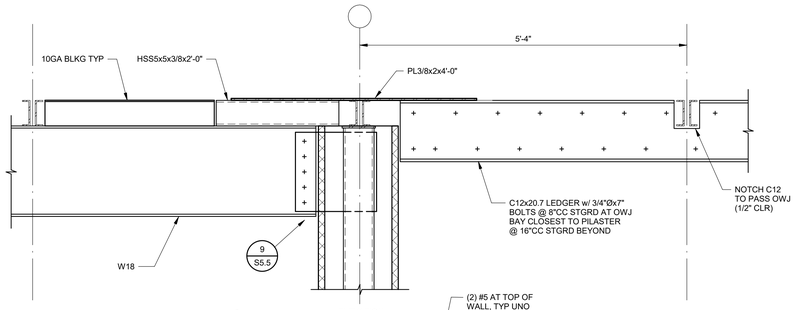
PLAN SECTION A-A



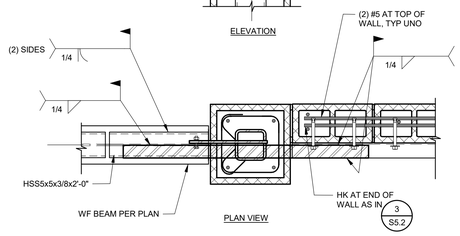
PARTIAL PLAN 7 S5.6 — 1/2" = 1'-0"



PARTIAL PLAN 6 S5.6 —

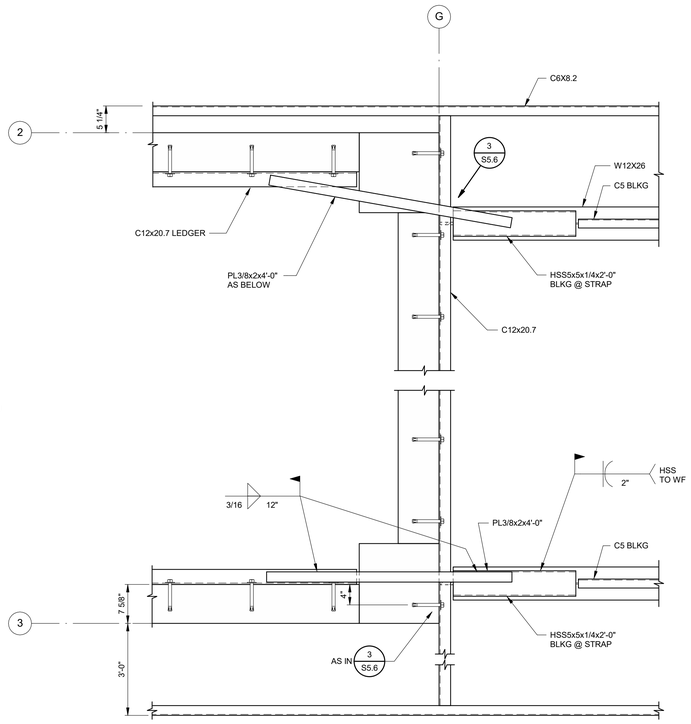


ELEVATION

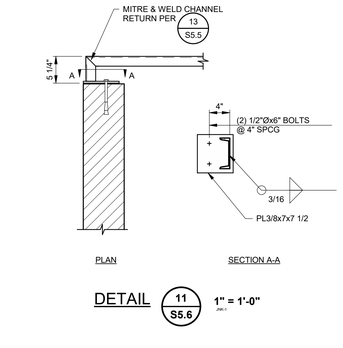


PLAN VIEW

DETAIL 9 S5.6 — 1" = 1'-0"

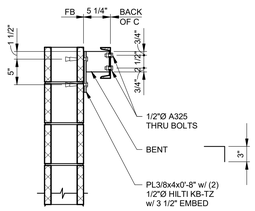


DETAIL 10 S5.6 — 1" = 1'-0"



PLAN SECTION A-A

DETAIL 11 S5.6 — 1" = 1'-0"



DETAIL 12 S5.6 — 1" = 1'-0"

AGENCY APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES
DELANO, CA

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

CALIFORNIA STATE FIRE MARSHAL APPROVED

Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

Reviewed by:

BUEHLER
600 Q STREET, SUITE 200
SACRAMENTO, CA 95811
916 443 0303

CONSULTANT
nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
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ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI-001	6/29/22

DATE 04/08/2020

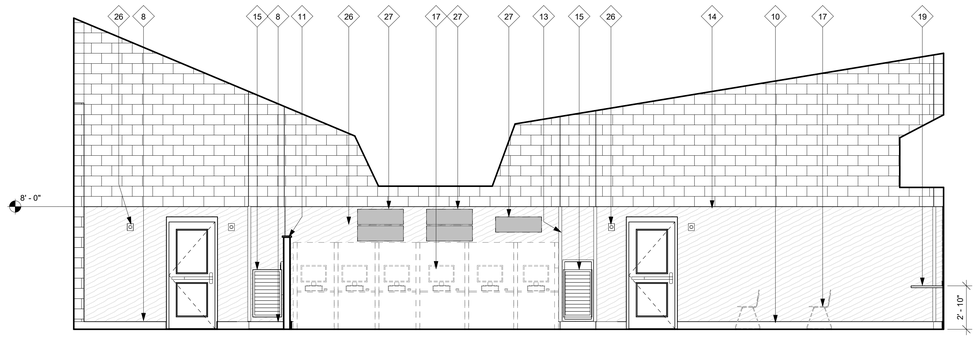
JOB NO. DGS 140724

SHEET TITLE

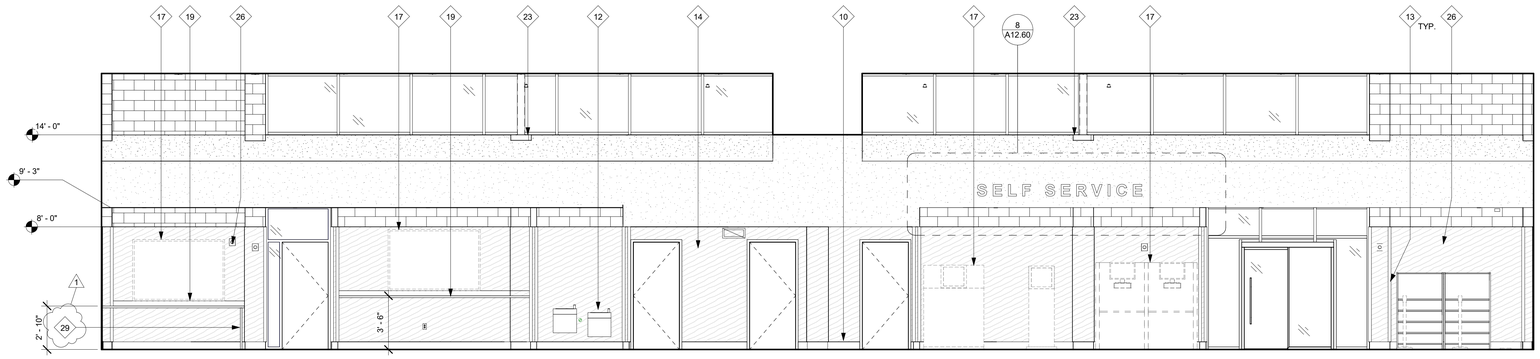
DETAILS

SHEET NO.

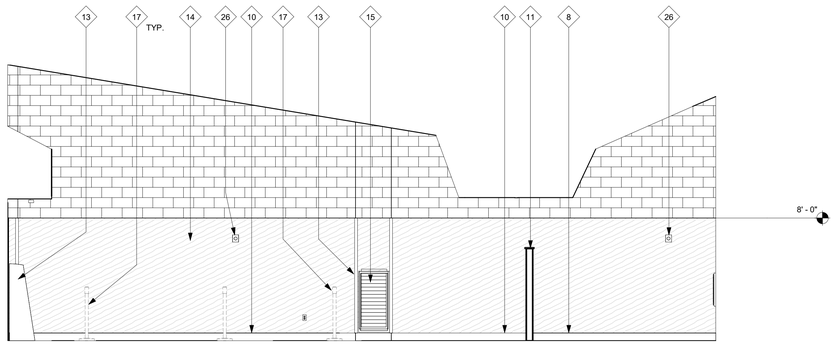
S5.6



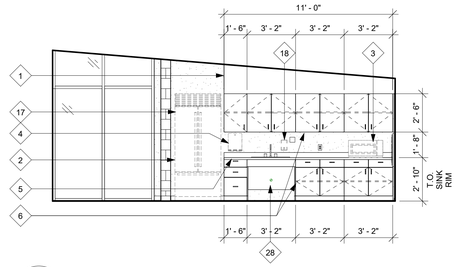
1 PUBLIC AREA - EAST
1/4" = 1'-0"



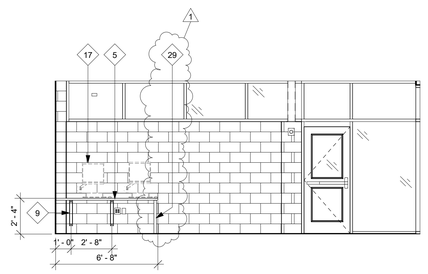
2 PUBLIC AREA - SOUTH
1/4" = 1'-0"



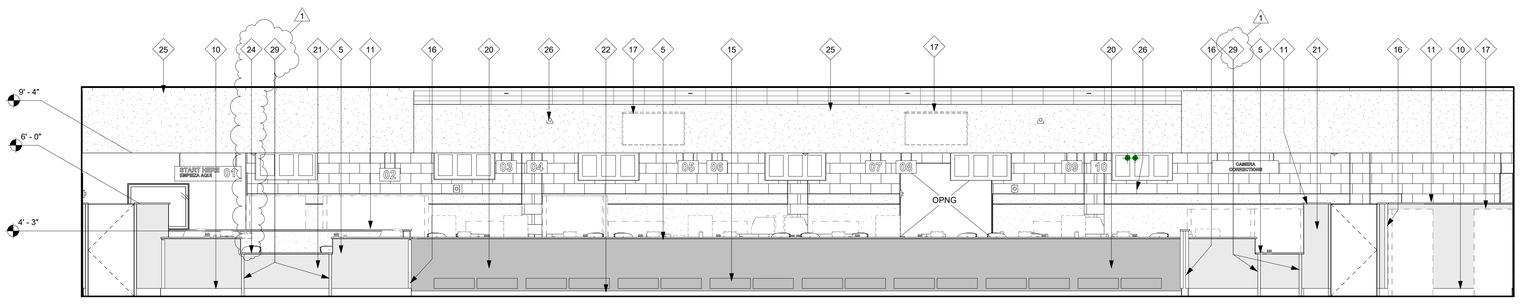
3 PUBLIC AREA - WEST
1/4" = 1'-0"



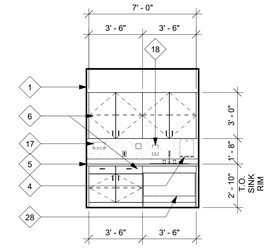
4 EMPLOYEE ROOM - EAST
1/4" = 1'-0"



5 EMPLOYEE ROOM - NORTH
1/4" = 1'-0"



6 PUBLIC AREA - NORTH
1/4" = 1'-0"



7 LACTATION
1/4" = 1'-0"

KEYNOTES:
THESE KEYNOTES APPLY TO THIS SHEET ONLY

1. PLASTIC LAMINATE CLOSURE PANEL, PLAM-1. SEE A11.10 FOR FINISH SCHEDULE.
2. OFOI REFRIGERATOR. SEE SHEET A10.00 FOR EQUIPMENT. SEE ELECTRICAL DRAWINGS FOR POWER REQUIREMENTS AND PLUMBING SHEETS FOR WATER SUPPLY.
3. OFOI MICROWAVE. SEE SHEET A10.00 FOR EQUIPMENT. SEE ELECTRICAL DRAWINGS FOR POWER REQUIREMENTS.
4. AUTOMATIC PAPER TOWEL DISPENSER. 10 28 00
5. SOLID SURFACE COUNTERTOP AND 4" BACKSPLASH (WHERE SHOWN), SOSU. SEE A11.10 FOR FINISH SCHEDULE.
6. PLASTIC LAMINATE FINISH, PLAM-1. SEE A11.10 FOR FINISH SCHEDULE.
7. CASEWORK OPEN FOR ACCESSIBILITY. SEE DETAIL 4/A8.40.
8. 6" RUBBER BASE. SEE A11.10 FOR FINISH SCHEDULE.
9. STAINLESS STEEL COUNTER SUPPORT BRACKET. SEE DETAIL 11/A8.40.
10. 6" TERRAZZO BASE, TYP. SEE DETAIL 8/A3.1.
11. SOLID SURFACE WALL CAP, SOSU-1. SEE FINISH SCHEDULE AND 11/A8.00.
12. BI-LEVEL DRINKING FOUNTAIN.
13. SS CORNER GUARDS AT ALL EXTERIOR CORNERS.
14. FRL-1 FINISH, SEE FINISH SCHEDULE.
15. MECHANICAL REGISTER. SEE MECHANICAL DRAWINGS.
16. SS CORNER GUARD, CUSTOM HEIGHT.
17. FURNITURE/EQUIPMENT SHOWN DASHED. SEE SHEET A10.00.
18. WALL MOUNTED SOAP DISPENSER.
19. WRITING COUNTERTOP. SEE 11/A8.40.
20. FRL-2 FINISH, SEE FINISH SCHEDULE.
21. FRL-3 FINISH, SEE FINISH SCHEDULE.
22. 4" TERRAZZO BASE THIS WALL ONLY. SEE DETAIL 8/A3.1.
23. WRAP CMU PILASTER WITH 5/8" GYP BOARD.
24. COUNTERTOP SUPPORT. SEE DETAIL 6/A8.40
25. P4 ACCENT PAINT, SEE FINISH SCHEDULE.
26. ELECTRICAL DEVICE/STROBE LIGHT, SEE ELECTRICAL DRAWINGS.
27. SIGNAGE SHOWN GRAY FOR REFERENCE. SEE SHEET A12.01.
28. PLASTIC LAMINATE PIPEGUARD. SEE DETAIL 5/A8.40.
29. COUNTERTOP SUPPORT. SEE DETAIL 12/A8.40

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

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ARCHITECT
No. C-27624
Dec 31, 2021

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 001	6/29/22

DATE 04/08/2020

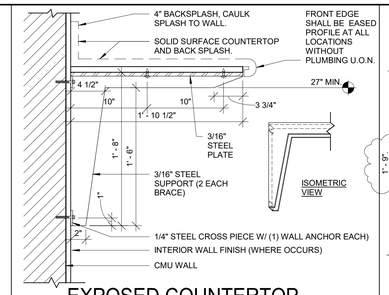
JOB NO. DGS 140724

SHEET TITLE

INTERIOR ELEVATIONS

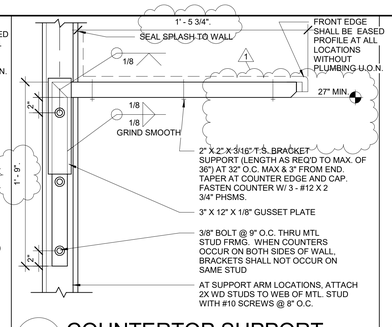
SHEET NO.

A7.50



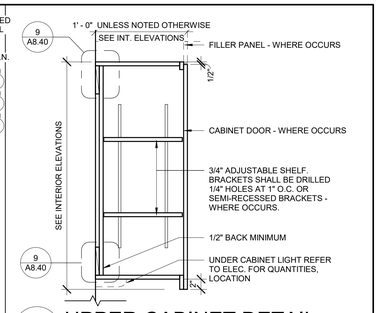
11 EXPOSED COUNTERTOP SUPPORT

1 1/2" = 1'-0"



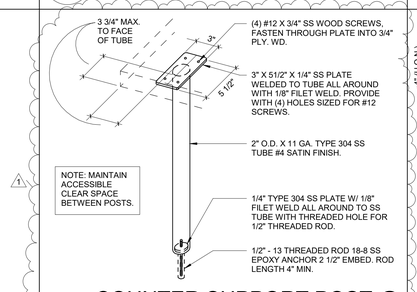
6 COUNTERTOP SUPPORT

1 1/2" = 1'-0"



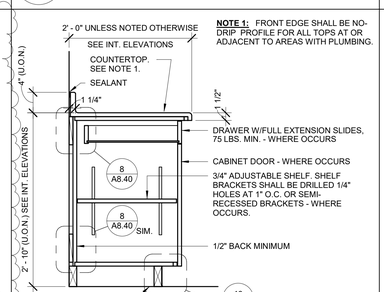
1 UPPER CABINET DETAIL

1" = 1'-0"



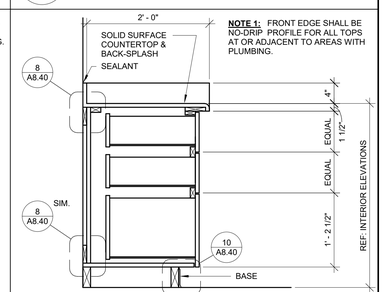
12 COUNTER SUPPORT POST @ EXPOSED CORNERS

1 1/2" = 1'-0"



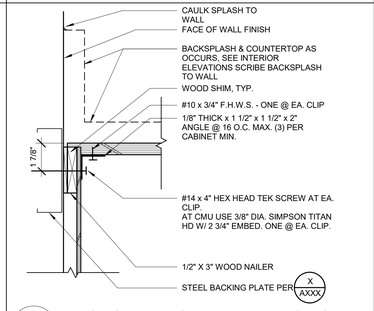
7 BASE CABINET DETAIL1

1" = 1'-0"



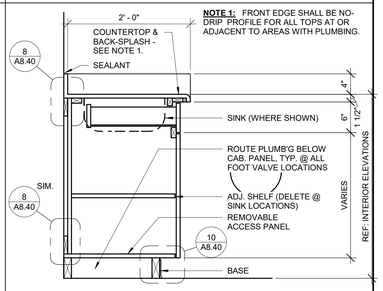
2 BASE CABINET W/ DRAWERS

1" = 1'-0"



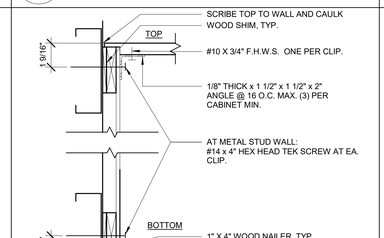
8 BASE/WALL CABINET ANCHOR1

3" = 1'-0"



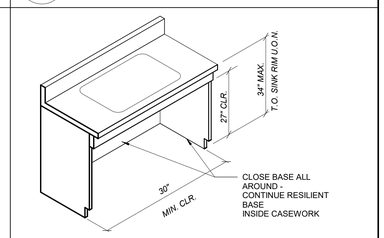
3 BASE CABINET W/ PLUMBING

1" = 1'-0"



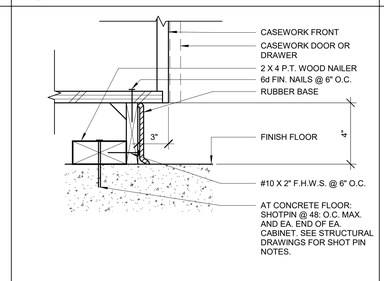
9 WALL HUNG CABINET ANCHORS

3" = 1'-0"



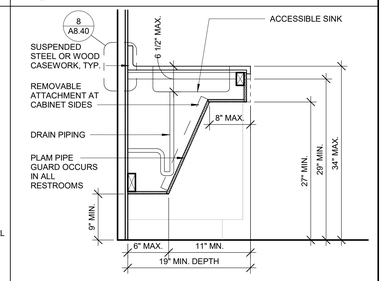
4 ACCESSIBLE BASE CABINET W/ PLUMBING

1/4" = 1'-0"



10 BASE CABINET ANCHOR1

3" = 1'-0"



5 KNEE SPACE CLEARANCES AT SINKS AND WORKSTATIONS

1" = 1'-0"

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

CONSULTANT

nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

No. C-27624 Dec 31, 2021

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 001	6/29/22

DATE 04/08/2020

JOB NO. DGS 140724

SHEET TITLE

CASEWORK DETAILS

SHEET NO.

A8.40

ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT

State of California • Department of General Services • Gavin Newsom, Governor
REAL ESTATE SERVICES DIVISION
Project Management and Development Branch
Architecture and Engineering Sections 1 & 2
707 Third St., Suite 4-105 • West Sacramento, California 95605-2811

ADDITIONAL DETAILED INSTRUCTIONS

ADI 002.2

PROJECT: DMV Delano **DATE:**

CLIENT AGENCY: California Department of Motor Vehicles
LOCATION: Dover Parkway Delano, CA **WORK**
ORDER:

CONTRACT:

CONTRACTOR:	**PROJECT DIRECTOR:**
Bernards Charlie Her 1781 E Fir Avenue, Suite 205 Fresno, CA 93720	**Ryan Beck** State of California, DGS, RESD, PMDB 707 Third St., Suite 04-105 West Sacramento, CA 95605
Tel: (818) 898 1521 Fax: (818) 361 9208	Tel: (916) 628-8192 Fax:

SUBJECT:	**REFERENCE DOCUMENTS:**
Re: RFI 024 Response -- Fire Water Gate Valves	See attached

Description:
Question #4 of RFI #024 asked:
"Note (9) on sheet C1.07 notes for a redundancy of gate valves to be installed throughout the fire water line. It is recommended the two 8" valves found on the Northwest and Southwest elbow on the fire water line to be omitted as they do not serve a purpose. Please see attachment (E) for your reference. Please advise."

Per the response to question #4 of RFI 024 by Gordon Fong, P.E.:

"4. 8" gate valves on northwest and southwest 90 degree bends on Fire water line may be omitted. Please see attached PDF." *Note in PDF, the gate valves at the proposed tee connection have been clarified. A gate valve north and another south (2 gate valves total) are required for isolation at the tee.*

The Work shall be carried out in accordance with these supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. **Proceeding with Work in accordance with these instructions indicates acceptance without change in the Contract Amount or Contract Duration.** It is the Contractor's responsibility to inform subcontractors, vendors and staff of these remarks to the design and/or construction.

Signed: Ryan Beck Digitally signed by Ryan Beck Date: 2022.11.03 09:35:05 -07'00' Date:

Ryan Beck
State of California, DGS, RESD, PMDB
707 Third St., Suite 04-105
West Sacramento, CA 95605

Tel: (916) 628-8192 Fax:

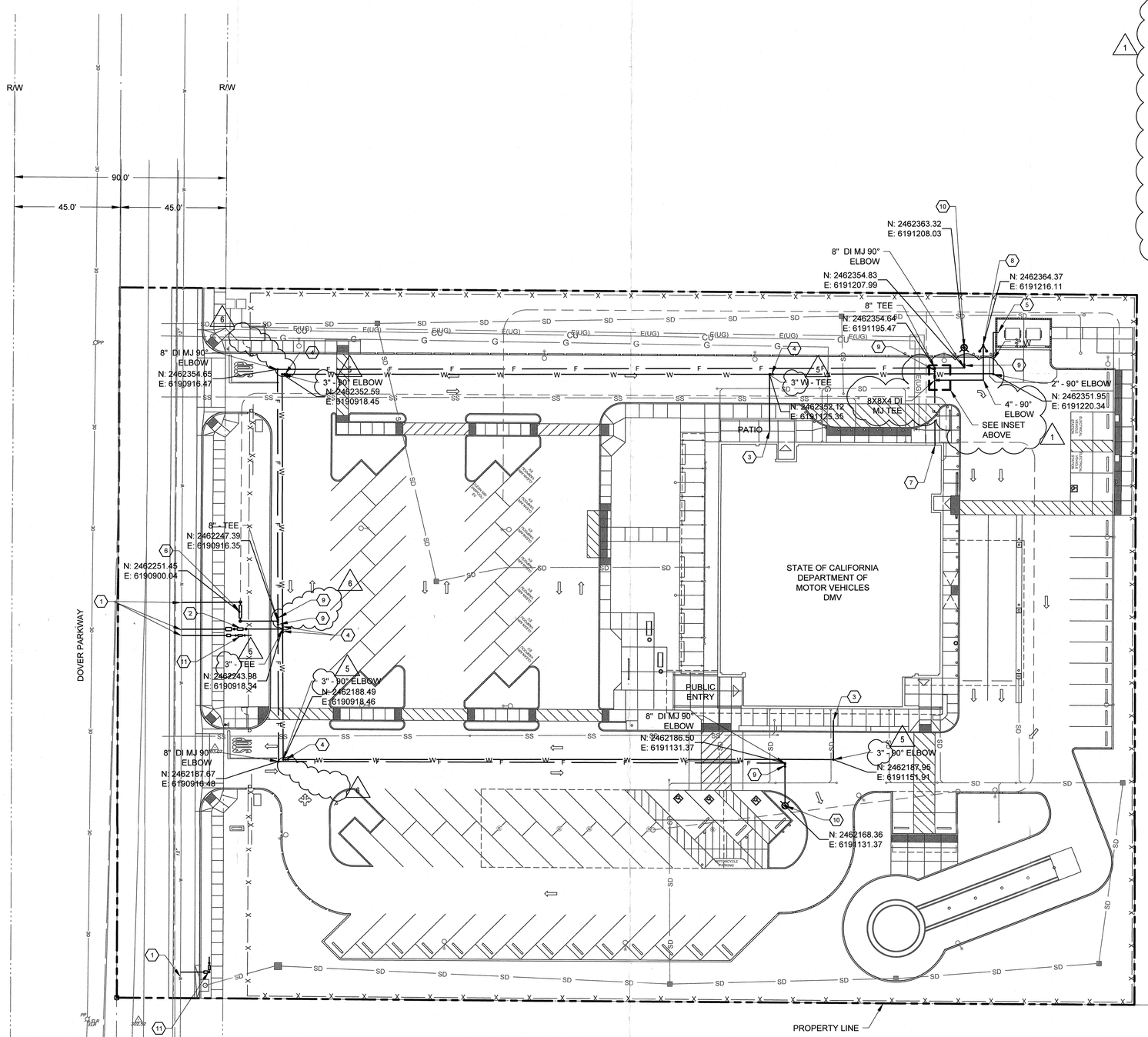
Office of the State Fire Marshal
Reviewed, No Exception Taken

Edward Arriaga, DSFM III

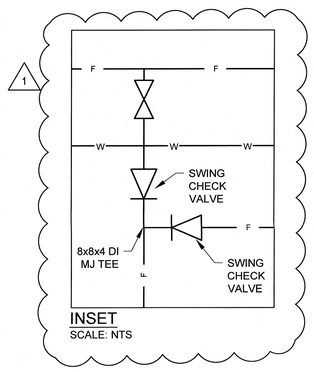
Date 11-07-22

cc:

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET



1 WATER PLAN
1" = 20'



INSET
SCALE: NTS

KEYNOTES:

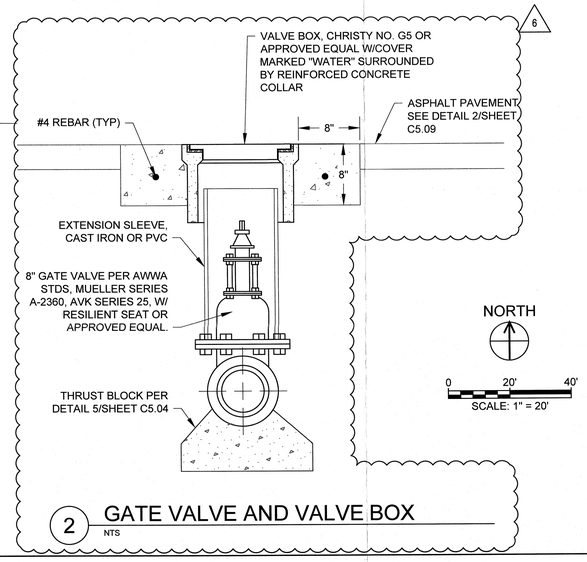
1. CONNECT TO EXISTING 12 INCH WATER LINE ALONG DOVER PARKWAY. COORDINATE WITH CITY OF DELANO ON REQUIREMENTS. CONTRACTOR IS RESPONSIBLE FOR ALL ITEMS NECESSARY TO MAKE CONNECTION. SEE DETAIL 1/C5.04 AND 2/C5.04 FOR IRRIGATION AND DOMESTIC WATER CONNECTION AND METER.
2. INSTALL 3" DOMESTIC WATER REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER. INSTALL ZURN 375 OR APPROVED EQUAL
3. POINT OF CONNECTION FOR DOMESTIC WATER LINE 5 FEET FROM BUILDING. SEE PLUMBING FOR CONTINUATION
4. INSTALL 3" BALL VALVE WITH TRAFFIC RATED COVER AND FRAME. COVER SHALL BE MARKED "WATER". VAULT SHALL BE SUPPORTED WITH 8 INCH WIDE AND DEEP REINFORCED CONCRETE COLLAR WITH #4 REBAR. BOTTOM OF VALVE BOX SHALL INCLUDE 6" THICK LAYER OF ¾" GRAVEL PLACED IN TWO- 3 INCH LIFTS.
5. INSTALL HOSE BIB. HOSE BIB SHALL BE LOCKABLE AND RECESSED IN CMU BLOCK WALL. HOSE BIB SHALL BE WOODFORD MODEL B24 OR APPROVED EQUAL.
6. INSTALL FIRE WATER DOUBLE CHECK DETECTOR BACKFLOW PREVENTER WITH OS&Y GATE VALVES
7. CONNECT TO FIRE RISER ROOM. SEE DETAIL 2/C5.05
8. INSTALL FIRE DEPARTMENT CONNECTION , SEE DETAIL 4/C5.05
9. INSTALL 8" DUCTILE IRON MECHANICAL JOINT GATE VALVE, SEE DETAIL 2 THIS SHEET.
10. INSTALL FIRE HYDRANT, SEE DETAIL 1/C5.05
11. INSTALL 1" IRRIGATION REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER. INSTALL ZURN 375XLB OR APPROVED EQUAL

SHEET NOTES:

1. ALL DOMESTIC WATER LINES SHALL BE 3" PVC, ASTM D2241, SDR 21 RATING.
2. ALL FIRE WATER LINES SHALL BE 8" AWWA C900, DR-18 PVC.
3. THRUST BLOCKS SHALL BE INSTALLED AT ALL CHANGES IN DIRECTION ON BOTH THE DOMESTIC AND FIRE WATER LINES. SEE DETAIL 5/C5.04
4. SEE SHEET C1.06 FOR UTILITY PLAN
5. SEE SHEETS C5.04 AND C5.05 FOR WATER DETAILS

LEGEND:

- PV CONDUIT
- E(UG) ELECTRICAL UNDERGROUND
- F FIRE WATER
- SS SANITARY SEWER
- W DOMESTIC WATER
- SD STORM SEWER
- CU COMMUNICATION LINE
- G NATURAL GAS LINE
- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- SWING CHECK VALVE
- ELECTRICAL AND COMMUNICATION VAULT



2 GATE VALVE AND VALVE BOX
NTS

NORTH
0 20' 40'
SCALE: 1" = 20'

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER GORDON HO-MAN CHONG C 87304 CIVIL STATE OF CALIFORNIA
10/28/2022

AECOM
CONSULTANT

nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

Office of the State Fire Marshal Reviewed, No Exception Taken
Edward Arriaga, DSFM III
Date 11-07-22

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	SFM REVIEW	07/02/20
2	CITY PLAN CHECK	09/15/21
3	ADI 002	10/28/22

DATE 10/28/2022

JOB NO. DGS 140724

SHEET TITLE

WATER PLAN

SHEET NO.

C1.07

State of California • Department of General Services • Gavin Newsom, Governor
REAL ESTATE SERVICES DIVISION
Project Management and Development Branch
Architecture and Engineering Sections 1 & 2
707 Third St., Suite 4-105 • West Sacramento, California 95605-2811

ADDITIONAL DETAILED INSTRUCTIONS

ADI: 003

PROJECT: DMV Delano **DATE:**

CLIENT AGENCY: California Department of Motor Vehicles
LOCATION: Dover Parkway Delano, CA **WORK**
ORDER:

CONTRACT:

CONTRACTOR:	**PROJECT DIRECTOR:**
Bernards Charlie Her 1781 E Fir Avenue, Suite 205 Fresno, CA 93720 Tel: (818) 898 1521 Fax: (818) 361 9208	**Ryan Beck** State of California, DGS, RESD, PMDB 707 Third St., Suite 04-105 West Sacramento, CA 95605 Tel: (916) 628-8192 Fax:

SUBJECT:	**REFERENCE DOCUMENTS:**
Re: RFI 020 Response -- Fire Water Gate Valves	See attached: Annotated RFBI documents

Description:
RFI #020 asked:

Question
Ref: DRWG No. 1306109_0.01 Sheet 1 of 2, DRWG No. 1306109_0.01 Sheet 2 of 2, E1.01, Off-site Drawings, RFBI No. 41

Per the pre-installation meeting on 08/18/22 with Southern Pacific Edison and Valley Unique, the following drawings were provided by SCE, DRWG No. 1306109_0.01 Sheet 1 of 2 and DRWG No. 1306109_0.01 Sheet 2 of 2. The following drawings were not part of the contract documents and it was the first time being provided to Bernard's. Due to these drawings not being part of the contract documents, the flowing scope of work illustrated on these documents were not captured. Please advise on the following items below.

First, please confirm all underground conduit pathways for power along Dover Parkway as shown on the SCE drawings is not part of Bernard's scope of work and is for the contractor's reference and coordination purposes only. Southern California Edison (SCE) will supply and install city property street lighting and feeders as stated in RFBI No. 41. Please see the attached for your reference.

Secondly, please confirm the boring across Dover Parkway and the intersection of Del Sol Parkway to install 3" conduit, so they can run the power to the vault onsite is not part of Bernard's scope of work.

If the following is to be part of Bernard's scope of work, please advise.

The official response from Gordon Fong, P.E.

Bernards is to install all power infrastructure (conduit, hand holes, and directional bore under Dover parkway) and streetlight infrastructure shown on SCE plans.

The concrete streetlight pole base and pole itself are installed by SCE contractor and not Bernards. The only portion that is installed Bernards related to the streetlight base is the riser conduit that will be adjusted by SCE contractor when base is being built.

Please submit a change order proposal for this added scope.

- Gordon Fong, P.E.

The Work shall be carried out in accordance with these supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. **Proceeding with Work in accordance with these instructions indicates acceptance without change in the Contract Amount or Contract Duration.** It is the Contractor's responsibility to inform subcontractors, vendors and staff of these remarks to the design and/or construction.

Signed: _____ Date: _____

Ryan Beck
State of California, DGS, RESD, PMDB
707 Third St., Suite 04-105
West Sacramento, CA 95605

Tel: (916) 628-8192 Fax:

cc:

REQUEST FOR BIDDING INTERPRETATION (RFBI)

(Email no later than March, 3rd, 2022, 5:00 p.m.)

PMDB RFBI No.: 41
Requestor RFBI No.: 013
Request Date: 3/10/2022
From (Bidder): S.C. Anderson, Inc.

To: **Ryan Beck, Project Director/Manager**
Project Management and Development Branch
Real Estate Services Division
Phone: 916-375-4310

Email: ryan.beck@dgs.ca.gov

Contact: Sandra Rodriguez
Phone: (661) 392-7000
Fax: (661) 391-9999
Email: rodriguezs@scanderson.com

All RFBIs received prior to deadline identified above, and responses from the State will be published on http://www.caleprocure.ca.gov. Click on "Start Search." In the event name field, enter the project number and click search. While viewing the Event Details, click on "View Event Package" to view RFBI responses.

Project No.: 140724
Project Name: DMV Delano
Location: Delano, CA

Drawing Reference: ST2.02 **Project Manual Reference**: 26 56 19 - LED Exterior Lighting

Question:

Please clarify type of feed, size of feed and provide detail on size and type of fixture for the Streetlight.

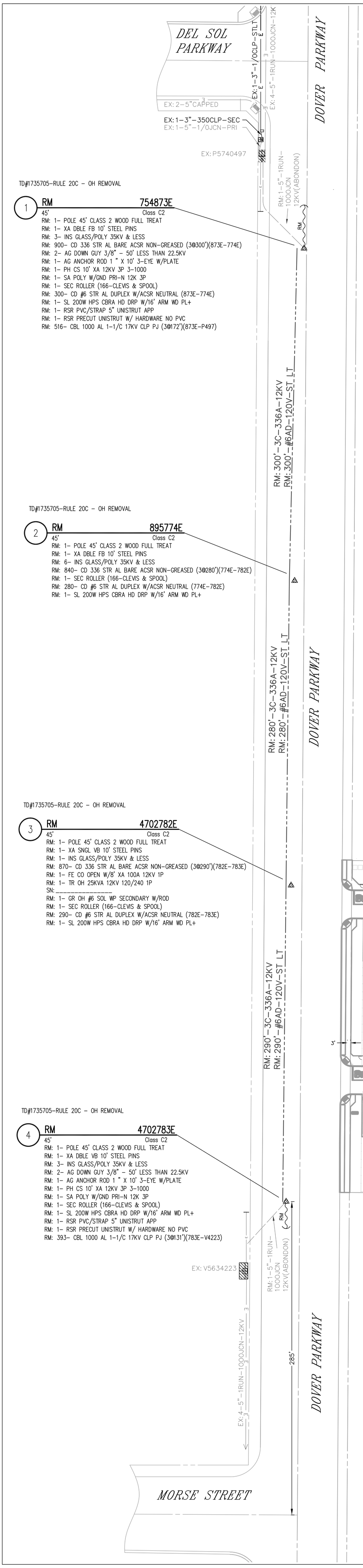
New street light shown on drawing ST2.01 is for the contractor's reference and coordination purposes only. Southern California Edison (SCE) will supply and install city property street lighting and feeders shown on ST2.01.

-Gordon Fong, P.E.

Fong, Gordon Digitally signed by Fong, Gordon
DN: CN="Fong, Gordon", OU=USSCR1, OU=US, OU=AMER, OU=AECOMUsers, DC=na, DC=aecomnet, DC=com
Date: 2022.03.11 12:59:13-08'00'

Bidder's Authorized Signature: Sandra Rodriguez

[ ] Check here if additional pages attached



TD#1735705-RULE 20C - OH REMOVAL

1 **RM** **754873E**
45' Class C2
RM: 1- POLE 45' CLASS 2 WOOD FULL TREAT
RM: 1- XA DBLE FB 10' STEEL PINS
RM: 3- INS GLASS/POLY 35KV & LESS
RM: 900- CD 336 STR AL BARE ACSR NON-GREASED (3@300')(873E-774E)
RM: 2- AG DOWN GUY 3/8" - 50' LESS THAN 22.5KV
RM: 1- AG ANCHOR ROD 1 " X 10' 3-EYE W/PLATE
RM: 1- PH CS 10' XA 12KV 3P 3-1000
RM: 1- SA POLY W/GND PRI-N 12K 3P
RM: 1- SEC ROLLER (166-CLEVIS & SPOOL)
RM: 300- CD #6 STR AL DUPLEX W/ACSR NEUTRAL (873E-774E)
RM: 1- SL 200W HPS CBRA HD DRP W/16' ARM WD PL+
RM: 1- RSR PVC/STRAP 5" UNISTRUT APP
RM: 1- RSR PRECUT UNISTRUT W/ HARDWARE NO PVC
RM: 516- CBL 1000 AL 1-1/C 17KV CLP PJ (3@172')(873E-P497)

TD#1735705-RULE 20C - OH REMOVAL

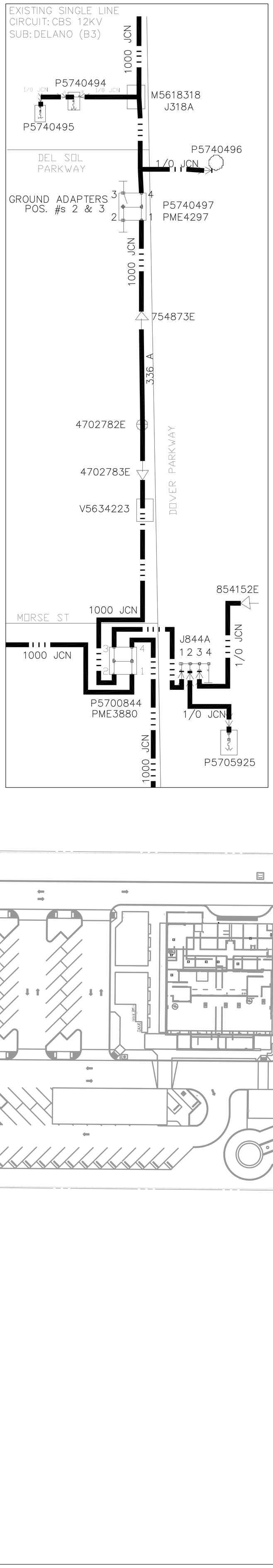
2 **RM** **895774E**
45' Class C2
RM: 1- POLE 45' CLASS 2 WOOD FULL TREAT
RM: 1- XA DBLE FB 10' STEEL PINS
RM: 6- INS GLASS/POLY 35KV & LESS
RM: 840- CD 336 STR AL BARE ACSR NON-GREASED (3@280')(774E-782E)
RM: 1- SEC ROLLER (166-CLEVIS & SPOOL)
RM: 280- CD #6 STR AL DUPLEX W/ACSR NEUTRAL (774E-782E)
RM: 1- SL 200W HPS CBRA HD DRP W/16' ARM WD PL+

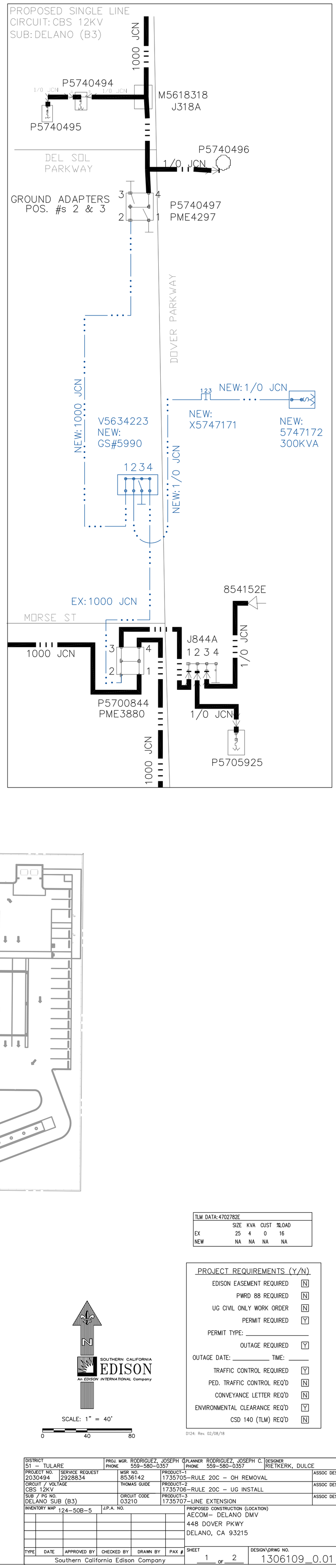
TD#1735705-RULE 20C - OH REMOVAL

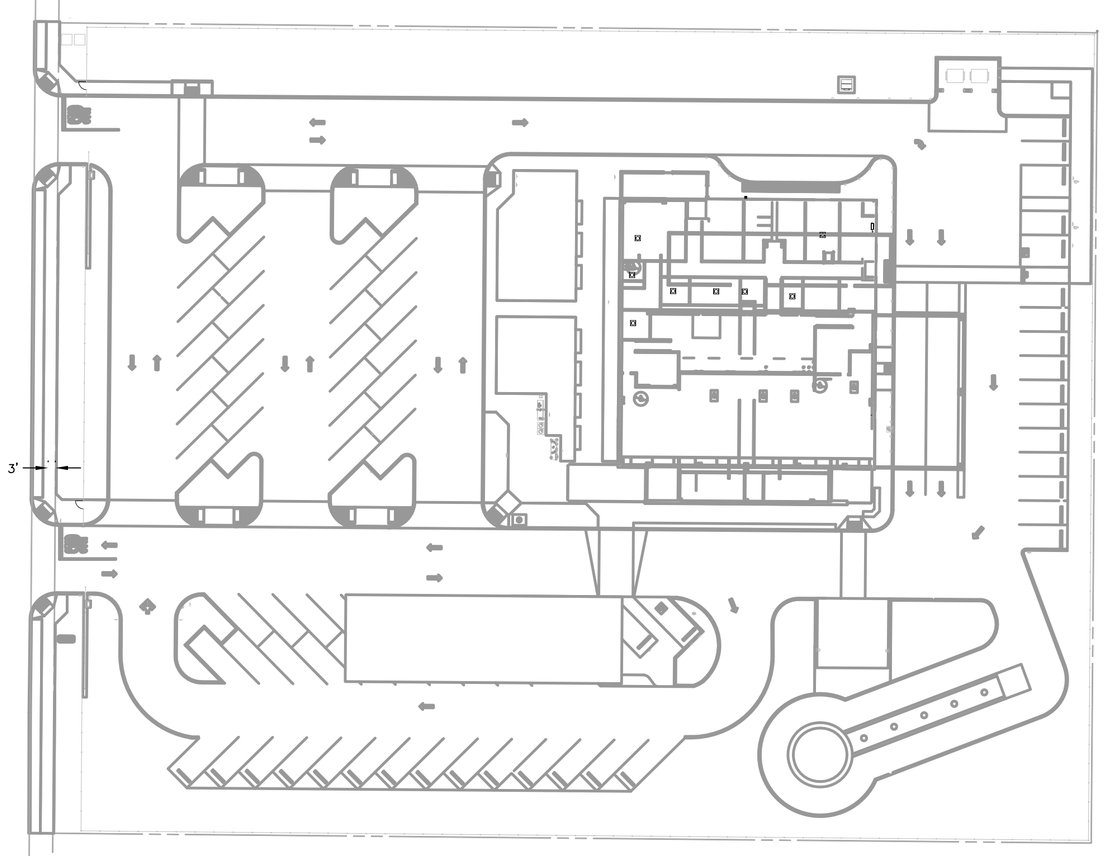
3 **RM** **4702782E**
45' Class C2
RM: 1- POLE 45' CLASS 2 WOOD FULL TREAT
RM: 1- XA SNGL VB 10' STEEL PINS
RM: 1- INS GLASS/POLY 35KV & LESS
RM: 870- CD 336 STR AL BARE ACSR NON-GREASED (3@290')(782E-783E)
RM: 1- FE CO OPEN W/8' XA 100A 12KV 1P
RM: 1- TR OH 25KVA 12KV 120/240 1P
SN: _____
RM: 1- GR OH #6 SOL WP SECONDARY W/ROD
RM: 1- SEC ROLLER (166-CLEVIS & SPOOL)
RM: 290- CD #6 STR AL DUPLEX W/ACSR NEUTRAL (782E-783E)
RM: 1- SL 200W HPS CBRA HD DRP W/16' ARM WD PL+

TD#1735705-RULE 20C - OH REMOVAL

4 **RM** **4702783E**
45' Class C2
RM: 1- POLE 45' CLASS 2 WOOD FULL TREAT
RM: 1- XA DBLE VB 10' STEEL PINS
RM: 3- INS GLASS/POLY 35KV & LESS
RM: 2- AG DOWN GUY 3/8" - 50' LESS THAN 22.5KV
RM: 1- AG ANCHOR ROD 1 " X 10' 3-EYE W/PLATE
RM: 1- PH CS 10' XA 12KV 3P 3-1000
RM: 1- SA POLY W/GND PRI-N 12K 3P
RM: 1- SEC ROLLER (166-CLEVIS & SPOOL)
RM: 1- SL 200W HPS CBRA HD DRP W/16' ARM WD PL+
RM: 1- RSR PVC/STRAP 5" UNISTRUT APP
RM: 1- RSR PRECUT UNISTRUT W/ HARDWARE NO PVC
RM: 393- CBL 1000 AL 1-1/C 17KV CLP PJ (3@131')(783E-V4223)







TLM DATA: 4702782E					
	SIZE	KVA	CUST	%LOAD	
EX	25	4	0	16	
NEW	NA	NA	NA	NA	

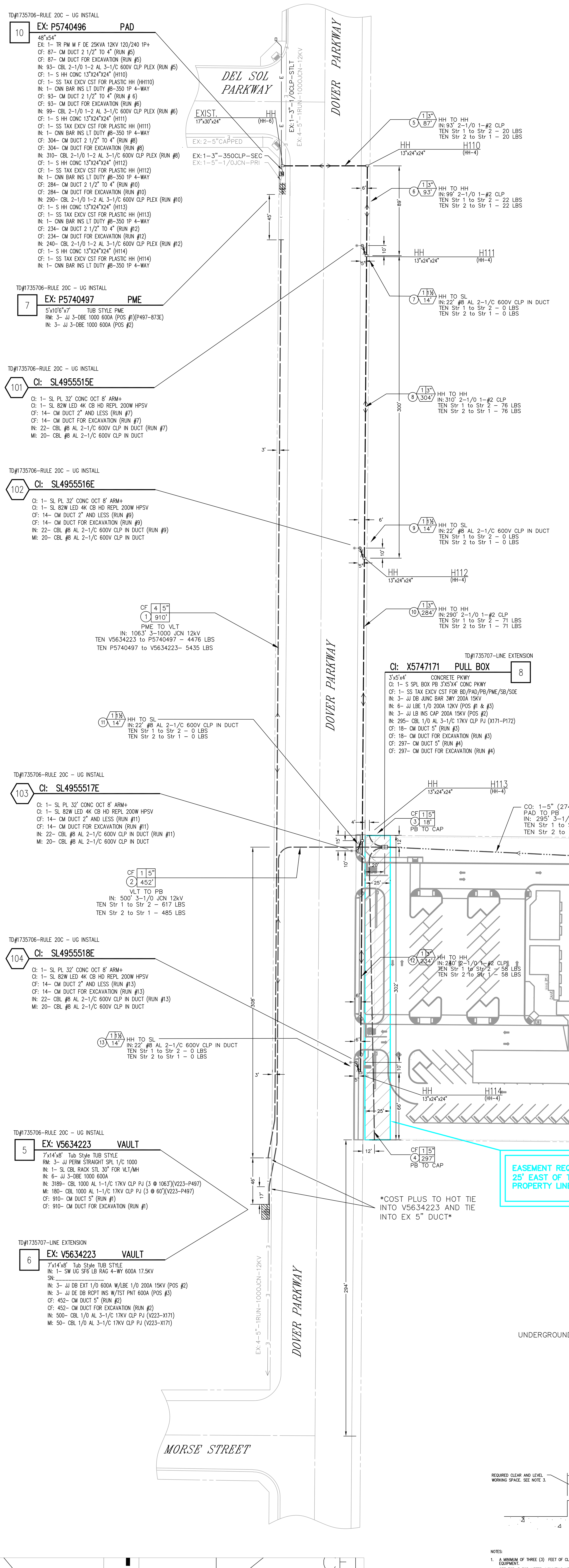
SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

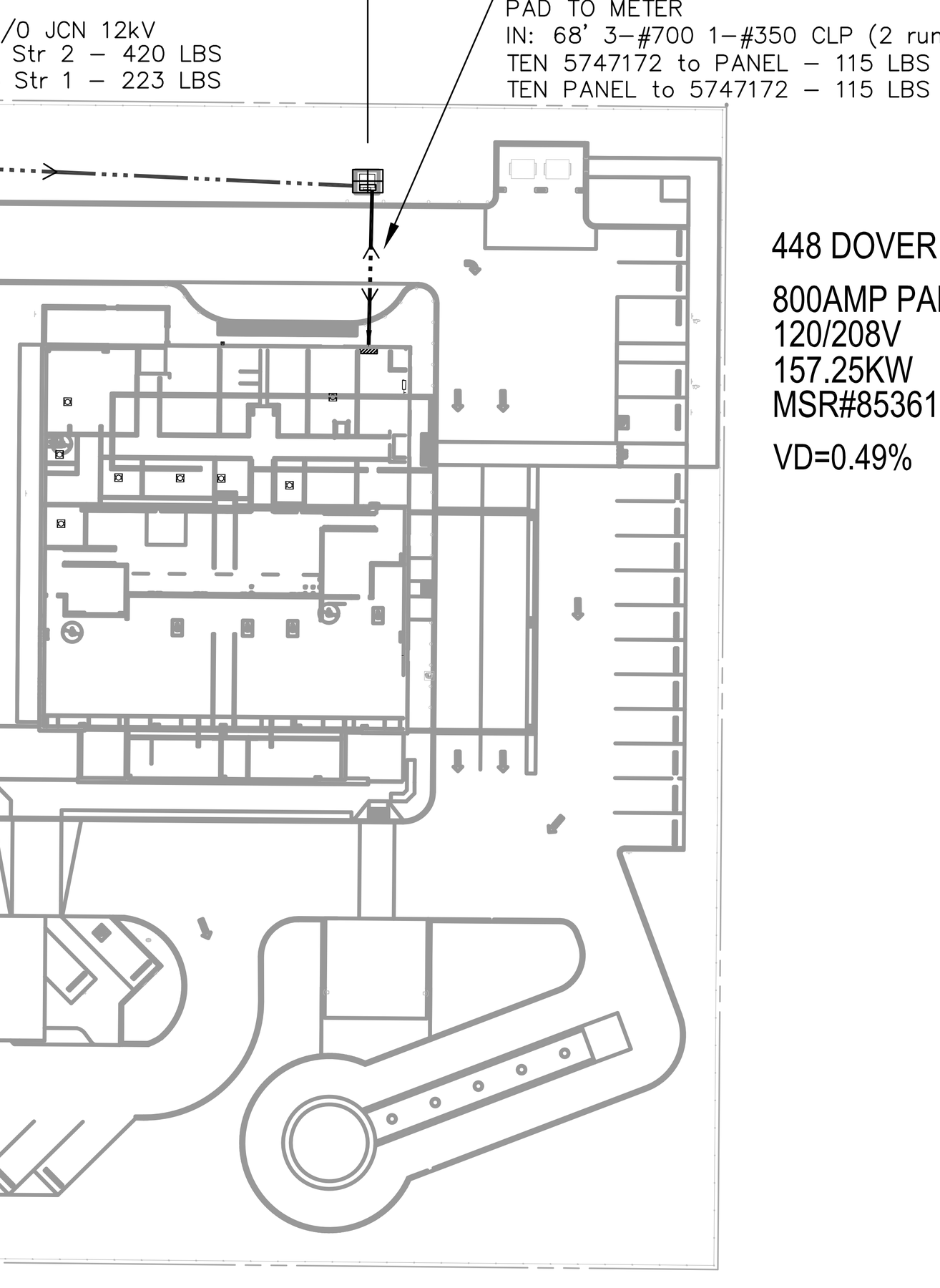
SCALE: 1" = 40'
0 40 80

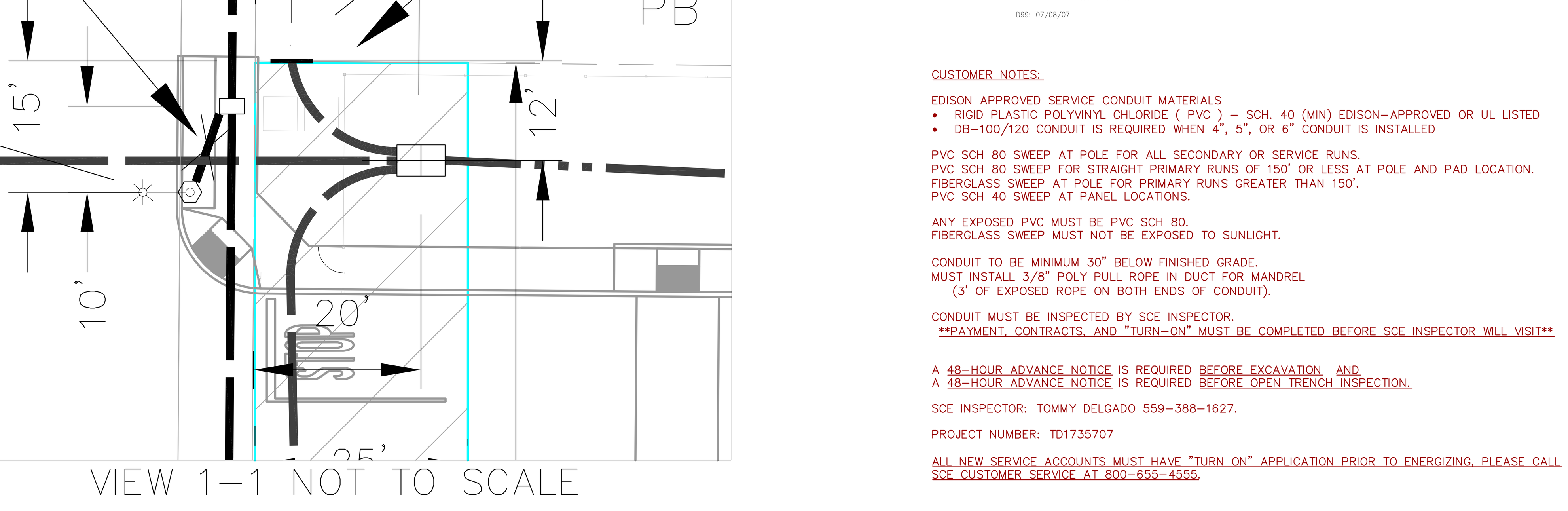
PROJECT REQUIREMENTS (Y/N)	
EDISON EASEMENT REQUIRED	N
PWRD 88 REQUIRED	N
UG CIVIL ONLY WORK ORDER	N
PERMIT REQUIRED	Y
PERMIT TYPE: _____	
OUTAGE REQUIRED	Y
OUTAGE DATE: _____ TIME: _____	
TRAFFIC CONTROL REQUIRED	Y
PED. TRAFFIC CONTROL REQ'D	N
CONVEYANCE LETTER REQ'D	N
ENVIRONMENTAL CLEARANCE REQ'D	Y
CSD 140 (TLM) REQ'D	N

D124: Rev. 02/08/18

DISTRICT: 51 - TULARE	PROJ. MGR. RODRIGUEZ, JOSEPH C. PHONE 559-580-0357		PLANNER RODRIGUEZ, JOSEPH C. PHONE 559-580-0357	DESIGNER: RIETKERK, DULCE	
PROJECT NO.: 2030494	SERVICE REQUEST: 2928834	MSR NO.: 8536142	PRODUCT-1: 1735705-RULE 20C - OH REMOVAL		ASSOC DESGN
CIRCUIT / VOLTAGE: CBS 12KV		THOMAS GUIDE	PRODUCT-2: 1735706-RULE 20C - UG INSTALL		ASSOC DESGN
SUB / PG NO.: DELANO SUB (B3)		CIRCUIT CODE: 03210	PRODUCT-3: 1735707-LINE EXTENSION		ASSOC DESGN
INVENTORY MAP: 124-50B-5	J.P.A. NO.		PROPOSED CONSTRUCTION (LOCATION): AECOM- DELANO DMV, 448 DOVER PKWY, DELANO, CA 93215		
TYPE / DATE / APPROVED BY / CHECKED BY / DRAWN BY / PAX #			SHEET: 1 OF 2	DESIGN\DRWG NO.: 1306109_0.01	
Southern California Edison Company					







VIEW 1–1 NOT TO SCALE

CONNECTING TO EXISTING SCE STRUCTURES

- Per SCE requirements, customers are not allowed to enter, intercept or tie–in to existing SCE facilities; e.g. structures, equipment, multi–conduit runs/banks, or conductors. These facilities may be energized and the work will only be performed by SCE. Contact the appropriate SCE inspector to schedule an appointment. Customers may connect to an existing conduit stub without a SCE inspector present.
- Multi–conduit runs/banks are runs of conduit in close proximity to each other and other SCE facilities. A conduit stub is a single empty conduit stub that is not in close proximity to other SCE owned facilities. Refer to the work order map for details.
- Per CPUC/SCE's Rule 15 B.1.A and Rule 16 D.1.A., the customer will provide all necessary excavations (with the exception of excavation under pads and primary splice boxes), material (including conduit and structures) and encasement, to be utilized in the intercept/tie–in process.
- The customer must adhere to all applicable Cal–OSHA, local, city, state and federal regulations, (including, but not limited to, all necessary shoring and traffic control in place to perform the intercept/tie–in work by SCE's underground civil contractor(s)).
- Intercept/tie–in work must be coordinated with SCE's civil contractors through the Division Inspector/P–Spec to limit exposure of excavation(s). Customer is responsible for securing excavation(s).

D08: 11/13/18

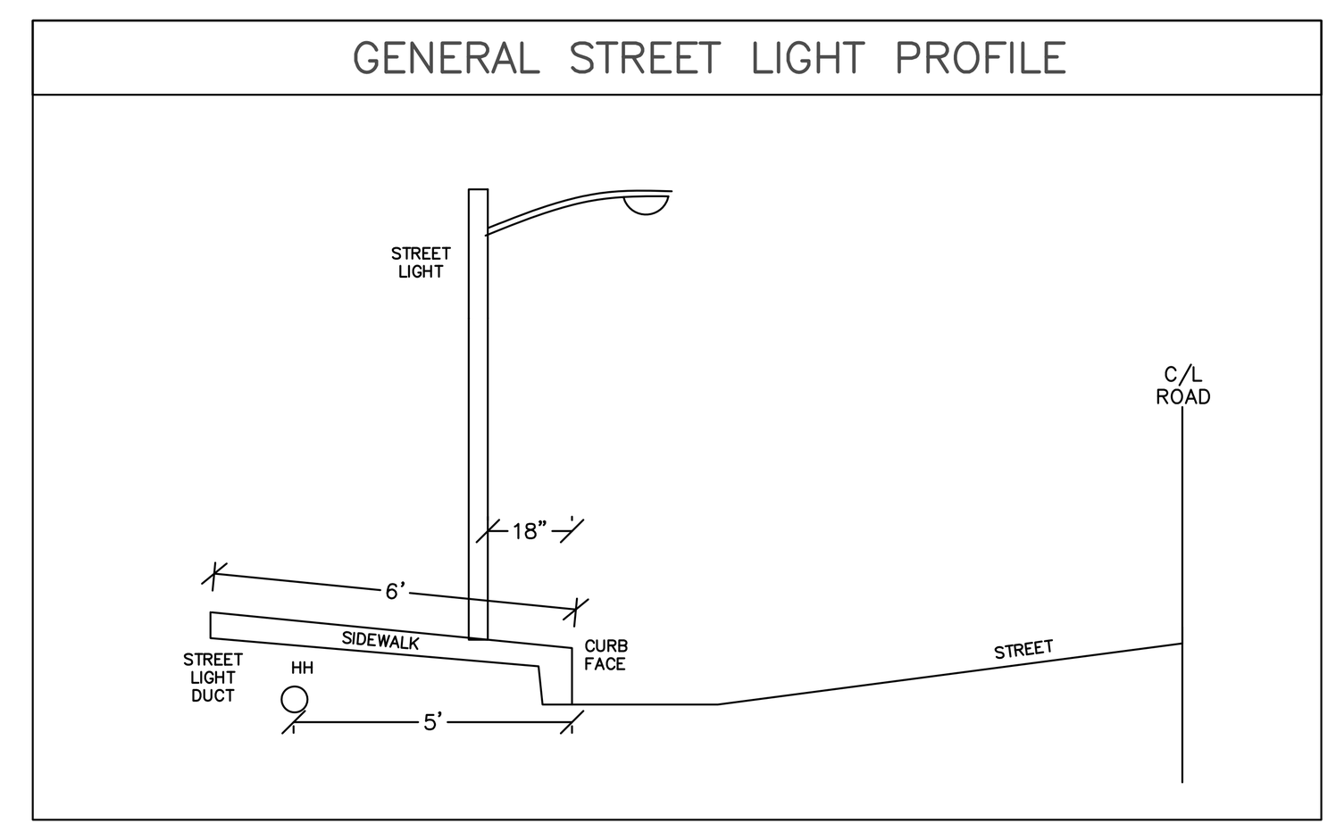
TIE–IN MADE INTO A SECONDARY HANDHOLE

If PVC conduit is used, riser bend installation may be made by the customer with prior SCE approval. Customer not to remove handhole cover. If metallic conduit is used or handhole cover needs to be removed, a SCE Qualified Person must be present.

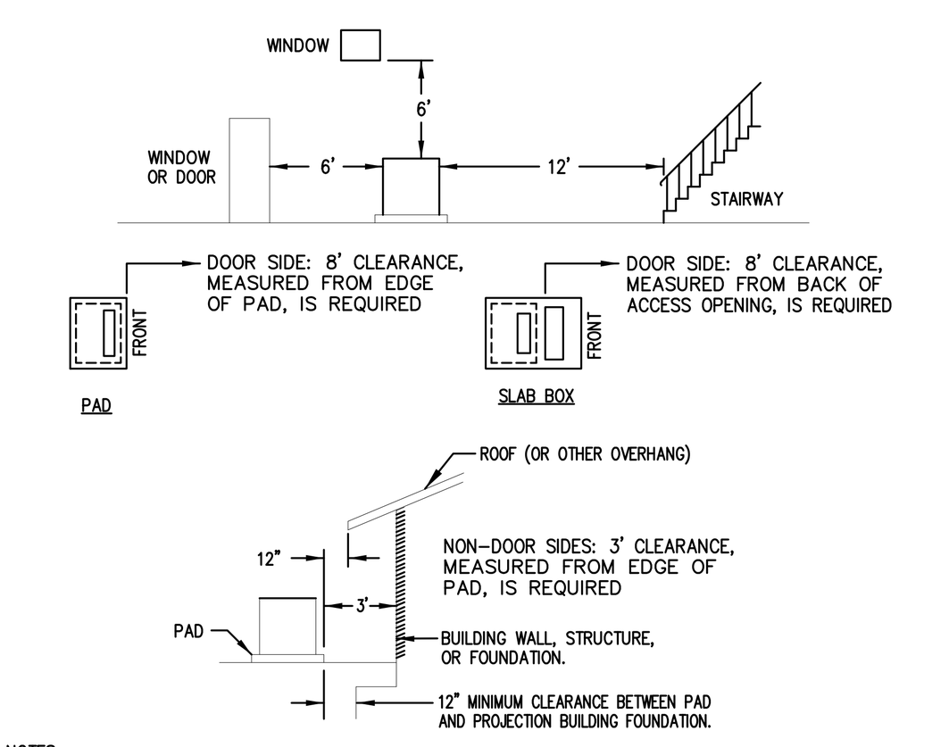
TIE–IN MADE THROUGH SIDE WALL OF STRUCTURE

(Vault, Manhole, PME, SOE/CST, BURD, Slab Box, Pull Box, PMH) The customer is responsible to trench to the structure entrance point and bring the conduit to within 5' of the structure being entered. The customer is to provide slip coupling and conduit.

GENERAL STREET LIGHT PROFILE



MINIMUM CLEARANCES FOR PADMOUNTED TRANSFORMERS
SEE DDS–3, 3–40

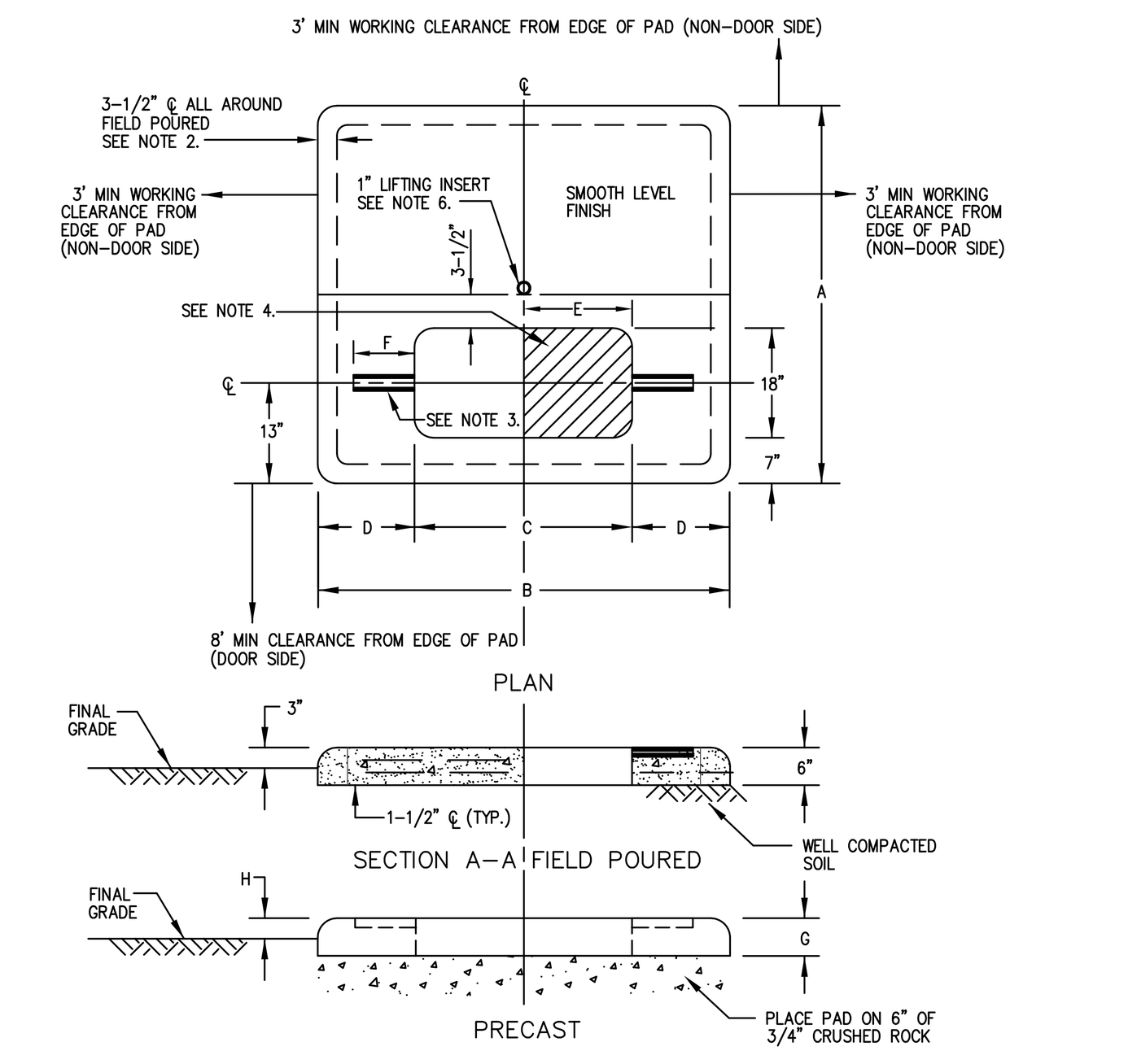


NOTES:

1. AN 8' MINIMUM CLEARANCE IS REQUIRED ON DOOR SIDE OF TRANSFORMER FOR OPERATION. THIS AREA MUST REMAIN CLEAR OF ALL OBSTRUCTIONS INCLUDING, BUT NOT LIMITED TO, SHRUBS, TREES, GATES, FENCES, WALLS, SIGNS AND POLES.
2. PAD–MOUNTED TRANSFORMERS SHALL NOT BE LOCATED IN FRONT OF DOORS, STAIRWAYS, BENEATH WINDOWS THAT CAN BE OPENED, OR WHERE THEY WILL OBSTRUCT THE VISION OF VEHICULAR TRAFFIC
3. PAD–MOUNTED TRANSFORMERS SHALL BE LOCATED AT LEAST THE MINIMUM DISTANCE AWAY FROM BUILDINGS OR OTHER STRUCTURES TO ENSURE ADEQUATE SPACE FOR OPERATING, TO MINIMIZE VIBRATION HUMS, AND TO MEET FIRE SAFETY REQUIRMENTS.
4. A CLEAR PASSAGEWAY OF 12 FEET MINIMUM SHALL BE AVAILABLE AT ALL TIMES, IMMEDIATELY ADJACENT TO ONE SIDE OF THE TRANSFORMER TO PROVIDE AN ACCESSIBLE ROADWAY FOR TRANSFORMER MAINTENANCE. THIS PASSAGEWAY SHALL BE DESIGNED TO MEET H–20 (20–TON) CONSTRUCTION.
5. TRANSFORMER STRUCTURES WILL NORMALLY BE INSTALLED ONLY IN NONTRAFFIC AREAS. TRANSFORMER PROTECTION IS REQUIRED WHEN COMPANY EQUIPMENT IS EXPOSED TO TRAFFIC. THIS PROTECTION MAY BE IN THE FORM OF BARRIERS, BARRICADES, OR CURB. A CURB MUST HAVE A MINIMUM HEIGHT OF 6 INCHES AND BE AT LEAST 6 INCHES THICK AND ITS FRONT FACE LOCATED 60 INCHES MINIMUM FROM THE EQUIPMENT FOUNDATION.

D54: Rev. 05/14/12

PAD FOR SURFACE–MOUNTED TRANSFORMER



TALE SS 504–1: Surface–Mounted Transformer Pads–Dimensions

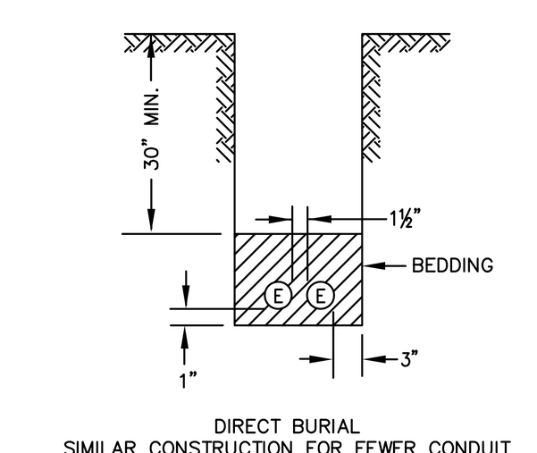
Transformer	Pad Dimensions (in)								Weight (lb)	SAP
	A	B	C	D	E	F	G	H		
1ø 25 KVA–167 KVA 3ø	54	48	26	11	12	6	4	2	750	10118012
3ø 75 KVA–150 KVA SW and Fuse	72	94	50	22	22	14	6	3	3,200	10118013

Note(s):

1. Concrete to be 3,000 psi (minimum) at 28 days.
2. Reinforcing steel to be No. 4 bars installed in a double net. Perimeter bars to be continuous (8" minimum lap or weld).
3. Hold–down brackets to be P–3200 series unistrut (or equal).
4. Primary cables must be installed in shaded area of drawing above as far to the right as possible on single phase transformers only. On three–phase transformers primary cables must be installed in the unshaded area of drawing above as far left as possible.
5. See AC 701 for pad–mounted transformer/capacitor grounding requirements and AC 703 for approved grounding materials.
6. 1–inch listing insert to be located at center of gravity on precast pads.
7. See SS 500 for approved manufacturers.
8. The three–phase transformer shall only be used on a pad when four or fewer services are to be installed. A slab box should be used when more than four services will be installed.
9. Use a thin layer of redi–crete (or equivalent) for rodent and weed control or where transformer does not fully cover opening in pad.
10. A 17" x 30" x 15" plastic handhole (SAP 10117726) shall be inverted and installed under the cable opening of the pad. This will provide adequate cable slack for operation of the load–break elbows on single phase transformers only.

D43: Rev. 05/28/20

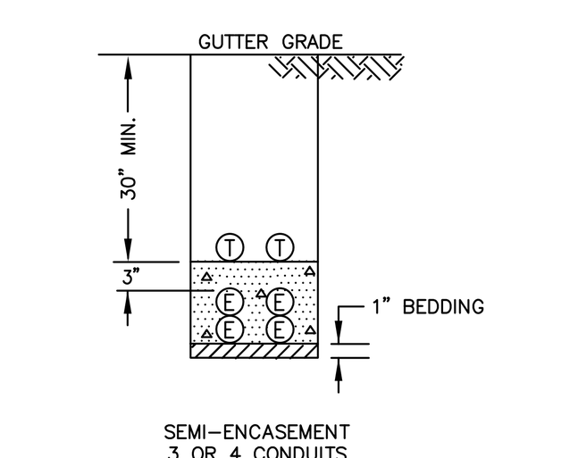
TYPICAL CONDUIT BANK SECTION
SEE UGS CD 120



DIRECT BURIAL
SIMILAR CONSTRUCTION FOR FEWER CONDUIT
2 CONDUITS MAX.

D81: Rev. 09/23/09

TYPICAL CONDUIT BANK SECTION JOINT WITH CATV & TELE
SEE UGS CD 120



SEMI–ENCASEMENT
3 OR 4 CONDUITS

D73–J: Rev. 09/23/09

CONCRETE PRODUCTS

Precast concrete item complete with neck. Cover and inserts may be obtained from any of the following listed and approved manufactureres:

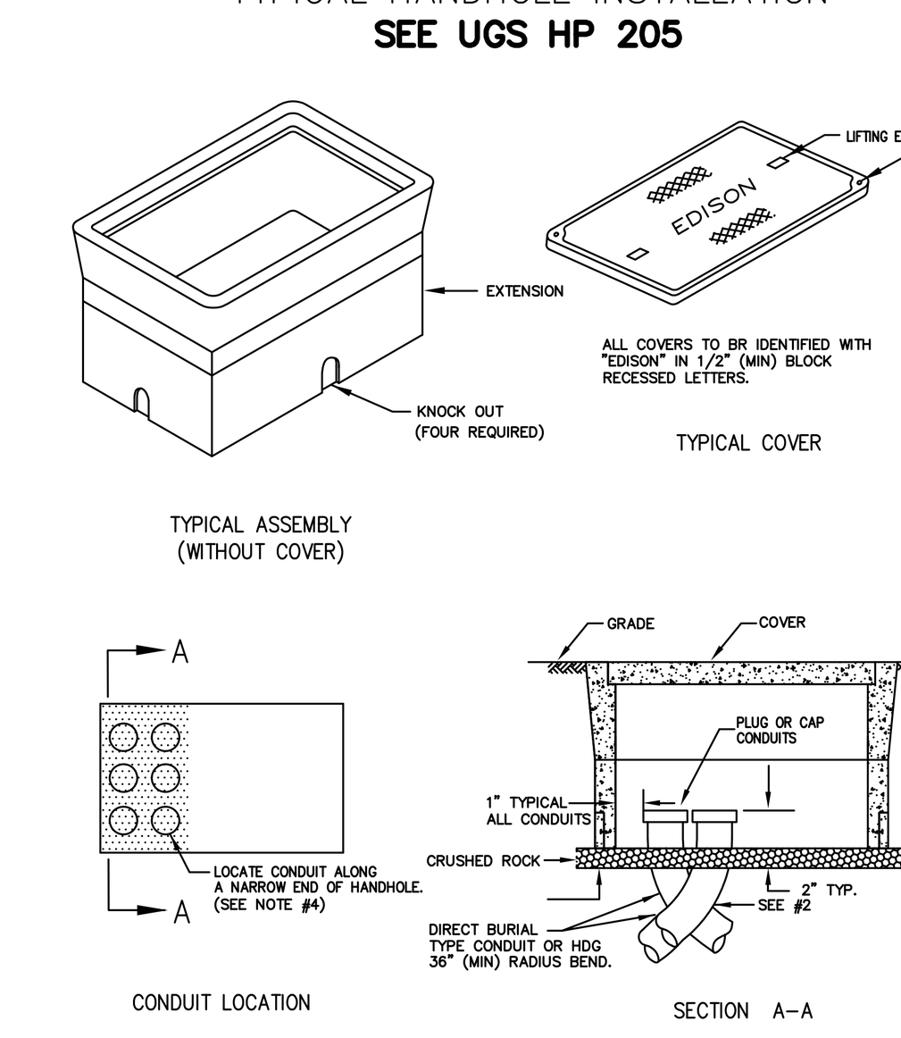
JENSEN PRECAST
14221 San Bernardino Ave., Fontana, Calif. 92335
Phone: (909) 350–4111
(800) 257–6100

OLDCASTLE PRECAST
10650 Hemlock Ave., Fontana, Calif. 92337
Phone: (909) 428–3700
(800) 626–3860

FOR HANDHOLE AND PULLBOX MANUFACTURERS, SEE UGS HP 200.

D41: Rev. 01/21/09

TYPICAL HANDHOLE INSTALLATION
SEE UGS HP 205

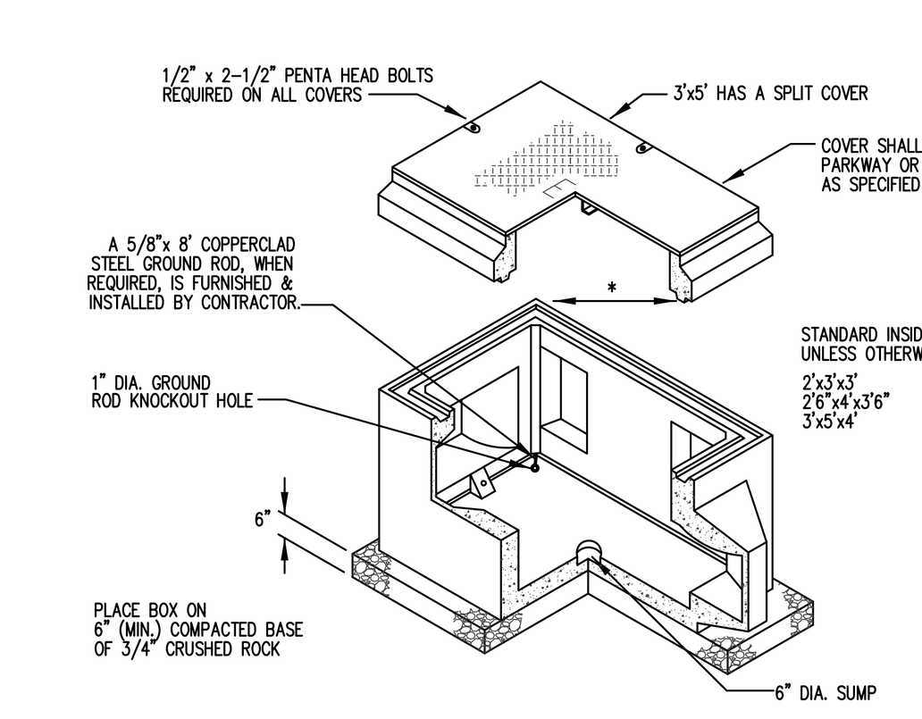


NOTES:

1. SEE UGS HP 200 FOR DIMENSIONS OF VARIOUS SIZE HANDHOLES AVAILABLE.
2. RADIUS ANGLE MAY BE REDUCED TO LESS THAN 90° PROVIDING THE PROJECTED CENTER LINE OF THE CONDUIT CLEARS HANDHOLE OPNING.
3. TWO HOLD DOWN DEVICES TO BE SUPPLIED WITH EACH HANDHOLE.
4. ALL CONDUITS SHOULD BE INSTALLED WITHIN THE SHADED AREA.

REF.: UGS HP 205
D75 REV. 06/28/07

PRECAST CONCRETE PULL BOX WITH DEEP RECESSES
(2'X 3' OR 2'6"X 4' OR 3'X 5')
SEE UGS HP 215, 220 & 225



* TYPE OF JOINT MAY VARY WITH MANUFACTURER
REF. UGS HP 215
UGS HP 220
UGS HP 225

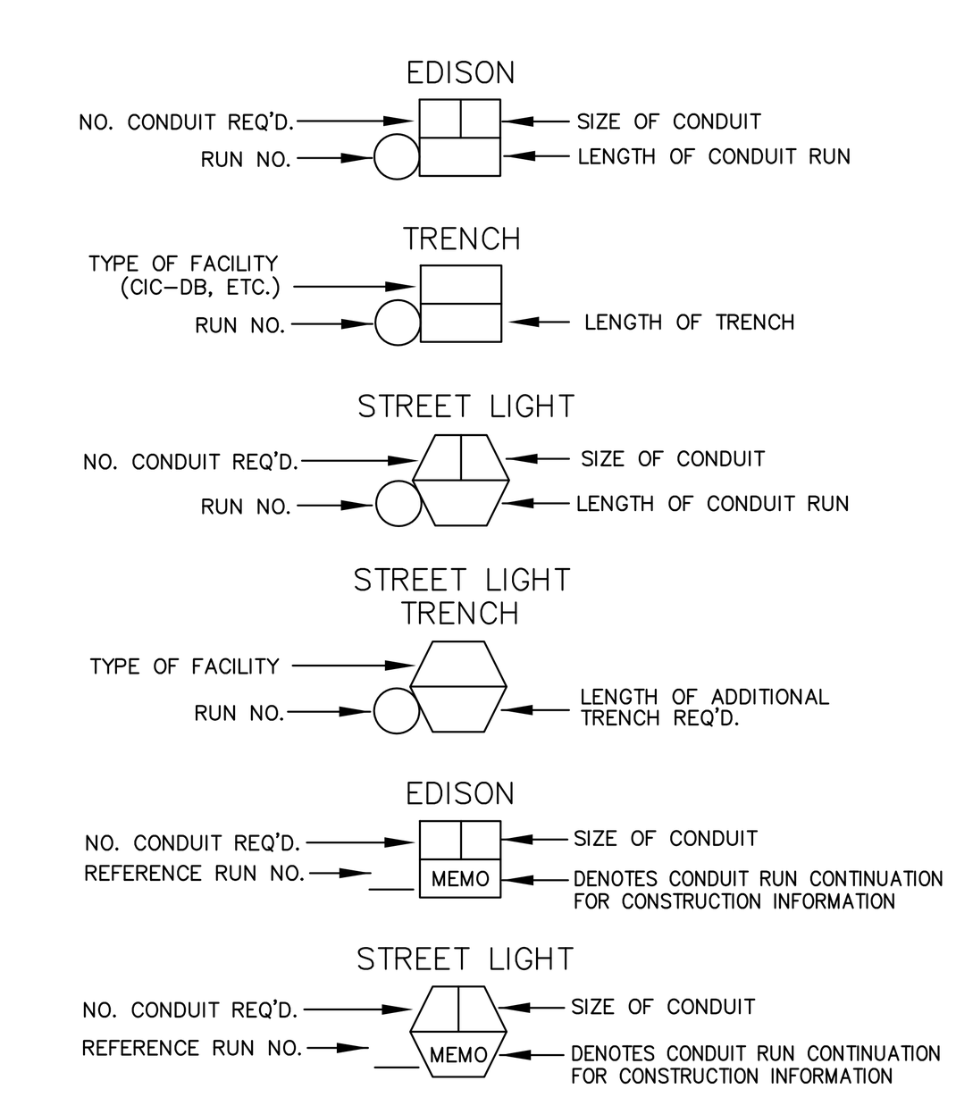
D53: Rev. 03/05/07

LEGEND CODE DEFINITIONS

- CI – CUSTOMER CONTRACTOR INSTALLED: MATERIALS FURNISHED AND INSTALLED BY APPLICANT AT EDISON'S EXPENSE AND ARE DEEDED TO EDISON. (EXCEPTION: STREET LIGHT ELECTROLIERS WILL BE INSTALLED BY EDISON'S CONTRACTOR.)
- CO – CUSTOMER CONTRACTOR OWNED: MATERIALS FURNISHED. INSTALLED. OWNED. AND MAINTAINED BY APPLICANT.
- CF – CUSTOMER CONTRACTOR FURNISHED: MATERIALS FURNISHED AND INSTALLED BY APPLICANT AT APPLICANT'S EXPENSE THAT MAY BE DEEDED TO EDISON.
- IN – INSTALL: MATERIALS FURNISHED AND INSTALLED BY APPLICANT IF APPLICANT INSTALLED PROJECT OR BY EDISON IF EDISON INSTALLED PROJECT. (EXCEPTION: FOR AN APPLICANT INSTALLED LINE EXTENSION. STATION NOS.______ HAVING AN ASTERISK ADJACENT TO AN "IN" LEGEND CODE REPRESENTS MATERIALS TO BE PROVIDED BY APPLICANT AND INSTALLED BY EDISON IN ALL CASES. REFER TO DPB 8258. PROJECT MATERIAL LIST BY ASSEMBLY WITHIN A STATION.)
- MI – MEMO INSTALL: SAME AS IN–INSTALL.
- MR – MEMO REMOVE: MATERIALS REMOVED BY EDISON.
- RM – MEMO REMOVED: MATERIALS REMOVED BY EDISON.
- SI – SHOOFLY IN: MATERIALS FURNISHED AND INSTALLED BY EDISON FOR TEMPORARY CONSTRUCTION.
- SR – SHOOFLY REMOVE: MATERIALS REMOVED BY EDISON FOR TEMPORARY CONSTRUCTION.
- TR – TRANSFER: EDISON LABOR REQUIRED TO TRANSFER EXISTING FACILITIES.

D31: Rev. 11/85

LEGEND OF CONDUIT SYMBOLS
(CONVENTIONAL U. G.)



DENOTES THE FOLLOWING:

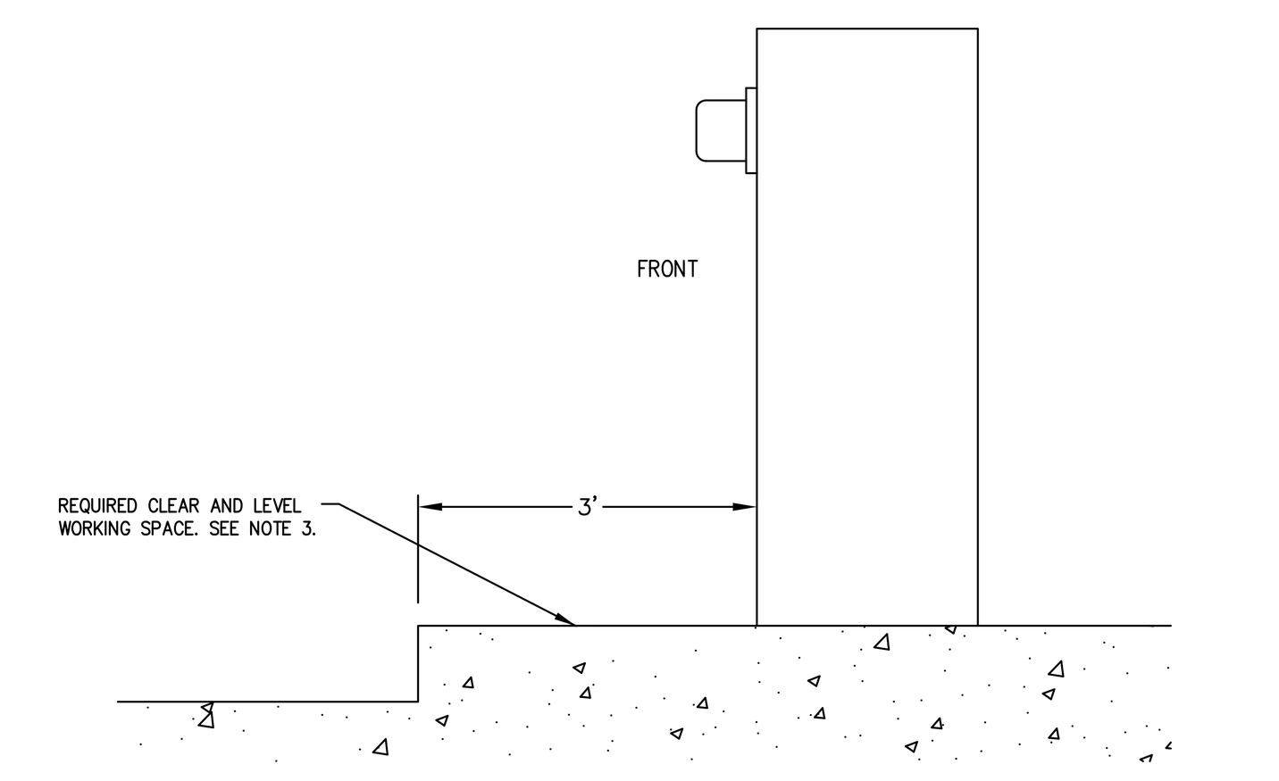
DB CONDUIT WITHOUT ENCASEMENT IS ACCEPTABLE FOR PORTIONS OF TRENCH WITH ONLY ONE OR TWO CONDUITS

SEMI–ENCASEMENT IS REQUIRED FOR PORTIONS OF TRENCH WITH ONLY THREE OR FOUR CONDUITS

FULL ENCASEMENT IS REQUIRED FOR MORE THAN FOUR CONDUITS

D18: Rev. 5/08/2006

PANEL CLEARANCE
UNDERGROUND SERVICE CONNECTIONS 0–600 VOLTS
SEE ESR 3–16



NOTES:

1. A MINIMUM OF THREE (3) FEET OF CLEAR, LEVEL WORK SPACE IS REQUIRED IN FRONT OF ALL TERMINATION, METERING, AND SERVICE EQUIPMENT.
2. SEE ESR–5 FOR METER–MOUNTING HEIGHT REQUIREMENTS. METER MOUNTING HEIGHT WILL BE MEASURED FROM THE STANDING AND WORKING SPACE TO THE CENTERLINE OF THE METER(S).
3. WHEN SERVICE EQUIPMENT IS INSTALLED ON AN ELEVATED PORTION OF THE FLOOR/GROUND, OR HOUSEKEEEPING PAD, THE PAD SHALL BE FLUSH WITH AND EXTEND A MINIMUM OF THREE (3) FEET. THIS IS MEASURED FROM THE FRONT OF THE SERVICE EQUIPMENT OR THE OUTER DOOR(S) OF THE SWITCHBOARD NEMA 3R ENCLOSURE WHEN INSTALLED. IN NO CASE SHALL THE MAXIMUM METER HEIGHT OF SIX (6) FEET THREE (3) INCHES BE EXCEEDED.
4. TO MAINTAIN A SAFE, CLEAR, AND LEVEL WORKING AREA IN FRONT OF NEW OR EXISTING METER AND SERVICE EQUIPMENT, A CONCRETE SLAB OR OTHER SUITABLE PERMANENT HARD SURFACE, ACCEPTABLE TO THE COMPANY, MUST BE USED.
5. FOR SWITCHBOARDS ABOVE 600V, FIVE–FOOT MINIMUM OF CLEAR AND LEVEL STANDING AND WORKING SPACE IS REQUIRED IN THE FRONT, REAR, AND SIDE OF ANY SECTION WHERE SUCH PART SUPPORTS OR PROVIDES ACCESS TO METERING, TESTING EQUIPMENT, OR SERVICE CABLE TERMINATION SECTIONS.

D99: 07/08/07

CUSTOMER NOTES:

EDISON APPROVED SERVICE CONDUIT MATERIALS
- RIGID PLASTIC POLYVINYL CHLORIDE (PVC) – SCH. 40 (MIN) EDISON–APPROVED OR UL LISTED
- DB–100/120 CONDUIT IS REQUIRED WHEN 4", 5", OR 6" CONDUIT IS INSTALLED

PVC SCH 80 SWEEP AT POLE FOR ALL SECONDARY OR SERVICE RUNS.
PVC SCH 80 SWEEP FOR STRAIGHT PRIMARY RUNS OF 150' OR LESS AT POLE AND PAD LOCATION.
FIBERGLASS SWEEP AT POLE FOR PRIMARY RUNS GREATER THAN 150'.
PVC SCH 40 SWEEP AT PANEL LOCATIONS.

ANY EXPOSED PVC MUST BE PVC SCH 80.
FIBERGLASS SWEEP MUST NOT BE EXPOSED TO SUNLIGHT.

CONDUIT TO BE MINIMUM 30" BELOW FINISHED GRADE.
MUST INSTALL 3/8" POLY PULL ROPE IN DUCT FOR MANDREL
(3' OF EXPOSED ROPE ON BOTH ENDS OF CONDUIT).

CONDUIT MUST BE INSPECTED BY SCE INSPECTOR.
PAYMENT, CONTRACTS, AND "TURN–ON" MUST BE COMPLETED BEFORE SCE INSPECTOR WILL VISIT

A 48–HOUR ADVANCE NOTICE IS REQUIRED BEFORE EXCAVATION AND
A 48–HOUR ADVANCE NOTICE IS REQUIRED BEFORE OPEN TRENCH INSPECTION.

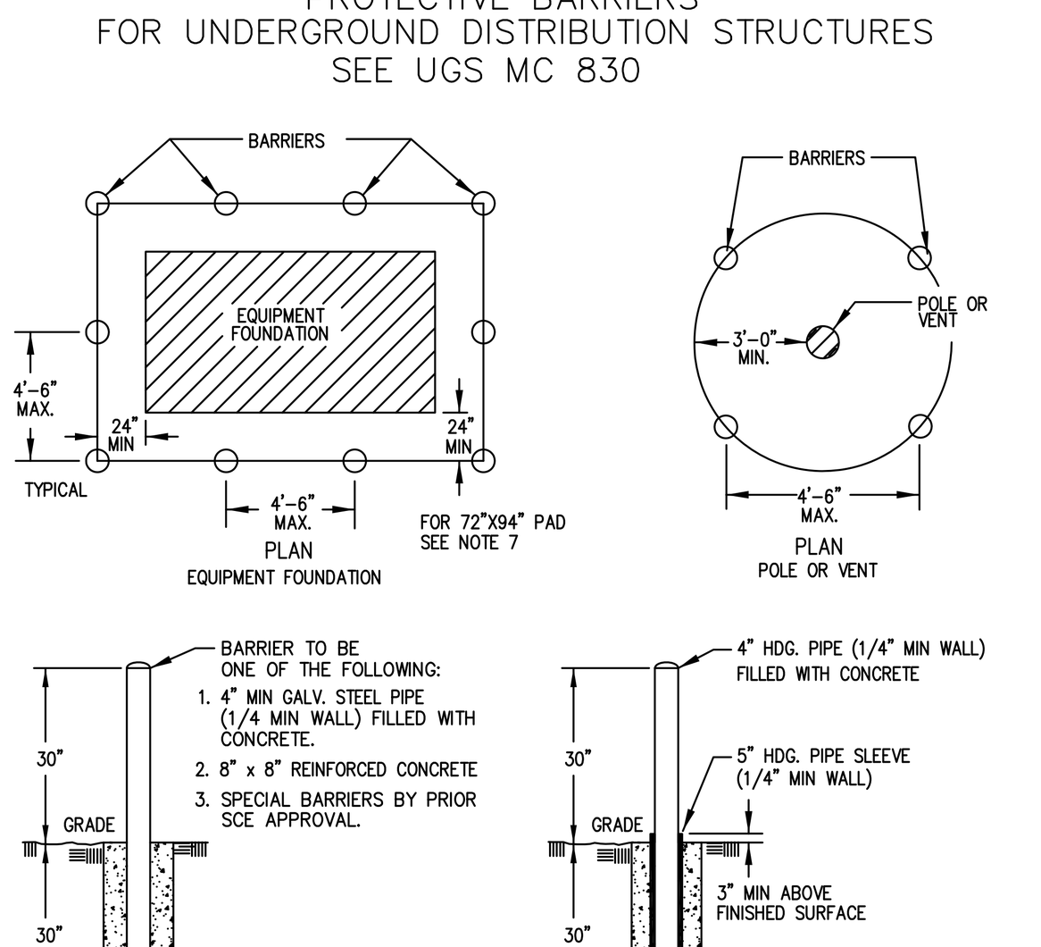
SCE INSPECTOR: TOMMY DELGADO 559–388–1627.

PROJECT NUMBER: TD1735707

ALL NEW SERVICE ACCOUNTS MUST HAVE "TURN ON" APPLICATION PRIOR TO ENERGIZING, PLEASE CALL SCE CUSTOMER SERVICE AT 800–655–4555.

CUSTOMER NOTES:
- STRUCTURES NOT PROTECTED BY CURB SHALL BE PROTECTED BY BOLLARDS
- METER ROOM SHALL COMPLY WITH MOST UP–TO–DATE ESR GUIDELINES

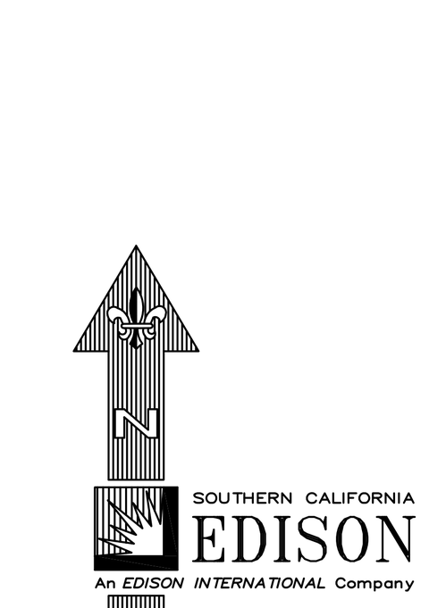
PROTECTIVE BARRIERS
FOR UNDERGROUND DISTRIBUTION STRUCTURES
SEE UGS MC 830



NOTES:

1. STRUCTURES WILL NORMALLY BE INSTALLED ONLY IN NON–TRAFFIC AREAS. PROTECTIVE BARRIERS TO BE USED WHERE CONSTRUCTION EXPOSES EQUIPMENT TO TRAFFIC.
2. TOP OF PROTECTIVE BARRIERS TO BE SMOOTH CUT AND TOP EDGES ARE TO BE ROUNDED.
3. AT LEAST ONE BARRIER IS TO BE REMOVABLE, WITH A MEANS OF LIFTING TO SUPPORT THE WEIGHT OF THE BARRIER, WHEN OVERHEAD OBSTACLES PREVENT EQUIPMENT REMOVAL OR INSTALLATION BY CRANE. THE LOCATION OF THE REMOVABLE BARRIER(S) SHALL BE APPROVED BY THE UNDERGROUND INSPECTOR.
4. ADEQUATE CLEARANCE MUST BE PROVIDED FOR DOORS, COOLING RADIATORS, AND SO FORTH.
5. PROTECTIVE BARRIERS, AS SHOWN, INDICATE TYPICAL REQUIREMENTS. FIELD CONDITIONS WILL NECESSITATE CHANGES FOR ADEQUATE EQUIPMENT PROTECTION. APPLICATION OF PROTECTIVE BARRIERS IS SITE–SPECIFIC.
6. THE UNDERGROUND INSPECTOR IN THE FIELD MUST APPROVE ALL PROTECTIVE BARRIER INSTALLATIONS PRIOR TO CONSTRUCTION. THE UNDERGROUND INSPECTOR WILL DETERMINE (A) STATUS OF OVERHEAD OBSTRUCTIONS, (B) THE FRONT AND BACK OF EQUIPMENT FOUNDATIONS, AND (C) CLEARANCES REQUIRED ON DOORS COOLING RADIATORS, AND SO FORTH.
7. WHEN A 72"X94" PAD IS BEING INSTALLED, (A) INCREASE THE DISTANCE TO 36 INCHES MINIMUM BETWEEN THE PROTECTIVE BARRIERS AND THE FRONT EDGE OF THE PAD; AND (B) INCREASE THE DISTANCE BETWEEN THE PROTECTIVE BARRIERS AND THE BACK EDGE OF THE PAD FOR CAPACITOR BANK (DOOR SIDE ONLY) TO 36 INCHES MINIMUM. THE UNDERGROUND INSPECTOR WILL DETERMINE THE FRONT AND BACK OF THIS EQUIPMENT FOUNDATION.
8. WHEN SPECIFIED ON WORKING DRAWING, A 6–INCH (MINIMUM VERTICAL FACE) CONCRETE CURB MAY BE INSTALLED IN PLACE OF PROTECTIVE BARRIERS. THIS CURB MUST BE AT LEAST 6 INCHES THICK AND ITS FRONT FACE AT LEAST 60 INCHES (MINIMUM SPACING) FROM THE EQUIPMENT FOUNDATION.

D91: Rev. 11/06/14



SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

SCALE: 1" = 40'
0 40 80

UNDERGROUND SERVICE ALERT
Contact USA
Dial 811 or 800-422-4133
www.digalert.org/contact
For Underground Locating
Two Working Days Before You Dig

D16: Rev. 05/28/20

WHERE CONDUITS ARE PICKED UP OR INTERCEPTED, CONDUIT SHALL BE MANDRELLED AND PULL ROPE INSTALLED FROM TERMINAL TO TERMINAL.

NOTE:
ALL ELECTRICAL DUCTS AND STRUCTURES WILL CONFORM TO GENERAL ORDER #128 (RULES FOR CONSTRUCTION OF UNDERGROUND ELECTRICAL SUPPLY AND COMMUNICATION PRESCRIBED BY THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA, JANUARY 2006).

TLM DATA: 5747172

	SIZE	KVA	CUST	%LOAD
EX	NA	NA	NA	NA
NEW	300	185	1	61

PROJECT REQUIREMENTS (Y/N)

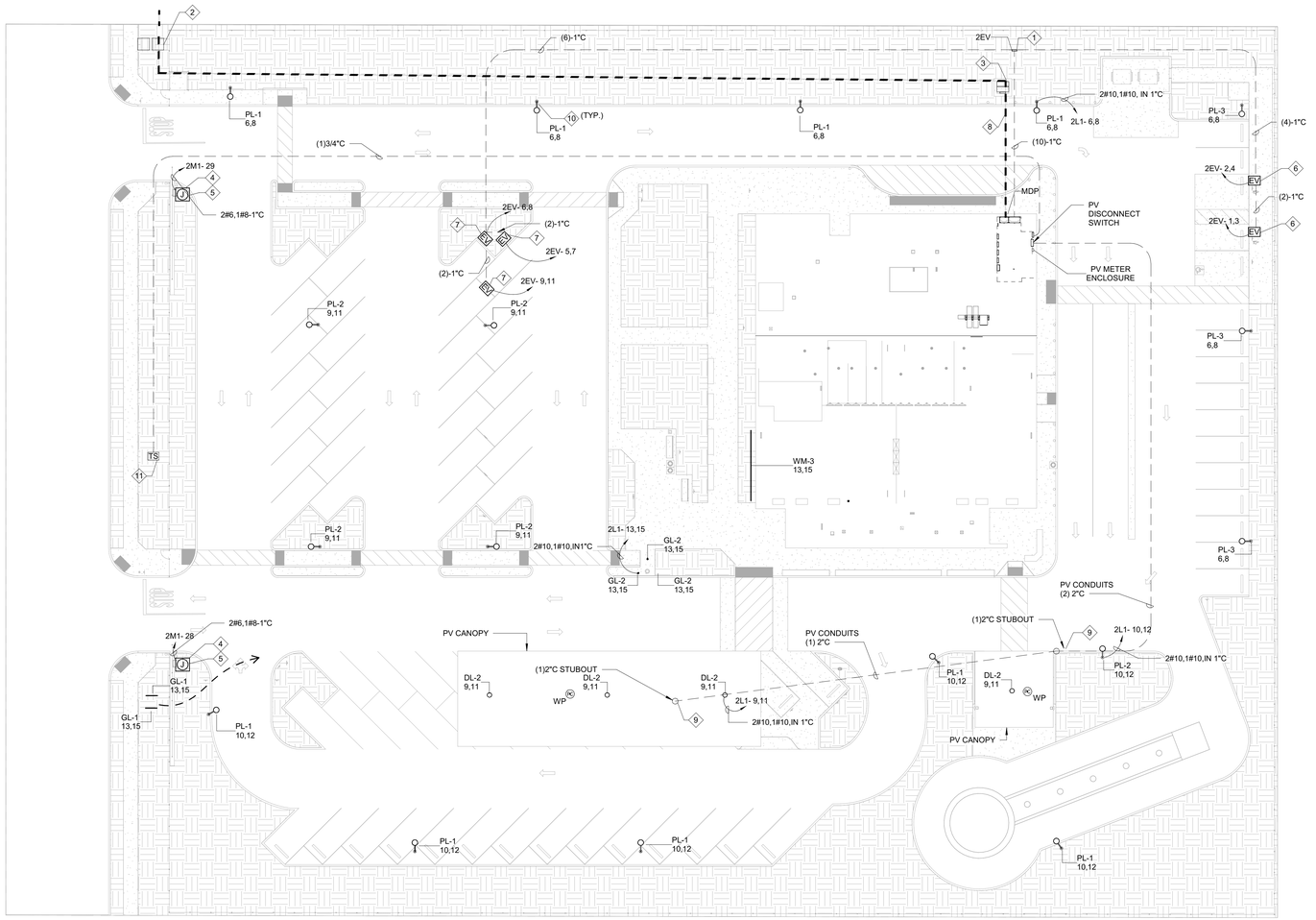
EDISON EASEMENT REQUIRED	Y
PWRD 88 REQUIRED	Y
UG CIVIL ONLY WORK ORDER	N
PERMIT REQUIRED	Y
PERMIT TYPE: ______	
OUTAGE REQUIRED	Y
OUTAGE DATE: ______ TIME: ______	
TRAFFIC CONTROL REQUIRED	Y
PED. TRAFFIC CONTROL REQ'D	N
CONVEYANCE LETTER REQ'D	N
ENVIRONMENTAL CLEARANCE REQ'D	Y
CSD 140 (TLM) REQ'D	Y

D124: Rev. 02/08/18

DISTRICT 51 – TULARE	PROJ. MGR. RODRIGUEZ, JOSEPH C. PHONE 559–580–0357	PLANNER RODRIGUEZ, JOSEPH C. PHONE 559–580–0357	DESIGNER RIETKERK, DULCE
PROJECT NO. 2030494 / SERVICE REQUEST 2928834	MSR NO. 8536142	PRODUCT–1 1735705–RULE 20C – OH REMOVAL	ASSOC DESGN
CIRCUIT / VOLTAGE CBS 12KV	THOMAS GUIDE	PRODUCT–2 1735706–RULE 20C – UG INSTALL	ASSOC DESGN
SUB / PG NO. DELANO SUB (B3)	CIRCUIT CODE 03210	PRODUCT–3 1735707–LINE EXTENSION	ASSOC DESGN
INVENTORY MAP 124–50B–5	J.P.A. NO.	PROPOSED CONSTRUCTION (LOCATION) AECOM– DELANO DMV 448 DOVER PKWY DELANO, CA 93215	

TYPE	DATE	APPROVED BY	CHECKED BY	DRAWN BY	PAX #	SHEET	DESIGN\DRWG NO.
						2 OF 2	1306109_0.01

Southern California Edison Company



1 ELECTRICAL SITE PLAN
1" = 20'-0"

N

GENERAL NOTES

1. FIELD VERIFY ALL CONDITIONS PRIOR TO START OF WORK.
2. THE LIGHTING CONTROL SYSTEM SHALL BE NETWORK BASED (nLIGHT ACUITY CONTROL OR APPROVED EQUAL). COORDINATE ALL REQUIREMENTS WITH MANUFACTURER AND PROVIDE NECESSARY COMPONENTS FOR A FULLY FUNCTIONAL T24 COMPLIANCE LIGHTING CONTROL SYSTEM. PROVIDE CONNECTION TO ALERTON BMS SYSTEM.
3. ALL OUTDOOR LIGHTING SHALL BE CONTROLLED WITH A PHOTOCELL IN ADDITION TO AN AUTOMATIC TIME-SWITCH CONTROL, OR AN ASTRONOMICAL TIME-SWITCH CONTROL.OUTDOOR LIGHTING SHALL BE CONTROLLED BY EXTERIOR PHOTOCELL THAT AUTOMATICALLY TURNS OFF WHEN SUFFICIENT DAYLIGHT IS AVAILABLE.
4. PROVIDE PV CONDUITS AND PULL BOXES FOLLOWING FINAL APPROVED PV DRAWINGS.
5. PROVIDE A COMPLETE DESIGN AND INSTALLATION OF A LIGHTNING PROTECTION SYSTEM FOR THE BUILDING AS SPECIFIED. SYSTEM SHALL BE DESIGN PER NFPA 780 AND LOCAL REQUIREMENTS. COMPLETED DESIGN SHALL BE SUBMITTED AND APPROVED PRIOR TO INSTALLATION.
6. PROVIDE A CANOPY MOUNTED 70 KW PHOTOVOLTAIC (PV) SYSTEM DESIGN AND INSTALLATION. SYSTEM SHALL BE BASED ON UTILIZING 380KW SOLAR PANEL. DESIGN SHALL BE APPROVED PRIOR TO INSTALLATION.
7. SEE LIGHT FIXTURE SCHEDULE ON SHEET E6.01 FOR FIXTURE TYPE DESCRIPTIONS AND INFORMATION.

KEYNOTES

KEY	DESCRIPTION
1	PROVIDE A FREE STANDING 36"W x 24"D x 36"H NEMA 4 STAINLESS STEEL ENCLOSURE.
2	PROVIDE 5'X5'X4" VAULT PER SOUTHERN CALIFORNIA EDISON REQUIREMENTS. COORDINATE WITH CIVIL.
3	PROVIDE 6'X8'X6" CONCRETE PAD FOR UTILITY TRANSFORMER PER SOUTHERN CALIFORNIA EDISON REQUIRMENTS. COORDINATE WITH CIVIL.
4	PROVIDE J-BOX FOR 120V, 20A CONNECTION IN 1" CONDUIT FOR MOTORIZED GATE. COORDINATE EXACT REQUIREMENT WITH MANUFACTURER BEFORE INSTALLATION. COORDINATE ROUTING WITH CIVIL.
5	PROVIDE J-BOX FOR ASSOCIATED 1" CONDUIT BACK TO THE MAIN COMMUNICATION ROOM AS REQUIRED FOR LOW VOLTAGE CONTROL/SECURITY PROVISIONS. COORDINATE EXACT REQUIREMENT WITH MANUFACTURER BEFORE INSTALLATION. COORDINATE ROUTING WITH CIVIL.
6	DUAL PORT PEDESTAL POS ELECTRICAL VEHICLE CHARGING STATION 208V, 40 AMPS, 2 POLES NEMA 3R, REFER TO MANUFACTURER WRITTEN RECOMMENDATIONS FOR INSTALLATIONS / ANCHORAGE DETAILS AND REQUIREMENTS.
7	PROVIDE A LISTED WET LOCATION SUITABLE JUNCTION BOX FOR FUTURE EV CHARGING STATION. VERIFY LOCATION PRIOR TO ROUGH IN. PROVIDE PERMANENT SIGNAGE AT JUNCTION BOX STATING "EV CAPABLE".
8	PROVIDE 5-4" C FOR INCOMING UTILITY SECONDARY CONDUCTORS FROM VAULT TO MDP PER SOUTHERN EDISON REQUIREMENTS. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH STRUCTURAL REGARDING CONDUITS ENTERING THE BUILDING AND BUILDING FOUNDATION.
9	PROVIDE CONDUIT STUB-OUTS FOR PV SYSTEM CONNECTION. RUN CONDUIT TO PV DISCONNECT. VERIFY LOCATION IN THE FIELD.
10	REFER TO DETAIL #2 ON SHEET E8.02 FOR POLE MOUNTED LUMINAIRE DETAIL.
11	PROVIDE (1)3/4" CONDUIT TO ABOVE GROUND SHUT OFF WITH TAMPER SWITCH FOR FIRE ALARM SUPERVISORY CIRCUIT. COORDINATE LOCATION OF TAMPER SWITCH WITH CIVIL.

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY
12/07/21
20-1059
Approval of this plan does not authorize or approve any omission or deviation from applicable requirements. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV
Dover Parkway, Delano
California Department of General Services

LICENSED PROFESSIONAL ENGINEER
SIGFA CULBERTSON
E22311
ELECTRICAL
STATE OF CALIFORNIA
10-15-2021

CONSULTANT
AECOM
nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

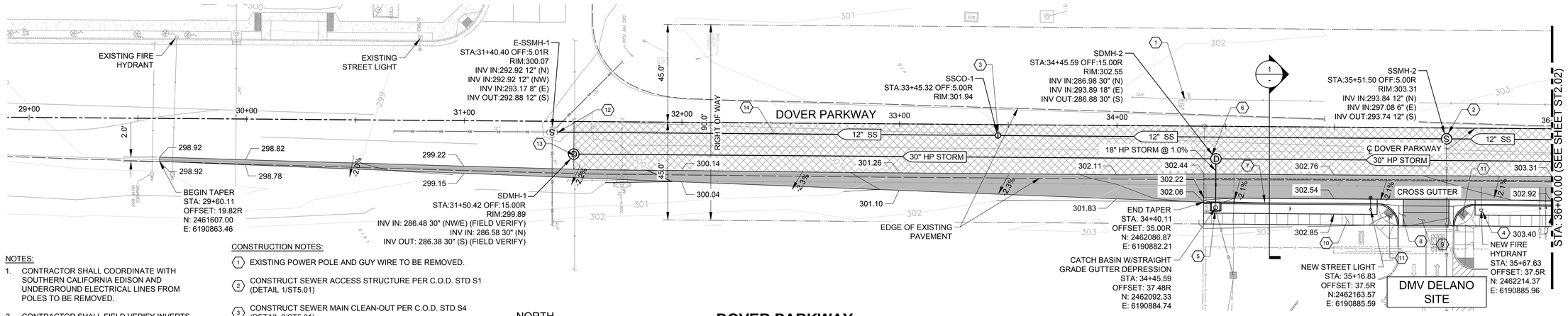
ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
1	SFM REVIEW	07/02/20
4	SFM BACKCHECK REVIEW	12/15/20
5	CITY PLAN CHECK	09/15/21

DATE 04/08/2020
JOB NO. DGS 140724
SHEET TITLE
ELECTRICAL SITE PLAN
SHEET NO.
E1.01

V4



NOTES:

1. CONTRACTOR SHALL COORDINATE WITH SOUTHERN CALIFORNIA EDISON AND UNDERGROUND ELECTRICAL LINES FROM POLES TO BE REMOVED.
2. CONTRACTOR SHALL FIELD VERIFY INVERTS OF EXISTING STORM DRAIN MANHOLE. IF SOUTHERN INVERT IS FOUND TO BE GREATER THAN 286.38, ENGINEER SHALL BE ALERTED IMMEDIATELY.
3. ADS HP-STORM PIPE OR APPROVED EQUAL SHALL BE USED FOR ALL STORM DRAIN PIPE WITHIN CITY RIGHT OF WAY. PIPE SHALL MEET ASTM F2881 OR AASHTO M330 STANDARDS AND HAVE A MANNING'S "n" VALUE OF 0.012. JOINTS SHALL BE WATERTIGHT IN ACCORDANCE WITH ASTM D3212. GASKETS SHALL MEET REQUIREMENTS OF ASTM F477. GASKETS SHALL BE INSTALLED BY PIPE MANUFACTURER AND COVERED WITH REMOVAL PROTECTIVE WRAP TO ENSURE THE GASKET IS FREE FROM DEBRIS PRIOR TO INSTALLATION. A JOINT LUBRICANT SHALL BE USED ON GASKET AND BELL DURING ASSEMBLY. TEST JOINTS IN ACCORDANCE WITH ASTM F1417 OR ASTM F2487. CONTACT MANUFACTURER FOR RECOMMENDED LEAKAGE RATES. INSTALL PIPE PER ASTM D2321 AND MANUFACTURER RECOMMENDATIONS.

CONSTRUCTION NOTES:

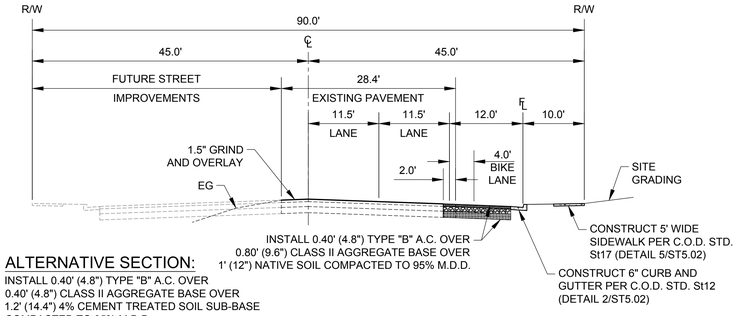
1. EXISTING POWER POLE AND GUY WIRE TO BE REMOVED.
2. CONSTRUCT SEWER ACCESS STRUCTURE PER C.O.D. STD S1 (DETAIL 1/ST5.01)
3. CONSTRUCT SEWER MAIN CLEAN-OUT PER C.O.D. STD S4 (DETAIL 2/ST5.01)
4. CONSTRUCT FIRE HYDRANT PER C.O.D. STD W1 (DETAIL 3/ST5.01)
5. CONSTRUCT CATCH BASIN PER C.O.D. STD D3 (DETAIL 5/ST5.01)
6. CONSTRUCT STORM DRAIN MANHOLE PER C.O.D. STD D5 (DETAIL 1/ST5.02)
7. CONSTRUCT CURB AND GUTTER PER C.O.D. STD St12 (DETAIL 2/ST5.02)
8. CONSTRUCT CROSS GUTTER PER C.O.D. STD St13 (DETAIL 3/ST5.02)
9. CONSTRUCT COMMERCIAL DRIVEWAY APPROACH PER C.O.D. STD St15 (DETAIL 4/ST5.02)
10. CONSTRUCT SIDEWALK PER C.O.D. STD St17 (DETAIL 5/ST5.02)
11. CONSTRUCT ADA CURB RAMP PER CALTRANS STANDARD PLAN A88A. PROVIDE DETECTABLE WARNING SURFACE FOR 3' DEPTH OF RAMP, EXTENDING FULL WIDTH OF RAMP.
12. CONTRACTOR SHALL FIELD LOCATE EXISTING BURIED SEWER WYE, CONNECT NEW 12" SEWER LINE TO END OF WYE. FIELD VERIFY EXISTING INVERTS AND ENSURE 0.20% SLOPE IS MAINTAINED.
13. REMOVE EXISTING STORM DRAIN MANHOLE AND REPLACE WITH NEW STORM DRAIN MANHOLE PER C.O.D. STD D5 (DETAIL 1/ST5.02). PROTECT AND RECONNECT EXISTING STUBOUTS.
14. 1.5" GRIND AND OVERLAY PER C.O.D. STD St21B (DETAIL 2/ST5.03) FROM STA: 31+50.42 TO STA: 37+49.32.

NORTH

0 20' 40'
SCALE: HORIZ: 1" = 20'
VERT:1" = 2'

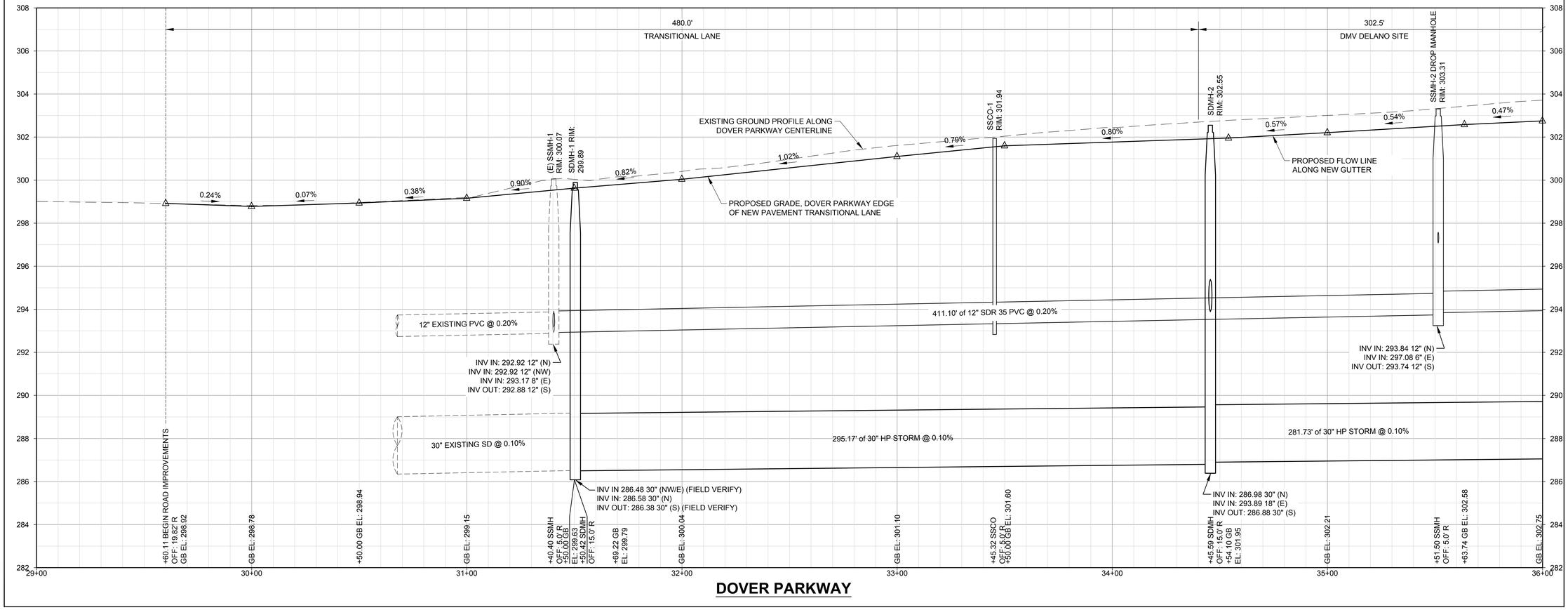
DOVER PARKWAY

STA: 29+00.00 TO STA 36+00.00



ALTERNATIVE SECTION:
INSTALL 0.40' (4.8") TYPE "B" A.C. OVER
0.40' (4.8") CLASS II AGGREGATE BASE OVER
1.2' (14.4") 4% CEMENT TREATED SOIL SUB-BASE
COMPACTED TO 95% M.D.D.

1 STREET SECTION
1" = 10'



DOVER PARKWAY

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano
California Department of General Services

REGISTERED PROFESSIONAL ENGINEER GORDON HO-MAY FONG C 87304 CIVIL STATE OF CALIFORNIA
09/21/2021
AECOM
CONSULTANT
nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000
ARCHITECT

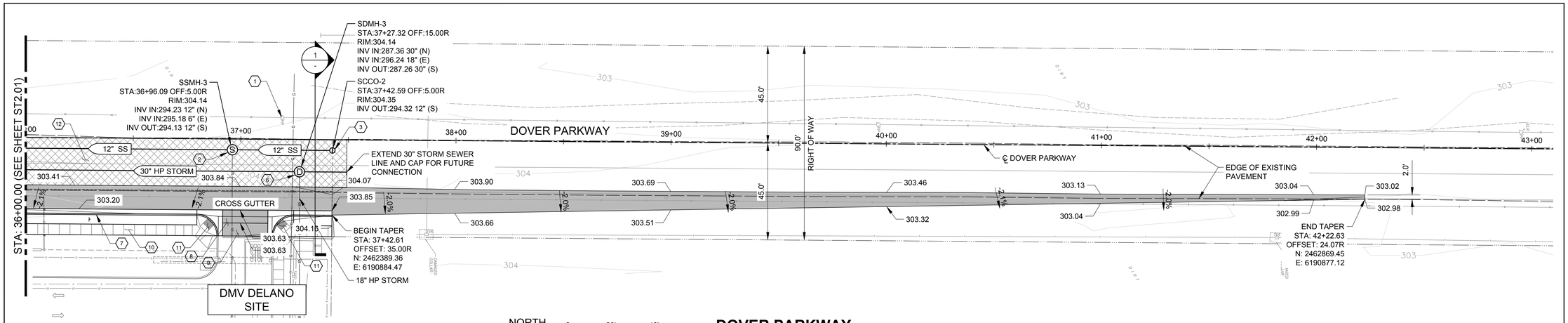
REVISIONS

NO.	DESCRIPTION	DATE

DATE 09/21/2021
JOB NO. DGS 140724
SHEET TITLE

DOVER PARKWAY
STA 29+00.00 TO
STA 36+00.00

SHEET NO.
ST2.01



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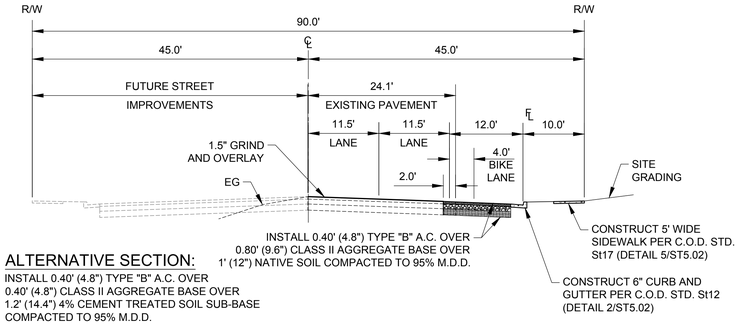
NORTH

0 20' 40'
SCALE: HORIZ: 1" = 20'
VERT:1" = 2'

DOVER PARKWAY

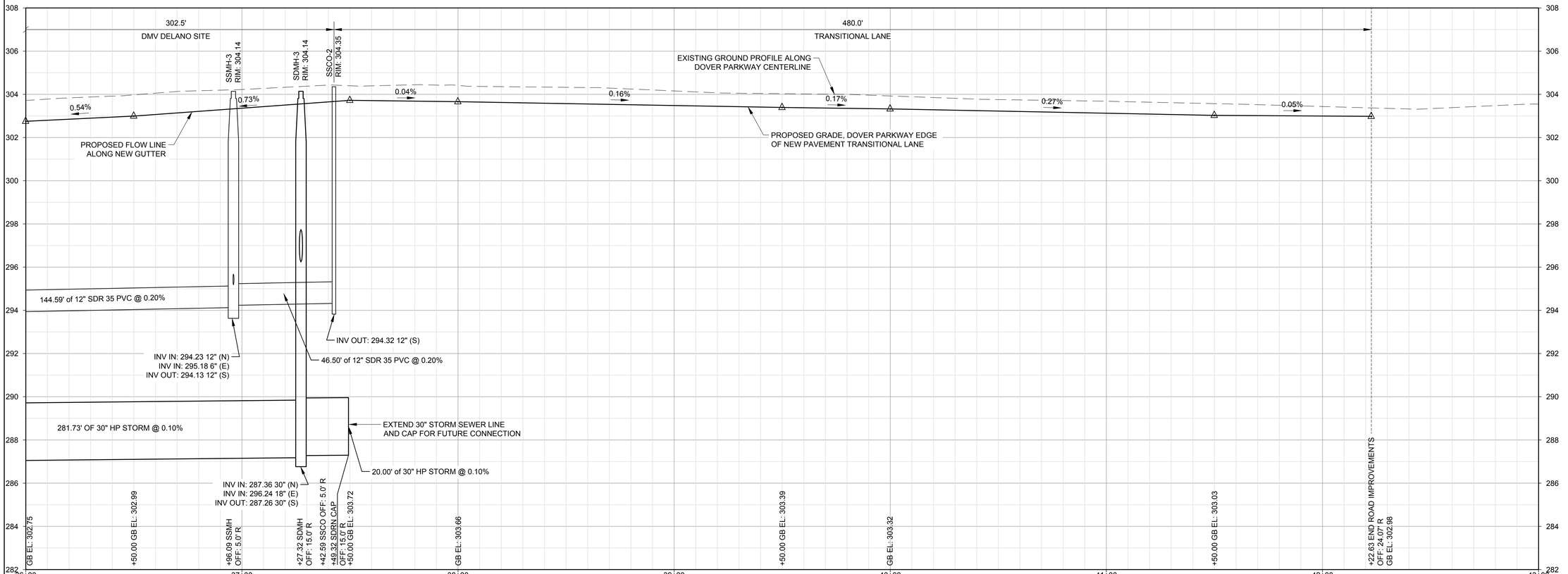
STA: 36+00.00 TO STA 43+00.00



ALTERNATIVE SECTION:

INSTALL 0.40' (4.8") TYPE "B" A.C. OVER
0.40' (4.8") CLASS II AGGREGATE BASE OVER
1.2' (14.4") 4% CEMENT TREATED SOIL SUB-BASE
COMPACTED TO 95% M.D.D.

1 STREET SECTION
1" = 10'



DOVER PARKWAY

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER GORDON HO-MAY FONG C 87304 CIVIL STATE OF CALIFORNIA

09/21/2021

AECOM

CONSULTANT

nacht&lewis

600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

ARCHITECT

REVISIONS		
NO.	DESCRIPTION	DATE

DATE 09/21/2021

JOB NO. DGS 140724

SHEET TITLE

DOVER PARKWAY STA 36+00.00 TO STA 43+00.00

SHEET NO.

ST2.02

State of California • Department of General Services • Gavin Newsom, Governor
REAL ESTATE SERVICES DIVISION
Project Management and Development Branch
Architecture and Engineering Sections 1 & 2
707 Third St., Suite 4-105 • West Sacramento, California 95605-2811

ADDITIONAL DETAILED INSTRUCTIONS

ADI: 004

PROJECT: DMV Delano Field Office **DATE: 02/17/2023**
CLIENT AGENCY: California Department of Motor Vehicles
LOCATION: 448 Dover Parkway Delano, CA **WORK ORDER:**
CONTRACT:

CONTRACTOR:	**PROJECT DIRECTOR:**
Bernards **555 First Street** **San Fernando, CA 91340** Tel: (818) 898 1521 Fax: (818) 361 9208	**Ryan Beck** State of California, DGS, RESD, PMDB 707 Third St., Suite 04-105 West Sacramento, CA 95605 Tel: (916) 628-8192 Fax:

SUBJECT:	**REFERENCE DOCUMENTS:**
Fire Riser Revisions	See Below

Description:

T0.2 – Replaced Fire Flow test with test performed on February 9, 2023
C0.01 - Replaced Fire Flow test with test performed on February 9, 2023
C1.06 – Replaced single 8-inch diameter fire riser with two (2) 4-inch diameter risers. One 4” for fire department connection, One 4” that transitions from the site 8” at the proposed tee.
C1.07 – Replaced single 8-inch diameter fire riser with two (2) 4-inch diameter risers. One 4” for fire department connection, One 4” that transitions from the site 8” at the proposed tee. Added keynote 12 to refer to structural detail for parallel pipe separation requirements at concrete footings.
C5.05 – Detail 2, replaced fire riser from 8” diameter to 4” diameter. Detail 4, updated label to reflect connection to fire riser room and changed material for underground pipe from 4” DIP to 4” C900 PVC.
F1.01 – Updated General Note 19 and Hydraulic Graph to reflect Fire Flow test performed on February 9,2023
F3.01 – Replaced single 8-inch diameter fire riser with two (2) 4-inch diameter risers.

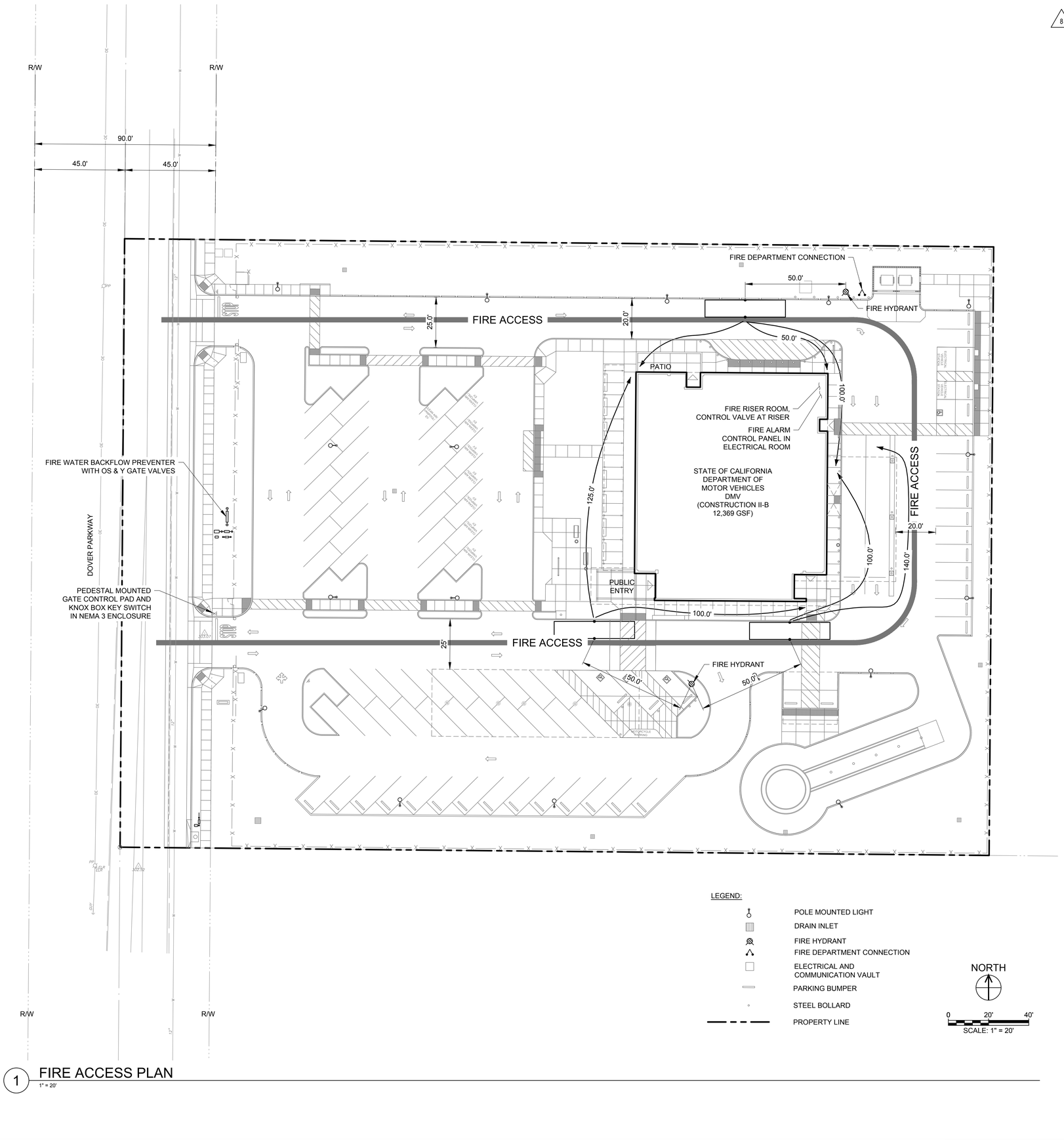
The Work shall be carried out in accordance with these supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. **Proceeding with Work in accordance with these instructions indicates acceptance without change in the Contract Amount or Contract Duration.** It is the Contractor’s responsibility to inform subcontractors, vendors and staff of these remarks to the design and/or construction.

Signed: _____ Date: _____

Ryan Beck
State of California, DGS, RESD, PMDB
707 Third St., Suite 04-105
West Sacramento, CA 95605

Tel: (916) 628-8192 Fax:

cc:



LEGEND:

- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- ELECTRICAL AND COMMUNICATION VAULT
- PARKING BUMPER
- STEEL BOLLARD
- PROPERTY LINE

NORTH

0 20' 40'

SCALE: 1" = 20'

1 FIRE ACCESS PLAN

1" = 20'

8

Hydrant Flow Test Report

Test Date 2/09/2023 **Test Time** 9:20am

Location

DMV DELANO
DOVER PARK WAY.
DELANO, CA.

Tested by

JAKE BUSTOS &
HECTOR CONTRERAS
CONTROL FIRE PROTECTION, INC.
1347 OGDEN ST.
BAKERSFIELD, CA. 93305

Notes

SEE INSPECTION REPORT FROM STATE FIRE MARSHAL

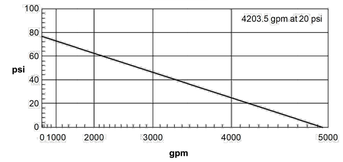
Read Hydrant

77 psi **static pressure**
70 psi **residual pressure**
2 ft **hydrant elevation**

Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1	2	2.5	.9	65	1353 gpm

Flow Graph



Created with the free hydrant flow test program from www.igneusinc.com

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY
DEPARTMENT OF FORESTRY AND FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE AND LIFE SAFETY DIVISION
INSPECTION REPORT
EN-02 (12/08)

INSPECTION REPORT

FILE NUMBER	PAGE	OF	PAGE
01-15-11-0235-10001	01		01
NAME OF FACILITY	HOURS		MINUTES
Dept. of Motor Vehicles			
NAME OF BUILDING			
DMV Office -Delano			
ADDRESS			
Dover Parkway Delano, CA			
DISCUSSED WITH	TITLE		
Danette Smith	DGS Construction Supervisor-I		
ACCOMPANIED BY	TITLE		
Danette Smith	DGS Construction Supervisor-I		

Dept. of Motor Vehicles - Delano **Govmotus #20-S-1059-CP-PI**

On February 9, 2023, Deputy State Fire Marshal-III Specialist Edward Arriaga (DSFM Arriaga) witness a fire hydrant flow test. DSFM Arriaga was accompanied by DGS Construction Supervisor-I Danette Smith, Bernard's Construction Superintendent Tim Brady, representatives from Control Fire Protection & the City of Delano.

Two fire hydrants were used for the water flow test; the test commenced at approximately 0930 hours.

Fire Hydrant-1 (Flow Hydrant)
Locate on Dover St
Total distance from fire hydrant to property line: 580 feet.
Total distance from fire hydrant to the southside of the building footprint: 790 feet.
Static was at 77 psi. Outlet was 2 ½".
Flow was at 65 psi. Outlet was 2 ½". Method of testing was a Pitot gauge.

Fire Hydrant-2 (Static/Residual Hydrant)
Locate on Morse Blvd.
Total distance from fire hydrant to property line: 604 feet.
Total distance from fire hydrant to the southside of the building footprint: 814 feet.
Static was at 70 psi (when Fire Hydrant-1 was flowing). Outlet was 2 ½".

NOTE: Fire hydrant flow test is valid for six months from 02-09-23 to 08-09-23.

NOTE: *Refer to Job Card, Building Plans, Specifications, etc., for additional required inspections. The OSFM does not perform Quality Control or Quality Assurance.*

END OF REPORT

RECEIVED BY	DATE
Danette Smith	
DEPUTY STATE FIRE MARSHAL	DATE OF INSPECTION
Edward Arriaga	02-09-23
Edward Arriaga	

HYDRANT FLOW TEST:

PERFORMED ON: FEBRUARY 9, 2023

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY Gavin Newsom, Governor

DEPARTMENT OF FORESTRY AND FIRE PROTECTION
Office of the State Fire Marshal
P.O. Box 944246 SACRAMENTO,
CA 94244-2460 (916) 568-2993
Website: www.osfm.fire.ca.gov

LOCAL FIRE AUTHORITY – ACCESS APPROVAL

Agency & Project Name: California Department of Motor Vehicles (DMV) - Delano

Address: 448 Dover Parkway, Delano, CA APN: 521-030-072

GovMotus Control Number: 20-1059

Pursuant to CCR Title 19 §3.00 and §3.05, the California State Fire Marshal is requesting certification from the local fire authority that the above sections are met to their satisfaction.

This form shall be scanned to the accompanying fire access plan reflecting all items under consideration, and wet signed by the local fire authority. Please complete all applicable items based on scope. California State Fire Marshal project approval may be delayed until this form is completed and returned. If you have any questions, please contact the California State Fire Marshal Plan Review Section at (916) 568-2993.

Approved	Yes	No
Fire Department Access	✓	
Fire Department Connection	✓	
Fire Hydrant	✓	
Fire Alarm Annunciator	✓	
Fire Alarm Control Panel	✓	
Knox Box	✓	
Emergency Responder Radio Coverage		✓
Medical Emergency Service Elevator		✓
Fire Service Access Elevator		✓
Bi-Directional Amplification (BDA) Systems		✓

Local Fire Authority: Kern County Fire Department
Address: 2820 M St.
City/State/ZIP: Bakersfield, CA 93301

Approval issued by: JESUS ARRIAGA
Rank/Title: Fire Inspector II
Phone Number: (661) 391-3240
Signature: [signature] **Date:** 02/16/2023

"The Department of Forestry and Fire Protection serves and safeguards the people and protects the property and resources of California."

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER
GORDON HO-MAN YONG
C 87304
CIVIL
STATE OF CALIFORNIA
02/16/2023

AECOM

CONSULTANT

nacht&lewis

600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 004	02/16/23

DATE 02/16/2023

JOB NO. DGS 140724

SHEET TITLE

FIRE ACCESS PLAN

SHEET NO.

T0.2

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
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ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

GENERAL NOTES:

1. CONTRACTOR TO COORDINATE WITH THE CITY OF DELANO PRIOR TO ANY CONSTRUCTION WORK PERFORMED WITHIN THE RIGHT OF WAY.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED FOR CONSTRUCTION.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING DIGGING PERMIT PRIOR TO ANY EXCAVATION OR TRENCHING ACTIVITIES, IF NECESSARY.
4. COORDINATE WITH STATE PRIOR TO SALVAGING ITEMS OR HAULING MATERIALS FROM THE CONSTRUCTION SITE.
5. CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF EXISTING UTILITIES AND EXERCISE PROPER CARE IN EXCAVATION OF THE AREA. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPLACED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE.
6. SWPPP BEST MANAGEMENT PRACTICES SHALL BE EMPLOYED AT ALL TIMES DURING CONSTRUCTION.
7. CONTRACTOR SHALL PERFORM THE MINIMUM CLEARING NECESSARY FOR WORK TO BE PERFORMED. CONTRACTOR SHALL BE RESPONSIBLE FOR RETURNING ALL DISTURBED AREAS TO THEIR ORIGINAL OR BETTER CONDITION IN ACCORDANCE WITH THE SPECIFICATIONS.
8. CONTRACTOR IS RESPONSIBLE FOR ALL PROJECT SAFETY INCLUDING, BUT NOT LIMITED TO, TRENCH EXCAVATION AND SHORING, AND SITE SECURITY.
9. ALL DIMENSIONS SHOWN ON PLANS ARE TO FACE OF CURB, OUTSIDE EDGE, CENTER OF STRIPE OR CENTER OF BOLLARD.

SURVEY NOTES:

TOPOGRAPHY: EXISTING TOPOGRAPHY AND SITE CONDITION INFORMATION SHOWN ON THESE PLANS ARE BASED ON A SURVEY COMPLETED BY JEFFERY D. BRIANS, RCE 36182 AT BLAIR, CHURCH & FLYNN.

SITE BENCHMARK:

CHISELED "X" ON TOP OF CURB WEST SIDE OF DOVER PARKWAY, APPROXIMATELY 735.9' SOUTH OF SOUTHERN PROPERTY LINE.
ELEVATION = 299.87' NAVD88 DATUM

DOVER PARKWAY STREET IMPROVEMENTS:

REFER TO SEPARATE DESIGN PACKAGE FOR CONSTRUCTION OF STREET IMPROVEMENTS ALONG DOVER PARKWAY. DESIGN PACKAGE IS THE CITY OF DELANO APPROVED DESIGN OF OFF-SITE IMPROVEMENTS WITHIN THE ADJOINING RIGHT OF WAY. IF THERE ARE DISCREPANCIES BETWEEN THESE PLANS AND STREET IMPROVEMENT PLANS, STREET IMPROVEMENT PLANS SHALL GOVERN.

CONTRACTOR SHALL OBTAIN ENCROACHMENT PERMIT FROM THE CITY OF DELANO PRIOR TO COMMENCING WORK IN RIGHT OF WAY,

ABBREVIATIONS:

&	AND
℄	CENTERLINE
°	DEGREES
Ø	DIAMETER
'	FEET, MINUTES
"	INCHES, SECONDS
#	NUMBER
%	PERCENT
ACC	ACCESSIBLE
ADJ.	ADJACENT
ASTM	ASTM INTERNATIONAL
AWWA	AMERICAN WATER WORKS ASSOCIATION
BC	BEGIN CURVE
BL	BEGIN LINE
BMP'S	BEST MANAGEMENT PRACTICES
CA	CALIFORNIA
CF	CUBIC FEET
CFS	CUBIC FEET PER SECOND
CLR	CLEARANCE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
CONT.	CONTINUOUS
CY	CUBIC YARD
DGS	DEPARTMENT OF GENERAL SERVICES
DI	DRAINAGE/DRAIN INLET
DIA	DIAMETER
DIV.	DIVISION
DMV	DEPARTMENT OF MOTOR VEHICLES
DWG.	DRAWING
E	EAST\EASTING
EC	END CURVE
EL	END LINE
ELEV	ELEVATION
ELL	ELBOW
EV	ELECTRIC VEHICLE
EVA	ELECTRIC VEHICLE ACCESSIBLE
E.W.	EACH WAY
FDC	FIRE DEPARTMENT CONNECTION
FF	FINISHED FLOOR
FS	FINISHED SURFACE (FINISHED GRADE ELEVATION)
FT.	FEET
FW	FIRE WATER
HDPE	HIGH-DENSITY POLYETHYLENE
I.D.	INSIDE DIMENSION
INV	INVERT
ISA	INTERNATIONAL SYMBOL OF ACCESS
LED	LIGHT-EMITTING DIODE
LF	LINEAR FEET/FOOT
MAX.	MAXIMUM
MIN.	MINIMUM
N	NORTH\NORTHING
NAVD88	NORTH AMERICAN VERTICAL DATUM OF 1988
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NO.	NUMBER
NPDES	NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM
NTS	NOT TO SCALE
O.C.	ON CENTER
O.D.	OUTSIDE DIMENSION
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OS & Y	OUTSIDE STEM AND YOKE
OZ	OUNCE
PCC	PORTLAND CEMENT CONCRETE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PV	PHOTOVOLTAIC
PVC	POLYVINYL CHLORIDE
R	RADIUS
RCE	REGISTERED CIVIL ENGINEER
R/W	RIGHT OF WAY
S	SLOPE, SOUTH
SCH	SCHEDULE
SDR	STANDARD DIMENSION RATIO
SDRN	STORM DRAIN
SQ	SQUARE
SS	SANITARY SEWER
SSCO	SANITARY SEWER CLEANOUT
STA	STATION
STD	STANDARD
SWPPP	STORM WATER POLLUTION PREVENTION PLAN
TOC	TOP OF CURB
TYP	TYPICAL
W	WEST
W/	WITH
WWF	WELDED WIRE FABRIC

LEGEND:

- KEYNOTE/CONSTRUCTION NOTE
- DETAIL CALLOUT (VIEW NUMBER / SHEET NUMBER)
- PV CONDUIT
- E(UG) — ELECTRICAL UNDERGROUND
- F — FIRE WATER
- SS — SANITARY SEWER
- W — DOMESTIC WATER
- SD — STORM SEWER
- CU — COMMUNICATION LINE
- G — NATURAL GAS LINE
- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- ELECTRICAL AND COMMUNICATION VAULT
- PARKING BUMPER
- STEEL BOLLARD
- SWALE FLOW-LINE DIRECTION
- CHAIN-LINK CONSTRUCTION FENCE
- SILT FENCE OR FIBER ROLL
- PROPERTY LINE
- DROUGHT TOLERANT, EASILY MAINTAINED LANDSCAPING
- ASPHALT PAVEMENT
- CONCRETE PAVEMENT
- CONCRETE WALKWAYS

DRAWING INDEX

8

Hydrant Flow Test Report

Test Date 2/09/2023 **Test Time** 9:20am

Location
DMV DELANO
DOVER PARK WAY.
DELANO, CA.

Tested by
JAKE BUSTOS &
HECTOR CONTRERAS
CONTROL FIRE PROTECTION, INC.
1347 OGDEN ST.
BAKERSFIELD, CA. 93305

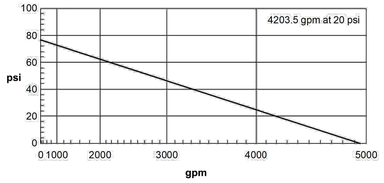
Notes
SEE INSPECTION REPORT FROM STATE FIRE MARSHAL

Read Hydrant
77 psi **static pressure**
70 psi **residual pressure**
2 ft **hydrant elevation**

Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1	2	2.5	.9	65	1353 gpm

Flow Graph



Created with the free hydrant flow test program from www.igneusinc.com

HYDRANT FLOW TEST:

PERFORMED ON: FEBRUARY 9, 2023

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY
DEPARTMENT OF FORESTRY AND FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE AND LIFE SAFETY DIVISION
INSPECTION REPORT
EN-02 (12/08)

INSPECTION REPORT

FILE NUMBER: 01-15-11-0235-10001		PAGE 01 OF PAGE 01	
NAME OF FACILITY: Dept. of Motor Vehicles		HOURS	MINUTES
NAME OF BUILDING: DMV Office -Delano			
ADDRESS: Dover Parkway Delano, CA			
DISCUSSED WITH: Danette Smith	TITLE: DGS Construction Supervisor-I		
ACCOMPANIED BY: Danette Smith	TITLE: DGS Construction Supervisor-I		

Dept. of Motor Vehicles - Delano **Govmotus #20-S-1059-CP-PI**

On February 9, 2023, Deputy State Fire Marshal-III Specialist Edward Arriaga (DSFM Arriaga) witness a fire hydrant flow test. DSFM Arriaga was accompanied by DGS Construction Supervisor-I Danette Smith, Bernard's Construction Superintendent Tim Brady, representatives from Control Fire Protection & the City of Delano.

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NOTE: *Refer to Job Card, Building Plans, Specifications, etc., for additional required inspections. The OSFM does not perform Quality Control or Quality Assurance.*

*****END OF REPORT*****

RECEIVED BY	DATE
Danette Smith	
DEPUTY STATE FIRE MARSHAL: Edward Arriaga	DATE OF INSPECTION: 02-09-23

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER
GORDON HO-MAN FONG
C 87304
CIVIL
STATE OF CALIFORNIA
02/16/2023

CONSULTANT
AECOM

nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 004	02/16/23

DATE 02/16/2023

JOB NO. DGS 140724

SHEET TITLE

CIVIL NOTES, ABBREVIATIONS, & LEGEND

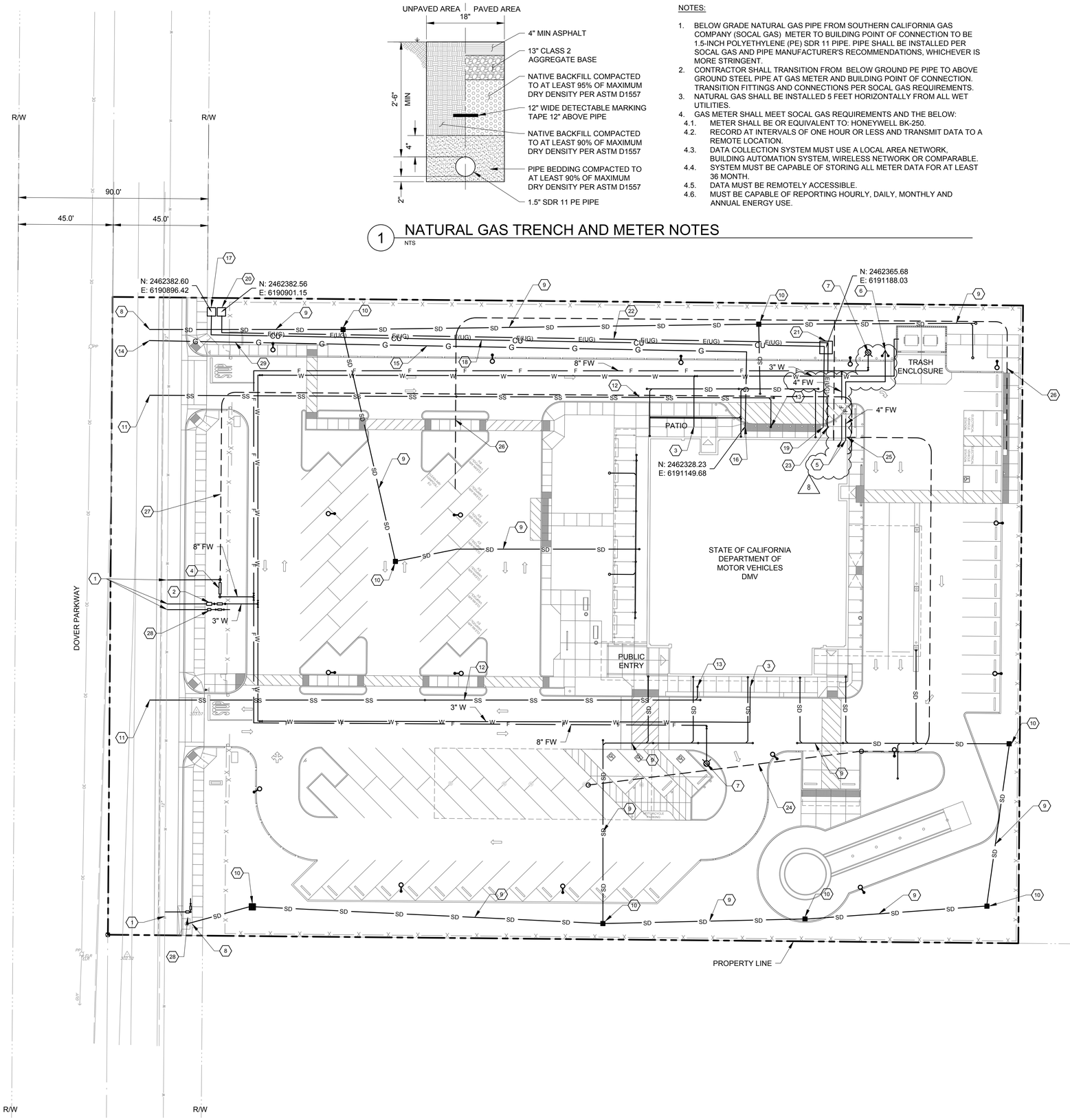
SHEET NO.

C0.01

NOTES:

1. BELOW GRADE NATURAL GAS PIPE FROM SOUTHERN CALIFORNIA GAS COMPANY (SOCAL GAS) METER TO BUILDING POINT OF CONNECTION TO BE 1.5-INCH POLYETHYLENE (PE) SDR 11 PIPE. PIPE SHALL BE INSTALLED PER SOCAL GAS AND PIPE MANUFACTURER'S RECOMMENDATIONS, WHICHEVER IS MORE STRINGENT.
2. CONTRACTOR SHALL TRANSITION FROM BELOW GROUND PE PIPE TO ABOVE GROUND STEEL PIPE AT GAS METER AND BUILDING POINT OF CONNECTION. TRANSITION FITTINGS AND CONNECTIONS PER SOCAL GAS REQUIREMENTS.
3. NATURAL GAS SHALL BE INSTALLED 5 FEET HORIZONTALLY FROM ALL WET UTILITIES.
4. GAS METER SHALL MEET SOCAL GAS REQUIREMENTS AND THE BELOW:
   - 4.1. METER SHALL BE OR EQUIVALENT TO: HONEYWELL BK-250.
   - 4.2. RECORD AT INTERVALS OF ONE HOUR OR LESS AND TRANSMIT DATA TO A REMOTE LOCATION.
   - 4.3. DATA COLLECTION SYSTEM MUST USE A LOCAL AREA NETWORK, BUILDING AUTOMATION SYSTEM, WIRELESS NETWORK OR COMPARABLE.
   - 4.4. SYSTEM MUST BE CAPABLE OF STORING ALL METER DATA FOR AT LEAST 36 MONTH.
   - 4.5. DATA MUST BE REMOTELY ACCESSIBLE.
   - 4.6. MUST BE CAPABLE OF REPORTING HOURLY, DAILY, MONTHLY AND ANNUAL ENERGY USE.

1 NATURAL GAS TRENCH AND METER NOTES
NTS



1 UTILITY PLAN
1" = 20'

KEYNOTES:

1. CONNECT TO EXISTING 12 INCH WATER LINE ALONG DOVER PARKWAY
2. INSTALL DOMESTIC WATER METER AND REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER
3. POINT OF CONNECTION FOR DOMESTIC WATER LINE 5 FEET FROM BUILDING. SEE PLUMBING FOR CONTINUATION
4. INSTALL FIRE WATER DOUBLE CHECK DETECTOR BACKFLOW PREVENTER, SEE SHEET C1.07
5. CONNECT TO FIRE RISER ROOM, SEE SHEET C1.07
6. INSTALL FIRE DEPARTMENT CONNECTION , SEE SHEET C1.07
7. INSTALL FIRE HYDRANT, SEE SHEET C1.07
8. CONNECT TO STORM SEWER
9. INSTALL STORM SEWER LINE, SEE SHEET C1.08
10. INSTALL 2'X2' PRECAST CONCRETE DRAIN INLET
11. CONNECT TO SANITARY SEWER
12. INSTALL SANITARY SEWER LINE, SEE SHEET C1.09
13. POINT OF CONNECTION FOR SANITARY SEWER LINE 5 FEET FROM BUILDING. SEE PLUMBING FOR CONTINUATION
14. CONNECT TO NATURAL GAS MAIN
15. INSTALL 1.5" POLYETHYLENE NATURAL GAS LINE
16. POINT OF CONNECTION FOR NATURAL GAS LINE 5 FEET FROM BUILDING. SEE PLUMBING FOR CONTINUATION.
17. INSTALL NEW COMMUNICATION VAULT, SEE ELECTRICAL
18. INSTALL NEW COMMUNICATION LINE, SEE ELECTRICAL
19. POINT OF CONNECTION FOR COMMUNICATION LINE 5 FEET FROM BUILDING. SEE ELECTRICAL FOR CONTINUATION
20. INSTALL NEW ELECTRICAL VAULT, SEE ELECTRICAL
21. INSTALL NEW ELECTRICAL TRANSFORMER, SEE ELECTRICAL
22. INSTALL NEW ELECTRICAL LINE, SEE ELECTRICAL
23. POINT OF CONNECTION FOR ELECTRICAL LINE 5 FEET FROM BUILDING. SEE ELECTRICAL FOR CONTINUATION
24. INSTALL PV CONDUIT
25. POINT OF CONNECTION FOR PV CONDUIT LINE 5 FEET FROM BUILDING. SEE ELECTRICAL FOR CONTINUATION.
26. INSTALL CONDUIT FOR EV CHARGER. SEE ELECTRICAL SITE PLAN.
27. INSTALL CONDUIT FROM FIRE WATER BACKFLOW PREVENTER TO FIRE ALARM CONTROL PANEL IN ELECTRICAL ROOM. SEE ELECTRICAL SITE PLAN
28. INSTALL IRRIGATION METER AND REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER. SEE LANDSCAPING FOR CONTINUATION.
29. INSTALL NATURAL GAS METER PER SOUTHERN CALIFORNIA GAS COMPANY REQUIREMENTS.

SHEET NOTES:

1. SEE SHEET C1.07 FOR WATER PLAN
2. SEE SHEET C1.08 FOR STORM DRAIN PLAN
3. SEE SHEET C1.09 FOR SANITARY SEWER PLAN
4. SEE ELECTRICAL FOR SITE ELECTRICAL PLAN

LEGEND:

- PV CONDUIT
- E(UG) — ELECTRICAL UNDERGROUND
- F — FIRE WATER
- SS — SANITARY SEWER
- W — DOMESTIC WATER
- SD — STORM SEWER
- CU — COMMUNICATION LINE
- G — NATURAL GAS LINE
- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- ELECTRICAL AND COMMUNICATION VAULT

NORTH

0 20' 40'
SCALE: 1" = 20'

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
Dover Parkway, Delano

California Department of General Services

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ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 004	02/16/23

DATE 02/16/2023

JOB NO. DGS 140724

SHEET TITLE

UTILITY PLAN

SHEET NO.

C1.06

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
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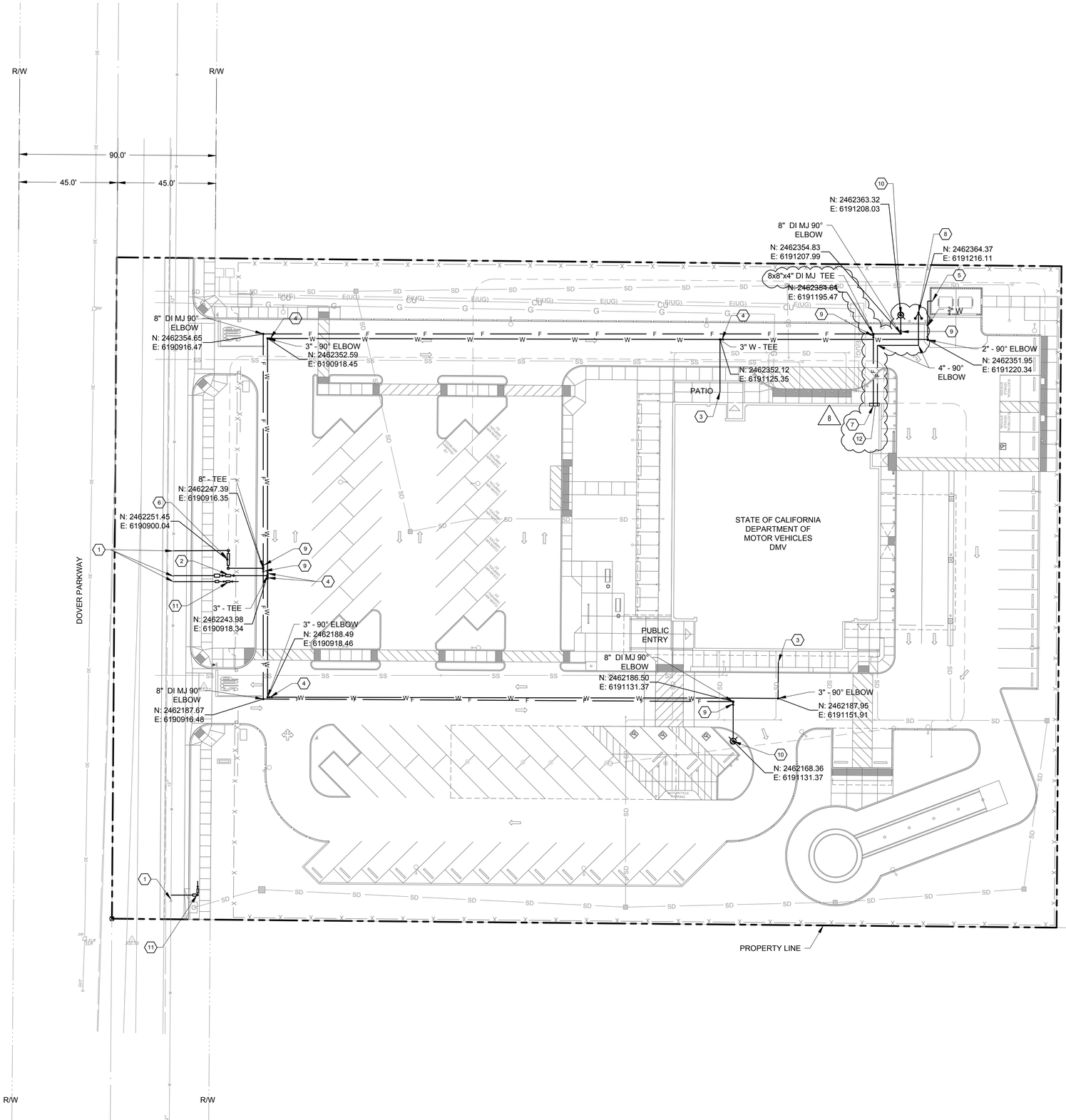


1 WATER PLAN
1" = 20'

KEYNOTES:

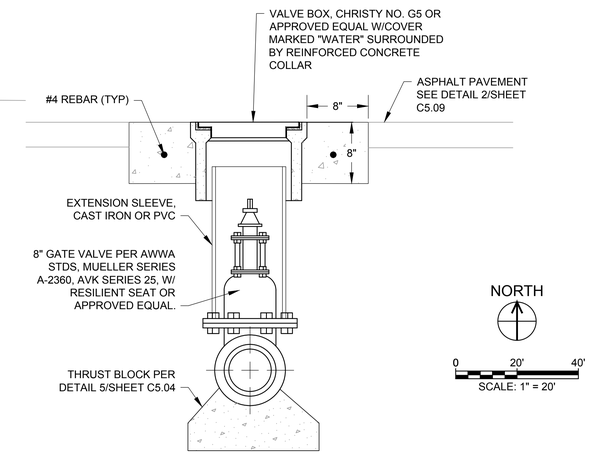
1. CONNECT TO EXISTING 12 INCH WATER LINE ALONG DOVER PARKWAY. COORDINATE WITH CITY OF DELANO ON REQUIREMENTS. CONTRACTOR IS RESPONSIBLE FOR ALL ITEMS NECESSARY TO MAKE CONNECTION. SEE DETAIL 1/C5.04 AND 2/C5.04 FOR IRRIGATION AND DOMESTIC WATER CONNECTION AND METER.
2. INSTALL 3" DOMESTIC WATER REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER. INSTALL ZURN 375 OR APPROVED EQUAL
3. POINT OF CONNECTION FOR DOMESTIC WATER LINE 5 FEET FROM BUILDING. SEE PLUMBING FOR CONTINUATION
4. INSTALL 3" BALL VALVE WITH TRAFFIC RATED COVER AND FRAME. COVER SHALL BE MARKED "WATER". VAULT SHALL BE SUPPORTED WITH 8 INCH WIDE AND DEEP REINFORCED CONCRETE COLLAR WITH #4 REBAR. BOTTOM OF VALVE BOX SHALL INCLUDE 6" THICK LAYER OF $\frac{3}{4}$" GRAVEL PLACED IN TWO- 3 INCH LIFTS.
5. INSTALL HOSE BIB. HOSE BIB SHALL BE LOCKABLE AND RECESSED IN CMU BLOCK WALL. HOSE BIB SHALL BE WOODFORD MODEL B24 OR APPROVED EQUAL.
6. INSTALL FIRE WATER DOUBLE CHECK DETECTOR BACKFLOW PREVENTER WITH OS&Y GATE VALVES
7. CONNECT TO FIRE RISER ROOM. SEE DETAIL 2/C5.05
8. INSTALL FIRE DEPARTMENT CONNECTION , SEE DETAIL 4/C5.05
9. INSTALL 8" DUCTILE IRON MECHANICAL JOINT GATE VALVE, SEE DETAIL 2 THIS SHEET.
10. INSTALL FIRE HYDRANT, SEE DETAIL 1/C5.05
11. INSTALL 1" IRRIGATION REDUCED PRESSURE DETECTOR BACKFLOW PREVENTER. INSTALL ZURN 375XLB OR APPROVED EQUAL.
12. REFER TO DETAIL 4/S5.1 FOR REQUIRED INSTALLATION OF PARALLEL PIPES AT CONCRETE FOOTINGS.

SHEET NOTES:

1. ALL DOMESTIC WATER LINES SHALL BE 3" PVC, ASTM D2241, SDR 21 RATING.
2. ALL FIRE WATER LINES SHALL BE 8" AWWA C900, DR-18 PVC.
3. THRUST BLOCKS SHALL BE INSTALLED AT ALL CHANGES IN DIRECTION ON BOTH THE DOMESTIC AND FIRE WATER LINES. SEE DETAIL 5/C5.04
4. SEE SHEET C1.06 FOR UTILITY PLAN
5. SEE SHEETS C5.04 AND C5.05 FOR WATER DETAILS

LEGEND:

- PV CONDUIT
- E(UG) ELECTRICAL UNDERGROUND
- F FIRE WATER
- SS SANITARY SEWER
- W DOMESTIC WATER
- SD STORM SEWER
- CU COMMUNICATION LINE
- G NATURAL GAS LINE
- POLE MOUNTED LIGHT
- DRAIN INLET
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- ELECTRICAL AND COMMUNICATION VAULT



2 GATE VALVE AND VALVE BOX
NTS

NORTH

0 20' 40'
SCALE: 1" = 20'

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
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ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 004	02/16/23

DATE 02/16/2023

JOB NO. DGS 140724

SHEET TITLE

WATER PLAN

SHEET NO.

C1.07

ONE AND ONE-HALF INCH = ONE FOOT
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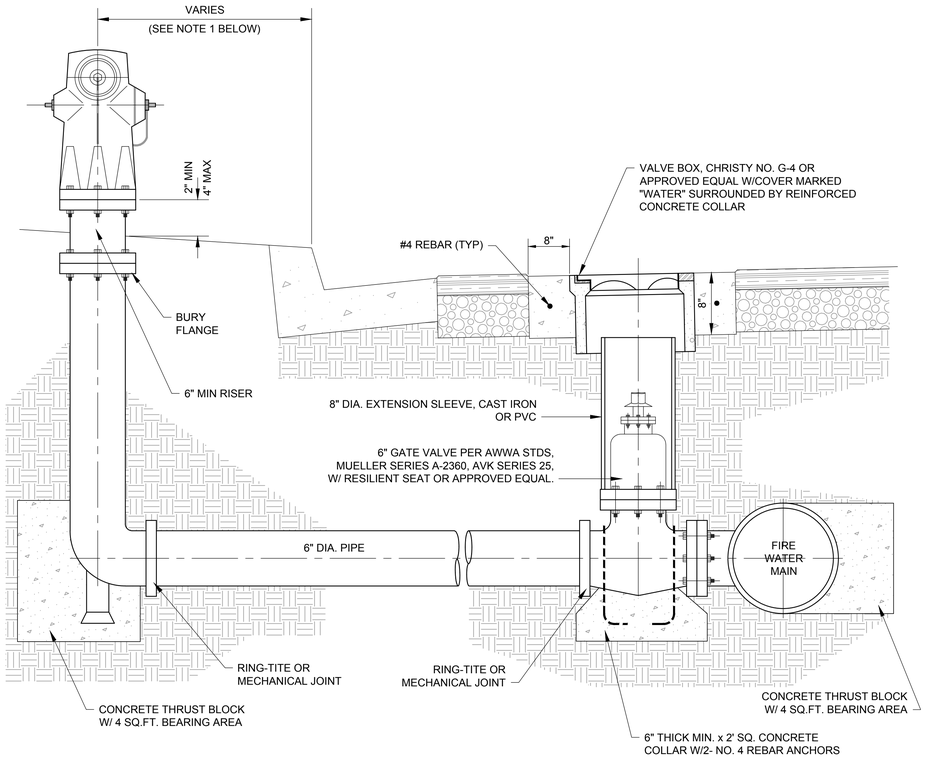
ONE INCH = TWENTY FEET

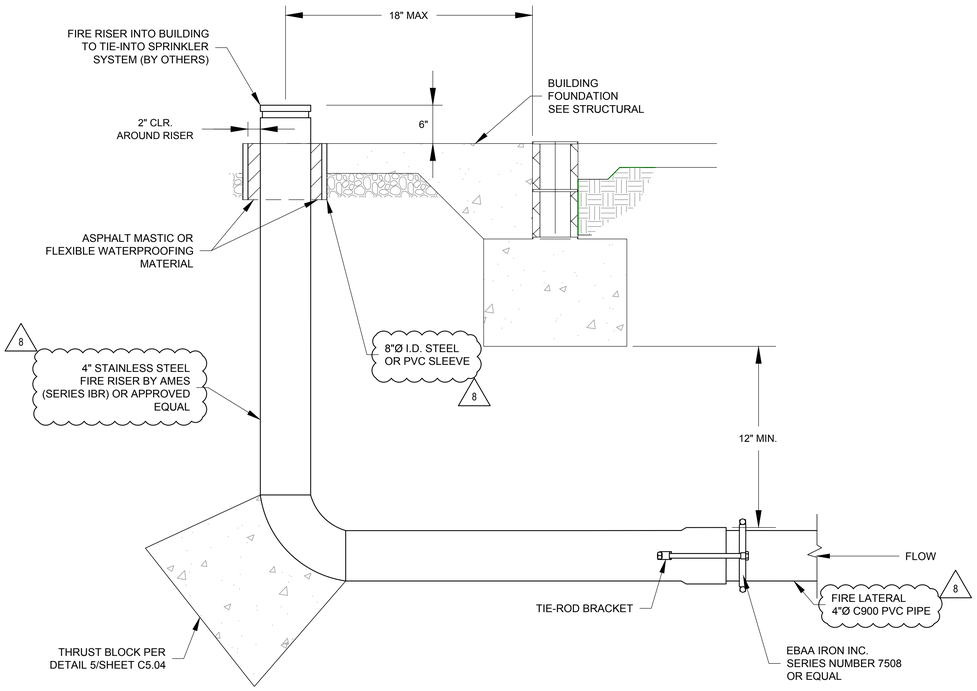


NOTES:

1. HYDRANT MINIMUM 18" BEHIND FACE OF CURB. BREAK-OFF BOLTS REQUIRED ON ALL HYDRANTS.
2. ALL HYDRANTS SHALL HAVE A MINIMUM OF 3' CLEAR TO ANY OBSTRUCTIONS.
3. FIRE HYDRANT SHALL BE AVK NO. 2490 W/ 2 2-1/2" NOZZLES AND 1 - 4-1/2" NOZZLE.
4. 4-1/2" STEAMER CONNECTION SHALL FACE ROADWAY AND 2-1/2" SHALL LAY PARALLEL WITH SAID ROADWAY.

1 FIRE HYDRANT ASSEMBLY (CITY OF DELANO STANDARD W1)

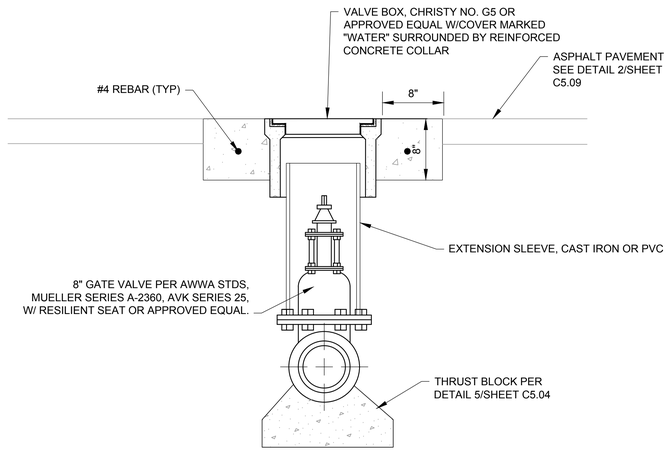
NTS



NOTE:
1. PIPE JOINTS SHALL NOT BE LOCATED DIRECTLY UNDER FOUNDATION FOOTINGS

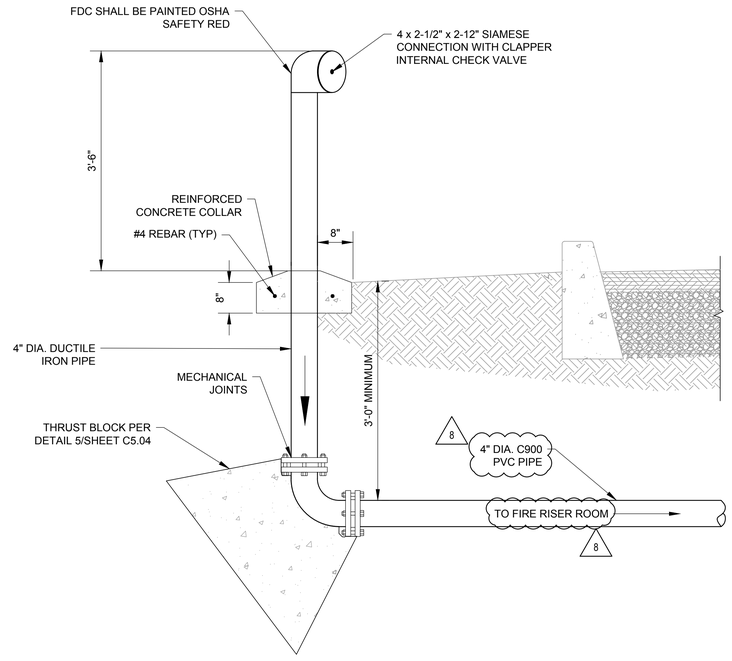
2 FIRE RISER

NTS



3 GATE VALVE AND VALVE BOX

NTS



4 FIRE DEPARTMENT CONNECTION

NTS

AGENCY APPROVAL

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER
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02/16/2023

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ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 004	02/16/23

DATE 02/16/2023

JOB NO. DGS 140724

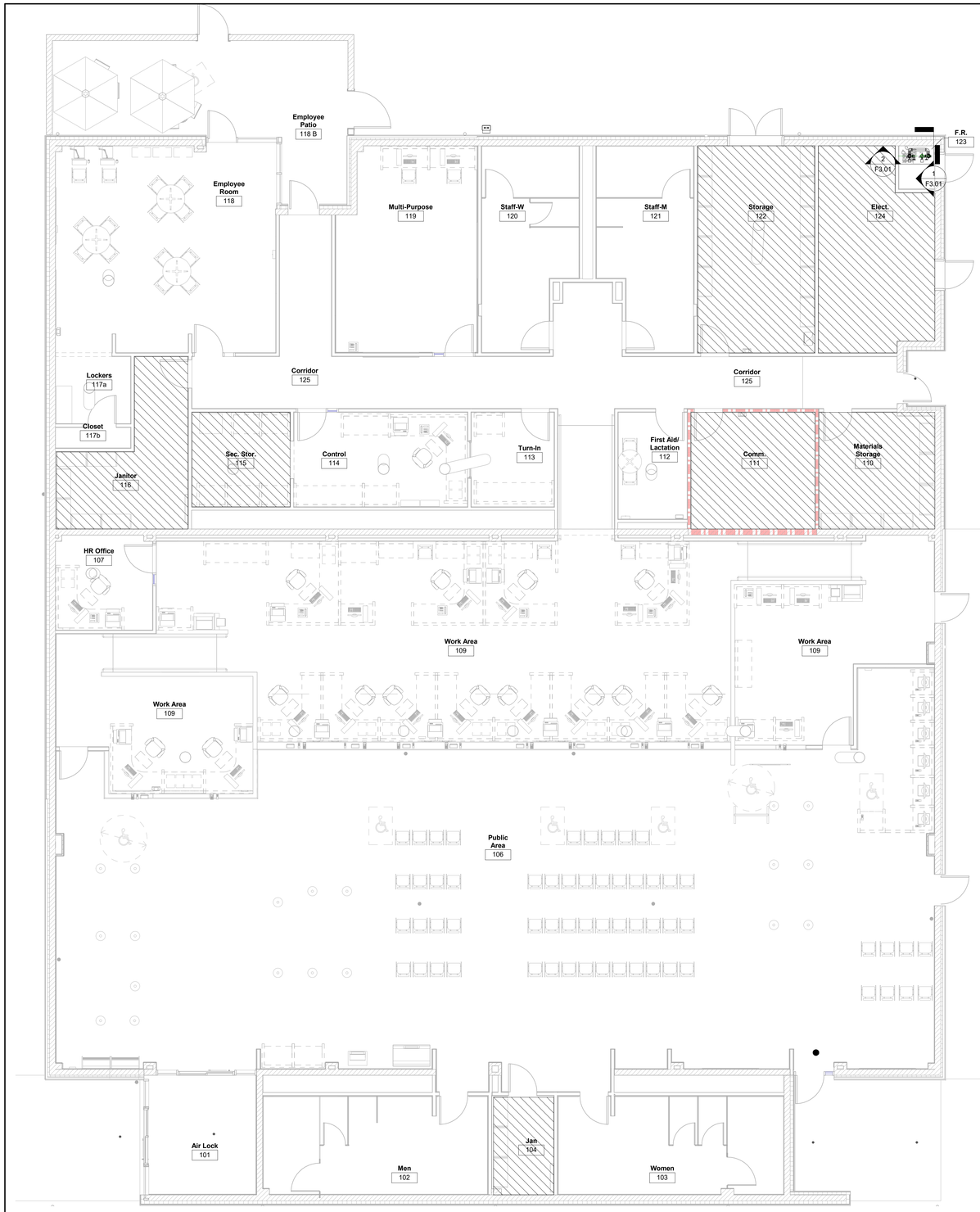
SHEET TITLE

WATER UTILITY DETAILS 2 OF 2

SHEET NO.

C5.05

ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET



1 FIRE PROTECTION FLOOR PLAN
3/16" = 1'-0"

LEGEND

LIGHT HAZARD: DESIGN CRITERIA: 0.10 GPM/FT² OVER 1500 FT²
HOSE STREAM 100 GPM.

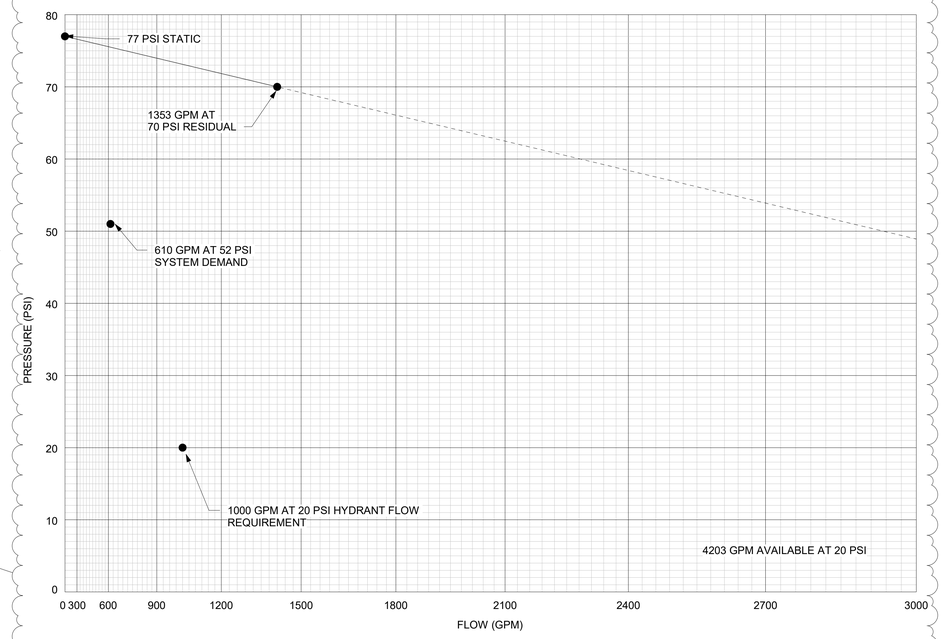
ORDINARY HAZARD GROUP 1: DESIGN CRITERIA: 0.15 GPM/FT² OVER
1500 FT², HOSE STREAM 250 GPM.

GENERAL NOTES

1. ALL FIRE PROTECTION SYSTEMS SHALL BE INSTALLED AS REQUIRED BY THESE DRAWINGS AND SPECIFICATIONS. THE DESIGN INTENT IS TO COMPLY WITH THE 2019 CALIFORNIA BUILDING CODE AND THE 2019 CALIFORNIA FIRE CODE.
2. INSTALL WET PIPE SPRINKLER SYSTEM THROUGHOUT THE BUILDING.
3. ALL SPRINKLER SYSTEM PIPING SHALL BE SCHEDULE 40 STEEL PIPING FOR SIZES 2 INCHES AND LESS IN DIAMETER. PROVIDE NO LESS THAN SCHEDULE 10 STEEL PIPING FOR SIZES GREATER THAN 2 INCHES.
4. ALL DEVICES TO BE UL LISTED OR FM APPROVED.
5. PROVIDE ALL HANGERS INCLUDING TRAPEZE HANGERS AS REQUIRED TO COMPLY WITH NFPA 13. HANGERS SHALL BE DESIGNED FOR SEISMIC CONSIDERATIONS.
6. PROVIDE SPARE SPRINKLERS AND SPRINKLER WRENCH IN METAL CABINET PER NFPA 13.
7. PROVIDE A LIST OF THE INSTALLED SPRINKLERS CONTAINING THE FOLLOWING INFORMATION:
   A. SPRINKLER IDENTIFICATION NUMBER (SIN) OR THE MANUFACTURER, MODEL, ORIFICE, DEFLECTOR TYPE, THERMAL SENSITIVITY, AND PRESSURE RATING.
   B. GENERAL DESCRIPTION
   C. QUANTITY OF EACH TYPE TO BE KEPT IN THE CABINET
   D. ISSUE OR REVISION DATE OF THE LIST
1. COORDINATE EXACT LOCATIONS OF SPRINKLERS AND PIPING WITH CEILING, ELECTRICAL, MECHANICAL AND STRUCTURAL ELEMENTS OF BUILDING. PROVIDE SHOP DRAWINGS AS REQUIRED BY NFPA 13 DEPICTING FULFILLMENT OF THESE COORDINATION REQUIREMENTS.
2. PROVIDE ALL DRAINS AND INSPECTION TEST CONNECTIONS REQUIRED TO COMPLY WITH NFPA 13.
3. FLUSH AND TEST SYSTEM IN ACCORDANCE WITH NFPA 13, 24, AND THE CONTRACT SPECIFICATIONS.
4. ALL VALVES WHICH CONTROL FLOW OF WATER SHALL BE EQUIPPED WITH A TAMPER SWITCH CONNECTED TO THE FIRE ALARM SYSTEM.
5. SEAL ALL OPENINGS THROUGH FLOORS, CEILINGS AND PARTITIONS TO RE-ESTABLISH THE FIRE RATING OF THAT FLOOR, CEILING OR PARTITION. SEE ARCHITECTURAL DRAWINGS FOR RATINGS.
6. PROVIDE END CAPS TAPPED WITH A VALVED GAUGE PORT FOR TESTING PRESSURE AND A LOW POINT DRAIN ON ALL PIPES IN TRENCH TO ALLOW DRAINING.
7. PROVIDE ALL EQUIPMENT I.E. CONTROL VALVES, CHECK VALVES WITH A MINIMUM CLEARANCE OF 3 FEET.
8. SPRINKLER PIPE AND FITTINGS MUST BE METAL.
9. PLAIN END FITTINGS WITH MECHANICAL COUPLINGS AND FITTINGS THAT USE STEEL GRIPPING DEVICES TO BITE INTO THE PIPE ARE PROHIBITED. STEEL PIPING WITH WALL THICKNESS LESS THAN SCHEDULE 40 MUST NOT BE THREADED OR CUT GROOVED.
10. SIDE OUTLET TEES USING RUBBER GASKET FITTINGS ARE NOT PERMITTED.
11. THE SAME MANUFACTURER MUST SUPPLY FITTINGS, MECHANICAL COUPLINGS, AND RUBBER GASKETS.
12. ALL SPRINKLER PIPING MUST BE CONCEALED EXCEPT IN SPACES WITHOUT CEILINGS.
13. PROVIDE FITTINGS FOR CHANGES IN DIRECTION OF PIPING AND FOR CONNECTIONS. MAKE CHANGES IN PIPE SIZES THROUGH TAPERED REDUCING PIPE FITTINGS.
14. TERMINATE ALL DRAINAGE AND INSPECTOR TEST CONNECTION PIPING TO THE EXTERIOR OF THE BUILDING SO IT WILL NOT CAUSE DAMAGE. DISCHARGE TO THE EXTERIOR MUST NOT INTERFERE WITH EXITING FROM THE BUILDING. WATER DISCHARGE MUST NOT CROSS AN EXIT OR EXIT DISCHARGE.
15. ANY DRAINS, TEST CONNECTION PIPE, ETC. THAT PENETRATE THE EXTERIOR WALL MUST DO SO NO GREATER THAN 2 FEET ABOVE FINISHED GRADE.
16. THE DRAIN/TEST CONNECTION MUST BE PIPED TO A LOCATION THAT WILL ACCEPT FULL FLOW AND WILL NOT CAUSE PROPERTY DAMAGE WHEN WATER IS DISCHARGING. DISCHARGE TO ANY SINK IS NOT ACCEPTABLE.
17. TO FACILITATE TESTING, PROVIDE A PERMANENTLY PIPED DRAIN/TEST CONNECTION FOR EACH FLOW SWITCH.
18. PROVIDE SPRINKLER HEAD GUARDS FOR SPRINKLERS THAT ARE LESS THAN 7 FEET ABOVE FINISHED FLOOR.
19. HYDRANT FLOW TEST WAS PERFORMED ON 09 FEBRUARY 2023 BY THE CONTROL FIRE PROTECTION. THE TEST WAS TAKEN NEAR THE INTERSECTION OF MORSE STREET AND DOVER PARKWAY. THE RESULTS OF THE TEST WERE 77 PSI STATIC, 70 PSI RESIDUAL WITH 1353 GPM FLOWING.

2 FIRE PROTECTION NOTES

NONE



8

3 HYDRAULIC GRAPH

NONE

AGENCY APPROVAL

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ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
8	ADI 004	02/16/23

DATE 02/16/2023

JOB NO. DGS 140724

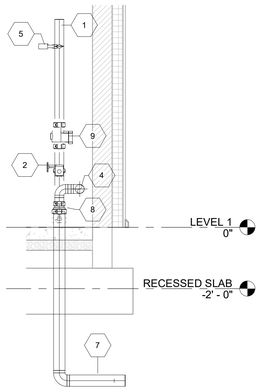
SHEET TITLE

FIRE PROTECTION FLOOR PLAN

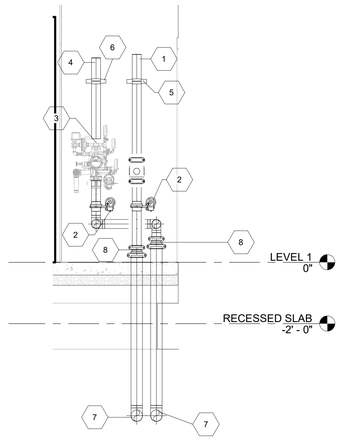
SHEET NO.

F1.01

ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE-HALF INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT



1 RISER ELEVATION
1/2" = 1'-0"



2 RISER ELEVATION 2
1/2" = 1'-0"

KEYNOTES

1 TO WET PIPE SPRINKLERS.
2 BUTTERFLY VALVE WITH TAMPER SWITCH.
3 DRY PIPE VALVE.
4 TO DRY PIPE SPRINKLERS UNDER CANOPY.
5 FLOW SWITCH.
6 PRESSURE SWITCH.
7 FROM SUPPLY. SEE CIVIL DRAWINGS FOR DEPTH OF PIPE.
8 CONCENTRIC REDUCER.
9 CHECK VALVE.

AGENCY APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV
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AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
8	ADI 004	02/16/23

DATE 02/16/2023

JOB NO. DGS 140724

SHEET TITLE

RISER SECTIONS

SHEET NO.

F3.01

ONE INCH = TWENTY FEET
ONE-SIXTEENTH INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT

State of California • Department of General Services • Gavin Newsom, Governor
REAL ESTATE SERVICES DIVISION
Project Management and Development Branch
Architecture and Engineering Sections 1 & 2
707 Third St., Suite 4-105 • West Sacramento, California 95605-2811

ADDITIONAL DETAILED INSTRUCTIONS

ADI: 005

PROJECT: DMV Delano **DATE:**

CLIENT AGENCY: California Department of Motor Vehicles
LOCATION: Dover Parkway Delano, CA **WORK**
ORDER:

CONTRACT:

CONTRACTOR:	**PROJECT DIRECTOR:**
Bernards Charlie Her 1781 E Fir Avenue, Suite 205 Fresno, CA 93720	**Ryan Beck** State of California, DGS, RESD, PMDB 707 Third St., Suite 04-105 West Sacramento, CA 95605
Tel: (818) 898 1521 Fax: (818) 361 9208	Tel: (916) 628-8192 Fax:

SUBJECT:	**REFERENCE DOCUMENTS:**
Re: Rating of Comm Room walls	See attached: Revised Plan Sheets

Description:
Per the directive of the site State Fire Marshall, Eddie Arriaga, the Comm Room walls are to be 1-hour rated.

Attached are the revised Plan Set sheets showing the rated walls/UL assemblies and related work (smoke dampers, fire caulking, fire alarm interface, etc.).

A narrative describing the revisions on each sheet is attached.

The Work shall be carried out in accordance with these supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. **Proceeding with Work in accordance with these instructions indicates acceptance without change in the Contract Amount or Contract Duration.** It is the Contractor's responsibility to inform subcontractors, vendors and staff of these remarks to the design and/or construction.

Signed: _____ Date: _____

Ryan Beck
State of California, DGS, RESD, PMDB
707 Third St., Suite 04-105
West Sacramento, CA 95605

Tel: (916) 628-8192 Fax:

cc:

DESCRIPTION OF REVISIONS TO SHEETS FOR THE RATING OF THE COMM ROOM WALLS:

T0.0 – Revised Drawing Index to include new sheets
T0.3 – Added new sheet to include CBC prescriptive code rating of CMU walls and UL assemblies for 1-hour wall construction, rated wall attachment to CMU, top of wall detail and through-penetration firestop systems.
T0.4 – Added new sheet T0.4 – UL Details. Sheet includes pipe/conduit and duct penetration details for all Communication Room Penetrations.
A1.00 – REVISED Floor Plan showing rated walls.
A6.00 – revised Door Schedule to include rating of Comm Room door.
A8.00 – added information to wall types 3 & 5 regarding fire rating identification.
M1.01 – Added symbol for required volume dampers. Requirement for volume dampers are identified in specification 23 33 00, 3.01D, drawings were updated to show locations.

- *Corrected incorrect air terminal tagging. Overall quantity identified in schedule M6.01 remains unchanged.*
- *Rerouted duct work and refrigerant lines in First Aid/Lactation, Communication Room, and Materials Storage to be served directly from Corridor.*
- *Added Transfer Grilles*
- *Added FSD-1 for Communication Room*
- *Updated Communication Room background to show fire rated walls.*

M3.02 - Corrected incorrect air terminal tagging. Overall quantity identified in schedule M6.01 remains unchanged.
M5.01 – Added detail of Fire and Smoke Damper
M5.02 - Included seismic bracing requirement for VRF Evaporator per RFI 057 response.
M6.01 – Added Schedule for Fire & Smoke Dampers. Added two more transfer grilles.
E0.01 – Added symbol for Emergency Power Off (EPO) Button
E1.02 – Added power for FSDs, general note, and updated circuitry.
E2.01 – Updated lighting circuitry.
E4.01 – Added EPO Switch and updated circuitry.
E5.01 – Updated One line diagram.
E6.02 – Added FSD and updated panels for VRF Evaporator and ERV.
E6.03 – Updated Panel Schedules and added new Panel 2T1.
LV1.02 – Added requirement for fire sealed sleeves.
LV4.01 – Updated communication wall backgrounds, moved 4 sleeves on the plan south wall to plan west wall. Added requirement for fire sealed sleeves.

Revision 1 per SFM comments:
1. Architect's stamp added to all sheets
2. Address has been added to all sheets
3. RFI 057 has been added to sheet M5.02
4. SFM # has been added to all sheets

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV

Dover Parkway, Delano

California Department of General Services

ABBREVIATIONS

&	AND
L	ANGLE
@	AT
DIA	DIAMETER
#	NUMBER
(E)	EXISTING
(N)	NEW
d	PENNY
PL	PLATE
AC	ASPHALT CONCRETE
A.D.	AREA DRAIN
ADJ.	ADJUSTABLE
A.F.F.	ABOVE FINISHED FLOOR
AGGR.	AGGREGATE
AHJ	AUTHORITY HAVING JURISDICTION
ALD	ASSISTIVE LISTENING DEVICE
ALUM.	ALUMINUM
APPROX.	APPROXIMATE
ARCH.	ARCHITECTURAL
BD.	BOARD
BITUM.	BITUMINUOUS
BLDG.	BUILDING
BLKG.	BLOCKING
BM.	BEAM
B.N.	BULLNOSE
BOTT.	BOTTOM
B.U.	BUILT-UP
C.B.	CATCH BASIN
CEM.	CEMENT
C.E.P.S.	CEMENTITIOUS EXTERIOR PLASTER SYSTEM
CER.	CERAMIC
C.F.C.I.	CONTRACTOR FURNISHED CONTRACTOR INSTALLED
C.I.	CAST IRON
C.J.	CONSTRUCTION JOINT
CLKG	CAULKING
CLNG.	CEILING
CLR.	CLEAR
C.M.T.	CERAMIC MOSAIC TILE
C.M.U.	CONCRETE MASONRY UNIT
CNTR.	COUNTER
C.O.	CLEAN OUT
COL.	COLUMN
CONC.	CONCRETE
CONN.	CONNECTOR
CONSTR.	CONSTRUCTION
CONT.	CONTINUOUS
CSMU	CONCRETE SILICATE MASONRY UNIT
C.T.	CERAMIC TILE
CTSK.	COUNTERSINK
D.A.	DISABLED ACCESSIBLE
DBL.	DOUBLE
DIM.	DIMENSION
DN.	DOWN
D.O.	DOOR OPENING
DR.	DOOR
DRW.	DRAWER
DS.	DOWNSPOUT
DTL.	DETAIL
DWG.	DRAWING
EA.	EACH
E.J.	EXPANSION JOINT
EL.	ELEVATION
ELEC.	ELECTRICAL
ENCL.	ENCLOSURE
E.O.	EDGE OF
E.P.S	(CEMENTICIOUS) EXTERIOR PLASTER SYSTEM
EQ.	EQUAL
EXP.	EXPOSED
EXT.	EXTERIOR
F.D.	FLOOR DRAIN
FIN.	FINISH
FL.	FLOOR
FLASH.	FLASHING
FLUOR.	FLUORESCENT
F.O.	FACE OF
F.O.F.	FACE OF FINISH
F.O.M.	FACE OF MASONRY
F.O.S.	FACE OF STUDS
FT.	FOOT/FEET
FTG.	FOOTING
FURR.	FURRING
FUT.	FUTURE
GA.	GAUGE
GALV.	GALVANIZED
G.B.	GRAB BAR
G.I.	GALVANIZED IRON
GL.	GLASS
GND.	GROUND
GRD.	GRADE
GYP.	GYPSUM
H.	HEIGHT
H.C.	HOLLOW CORE
HDWD.	HARDWOOD
H.M.	HOLLOW METAL
HORIZ.	HORIZONTAL
HR.	HOUR
I.D.	INSIDE DIAMETER
INSUL.	INSULATION
INT.	INTERIOR
JT.	JOINT
K.S.	KNEE SPACE
LAM.	LAMINATE
LAV.	LAVATORY
MAX.	MAXIMUM
M.B.	MACHINE BOLT
M.C.	MEDICINE CABINET
MECH.	MECHANICAL
MED.	MEDIUM
MEMB.	MEMBRANE
MFR.	MANUFACTURER
MIN.	MINIMUM
MIR.	MIRROR
MISC.	MISCELLANEOUS
M.O.	MASONRY OPENING
MTD.	MOUNTED
MTL.	METAL
MUL.	MULLION
N	NORTH
N.I.C.	NOT INCLUDED IN CONTRACT
NLR.	NAILER
NO.	NUMBER
NOM.	NOMINAL
N.T.S.	NOT TO SCALE
OA.	OVERALL
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
OP. H.	OPPOSITE HANDED
O.F.C.I.	OWNER FURNISHED CONTRACTOR INSTALLED
O.F.O.I.	OWNER FURNISHED OWNER INSTALLED
OPNG.	OPENING
OPP.	OPPOSITE
PLAS.	PLASTIC
PLAM.	PLASTIC LAMINATE
PLYWD.	PLYWOOD
PM	PRESSED METAL
PNL	PANEL
PRECST.	PRECAST
PTN.	PARTITION
Q.T.	QUARRY TILE
R.A.	RETURN AIR
RCMD.	RECOMMENDATION
R.D.	ROOF DRAIN
REINF.	REINFORCING
REQ'D.	REQUIRED
REQ'S	REQUIREMENTS
RESIL.	RESILIENT
R.O.	ROUGH OPENING
RWD.	REDWOOD
RWL	RAIN WATER LEADER
S	SOUTH
SCFS	SINTERED CERAMIC FACADE SYSTEM
SHWR.	SHOWER
SHT.	SHEET
SIM.	SIMILAR
S.M.S.	SHEET METAL SCREW
SQ.	SQUARE
S.S.	STAINLESS STEEL
STD.	STANDARD
STL.	STEEL
STOR.	STORAGE
STRUCT.	STRUCTURAL
SUSP.	SUSPENDED
SYM.	SYMMETRICAL
T&G	TONGUE & GROOVE
TEL.	TELEPHONE
THK.	THICK
T.O.C.	TOP OF CURB
T.O.S.	TOP OF STEEL
TYP.	TYPICAL
U/C	UNDERCOUNTER
UNF.	UNFINISHED
U.N.O.	UNLESS NOTED OTHERWISE
U.S.	UNDERSIDE
VERT.	VERTICAL
W/	WITH
W / E	WEST / EAST
W/O	WITHOUT
W.C.	WATER CLOSET
WD.	WOOD
W.O.	WHERE OCCURS
WP.	WATERPROOF
WR.	WATER RESISTANT
W.S.	WEATHER STRIP
W.W.F.	WELDED WIRE FABRIC

BUILDING DATA

SEE SHEET T0.1 FOR COMPLETE BUILDING AND CODE ANALYSIS

AREA:	12,371 S.F. (INTERIOR CONDITIONED SPACE) 13,726 S.F. (UNDER-ROOF AREA)
CONSTRUCTION:	II-B
OCCUPANCY:	TYPE B UNSEPARATED

VICINITY MAP

APPLICABLE CODES

ALL WORK SHALL CONFORM TO THE FOLLOWING AND ALL OTHER APPLICABLE CODES AND ORDINANCES.

2019 CALIFORNIA BUILDING STANDARDS ADMINISTRATIVE CODE, PART 1, TITLE 24, C.C.R.
2019 CALIFORNIA BUILDING CODE (CBC), PART 2, TITLE 24, C.C.R.
2019 CALIFORNIA ELECTRICAL CODE (CEC), PART 3, TITLE 24, C.C.R.
2019 CALIFORNIA MECHANICAL CODE (CMC), PART 4, TITLE 24, C.C.R.
2019 CALIFORNIA PLUMBING CODE (CPC), PART 5, TITLE 24, C.C.R.
2019 CALIFORNIA ENERGY CODE (CEC), PART 6, TITLE 24, C.C.R.
2019 CALIFORNIA FIRE CODE (CFC), PART 9, TITLE 24, C.C.R.
2019 CALIFORNIA GREEN CODE, PART 11, TITLE 24, C.C.R.
2019 CALIFORNIA REFERENCED STANDARDS CODE, PART 12, TITLE 24, C.C.R.
2019 TITLE 19 C.C.R., PUBLIC SAFETY, DIVISION 1 STATE FIRE MARSHAL REGULATIONS
2019 NFPA 13 (2013 CALIFORNIA EDITION), THE INSTALLATION OF AUTOMATIC SPRINKLER SYSTEMS, AS AMENDED
2019 NFPA 14 (2013 CALIFORNIA EDITION), INSTALLATION OF STANDPIPE, PRIVATE HYDRANT, AND HOSE SYSTEMS
2019 NFPA 24 (AS AMENDED PER 2019 CBC CH. 35), INSTALLATION OF PRIVATE FIRE SERVICE MAINS AND THEIR APPURTENANCES
2019 NFPA 72 (AS AMENDED PER 2019 CBC CH. 35), NATIONAL FIRE ALARM CODE,

NOTE:

THE INTENT OF THESE DRAWINGS AND SPECIFICATIONS IS THAT THE WORK OF THE ALTERATION, REHABILITATION OR RECONSTRUCTION IS TO BE IN ACCORDANCE WITH TITLE 24, CALIFORNIA CODE OF REGULATIONS. SHOULD ANY EXISTING CONDITIONS SUCH AS DETERIORATION OR NONCOMPLYING CONSTRUCTION BE DISCOVERED WHICH IS NOT COVERED BY THE CONTRACT DOCUMENTS WHEREIN THE FINISHED WORK WILL NOT COMPLY WITH TITLE 24, CALIFORNIA CODE OF REGULATIONS, A CHANGE ORDER, OR A SEPARATE SET OF PLANS AND SPECIFICATIONS, DETAILING AND SPECIFYING THE REQUIRED REPAIR WORK SHALL BE SUBMITTED TO AND APPROVED BY AHJ (AUTHORITY HAVING JURISDICITON) BEFORE PROCEEDING WITH THE REPAIR WORK.

PROJECT TEAM

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ELECTRICAL ENGINEER:
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111 SW COLUMBIA STREET, SUITE 1500
PORTLAND, OR 97201
PHONE: (503) 222-7200
CONTACT: MICHAEL REBSTOCK

LANDSCAPE ARCHITECT:
MTW GROUP
2707 K STREET, SUITE 201
SACRAMENTO, CA 95816
PHONE: (916) 369-3990
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ZNE CONSULTANT
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DEFERRED APPROVAL ITEMS

INSTALLATION OF DEFERRED APPROVAL ITEMS SHALL NOT BE STARTED UNTIL CONTRACTOR'S DRAWINGS, SPECIFICATIONS AND ENGINEERING CALCULATIONS FOR THE ACTUAL SYSTEMS TO BE INSTALLED HAVE BEEN ACCEPTED AND SIGNED BY THE ARCHITECT OR ENGINEER, AND APPROVED BY THE APPROPRIATE APPROVING JURISDICTION.

1. FIRE SPRINKLERS
2. FIRE ALARM

GENERAL NOTES

1. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH ALL APPLICABLE CODES, AGENCIES AND REGULATIONS.
2. DO NOT SCALE DRAWINGS, WRITTEN DIMENSIONS TAKE PRECEDENCE OVER SCALE. SHOULD ANY DISCREPANCIES OCCUR, NOTIFY ARCHITECT BEFORE PROCEEDING WITH WORK.
3. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS AT THE SITE AND SHALL REPORT ANY DISCREPANCIES IN WRITING TO THE ARCHITECT PRIOR TO SUBMITTALS.
4. SPECIFIC ITEMS NOTED TO BE VERIFIED OR FIELD VERIFIED ARE REQUIRED TO BE VERIFIED PRIOR TO ORDERING MATERIALS OR PROCEEDING WITH THE WORK.
5. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR ASSURING THAT ALL NECESSARY PERMITS AND APPROVALS WITH THE CITY, COUNTY AND/OR OTHER AUTHORITIES WITH JURISDICTION ON THE PROJECT, ARE OBTAINED AND PAID FOR PRIOR TO BEGINNING WORK OR ORDERING MATERIALS. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR ASSURING THAT ALL NECESSARY PERMITS AND APPROVALS WITH THE CITY, COUNTY AND/OR OTHER AUTHORITIES WITH JURISDICTION ON THE PROJECT, ARE OBTAINED AND PAID FOR PRIOR TO BEGINNING WORK OR ORDERING MATERIALS.
6. ANY CONFLICT WITH THESE PLANS AND EXISTING CONDITIONS SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE STATE DEPARTMENT OF GENERAL SERVICES (DGS).
7. ALL WORK SHALL BE IN COMPLETE CONFORMANCE WITH MANUFACTURER'S SPECIFICATIONS AND RECOMMENDATIONS OR AS OTHERWISE OUTLINED IN THE SPECIFICATIONS.
8. CONTRACTOR SHALL COORDINATE WITH EQUIPMENT SUPPLIERS FOR POWER REQUIREMENTS, BLOCKING LOCATIONS, SUPPORT FOR EQUIPMENT, PLUMBING REQUIREMENTS AND ROUGH-IN LOCATIONS.
9. USE OF ANY NEW MATERIAL CONTAINING ASBESTOS IS PROHIBITED.
10. DETAILS, MATERIALS, AND FINISHES ARE TYPICAL FOR ALL SIMILAR CONDITIONS UNLESS NOTED OTHERWISE.
11. THE TERM "TYPICAL" (TYP) SHALL BE CONSTRUED TO MEAN APPLYING TO ALL LIKE OR SIMILAR CONDITIONS IN THE AREAS DESIGNATED FOR WORK SCOPE (I.E. WITHIN THE BOUNDARIES OF THIS PROJECT).
12. ALL PRODUCTS AND/OR MANUFACTURERS INDICATED ON DRAWINGS SHALL COMPLY WITH SPECIFICATIONS AND/OR BE APPROVED IN WRITING BY THE STATE PRIOR TO ORDERING OR INSTALLATION OF MATERIAL.
13. ALL DOORS NOT LOCATED BY DIMENSIONS ON PLANS OR DETAILS SHALL BE 4" FROM FINISH WALL TO DOOR BUCK.
14. ALL DIMENSIONS ARE GIVEN FROM FACE OF CONCRETE, BLOCK, STUD, OR CENTERLINE OF PARTITION UNLESS OTHERWISE NOTED.

SYMBOLS LEGEND

SEE INDIVIDUAL SHEETS FOR ADDITIONAL SHEET SPECIFIC SYMBOLS/ LEGENDS NOW INDICATED HERE

ROOM IDENTIFICATION — ROOM NAME / 101 ROOM NUMBER
COLUMN GRID — 1 / A
BUILDING SECTION — 1 SECTION NUMBER / A4.00 SHEET NUMBER
WALL SECTION — 1 SECTION NUMBER / A4.00 SHEET NUMBER
DETAIL — 1 DETAIL NUMBER / A101 SHEET NUMBER
CASEWORK REFERENCE — W212 W/C IDENTIFICATION / 2'-6" W WIDTH / 30" D DEPTH
INTERIOR ELEVATION — 1A ELEVATION NUMBER / 1B A7.50 1D SHEET NUMBER / 1C
EXTERIOR BUILDING ELEVATION — 1A ELEVATION NUMBER / A7.50 SHEET NUMBER
OPENING INDICATION — 101 DOOR; W01 WINDOW; L01 Llouver
MATCH LINE
DATUM WORK POINT OR CONTROL POINT
DIMENSION MARKS
REVISION

NORTH INDICATION — N / TRUE NORTH
CEILING HEIGHTS — ROOM NAME / 101 / 10' - 0"
KEYNOTE — 1
WALL TYPE — 1| WALL TYPE NUMBER
EQUIPMENT — E*
C.F.C.I.
O.F.C.I.
O.F.O.I.
METAL
PLYWD
GYPSUM BOARD
EARTH
CONCRETE
CONCRETE BLOCK
RIGID INSULATION
WOOD, FINISH
WOOD FRAMING, THROUGH MEMBER
WOOD FRAMING, INTERRUPTED MEMBER
RATED WALLS — 1 HR RATED CONSTRUCTION; 2 HR RATED CONSTRUCTION
SEE A0.10 FOR ADDITIONAL INFORMATION

DRAWING INDEX

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY
12/07/21
20-1059
Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

CONSULTANT
nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

REGISTERED ARCHITECT
No. C-27624
Dec 31, 2021
CALIFORNIA

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	SFM PLAN CHECK	7/15/20
2	DSA PLAN CHECK	7/15/20
4	SFM PLAN CHECK 2	12/09/20
3	CITY PLAN CHECK	8/07/20
6	ADI 001	6/29/22
5	BID CLARIFICATION	2/25/22
7	ADI 005	01/13/23

DATE 04/08/2020

JOB NO. DGS 140724

SHEET TITLE

TITLE SHEET

SHEET NO.

T0.0

1/6/23, 2:05 PM BXUV.U404 - Fire-resistance Ratings - ANSI/UL 263 | UL Product iQ

UL Product iQ®

BXUV.U404 - Fire-resistance Ratings - ANSI/UL 263

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States
BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

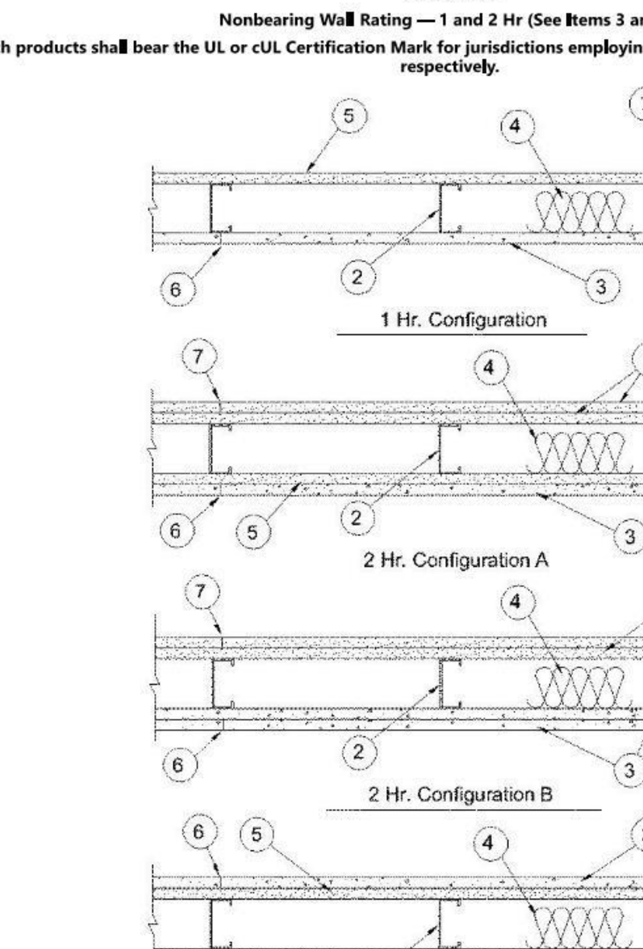
See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. U404

December 22, 2020

Nonbearing Wall Rating — 1 and 2 Hr (See Items 3 and 5)

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Steel Floor and Ceiling Runners** — (Not Shown) — Channel shaped, 3-1/2 in. wide by 1-1/4 in. deep, fabricated from min 20 MSG (0.0329 in., min bare metal thickness) galvanized steel. Attached to floor and ceiling with steel fasteners spaced 24 in. OC max.

2. **Steel Studs** — Channel shaped, fabricated from min 20 MSG corrosion-protected or galv steel, 3-1/2 in. min width, min 1-1/2 in. flanges and 1/4 in. return, spaced a max of 16 in. OC. Studs friction-fit into floor and ceiling runners. Studs to be cut 5/8 to 3/4 in. less than assembly height.

3. **Cementitious Backer Units*** — 1/2 in. or 5/8 in. thick, applied vertically or horizontally with vertical joints centered over studs. Fastened to studs and runners with corrosion resistant, chamfered, ribbed wafer head screws with a minimum head diameter of .400 inch. For nonbearing systems, fastened to studs and bottom runners with the uppermost screws placed 1/2 in. to 2 in. below the bottom edge of the leg of the top runner. Horizontal joints need not be backed by framing. **1 Hr System** - Screws shall be min 1-1/4 in. long and spaced a max of 8 in. OC. All vertical joints staggered one stud cavity from gypsum board vertical joints on the opposite side of studs. Horizontal edge joints and horizontal butt joints on opposite sides of studs need not be staggered. **2-Hr System** - For the base layer in Configuration B, the screws shall be min 1-1/4 in. long and spaced a max of 12 in. OC. For the face layers, screws shall be 1-5/8 in. long and spaced a max of 8 in. OC. All face layer joints offset min 12 in. from underlying base layer joints. Joints in either layer need not be staggered from joints on the opposite side of the wall.
UNITED STATES GYPSUM CO — Type DCB

4. **Batts and Blankets*** — Min 3 in. thick mineral wool insulation batts, friction-fitted between studs.
INDUSTRIAL INSULATION GROUP L L C — Type SAFB

JOHNS MANVILLE — Type SAFB

ROCKWOOL — Type AFB, min. density 1.8 pcf / 28.8 kg/m³

THERMAFIBER INC — Type SAFB, SAFB FF

5. **Gypsum Board*** — 5/8 in. thick, with square or tapered edges, applied vertically or horizontally with vertical joints centered over studs. Horizontal joints need not be backed by framing. Fastened with Type S-12 screws. **1-Hr System** - For vertical application, fastened to studs and runners with 1 in. long screws spaced max 8 in. OC at vertical edges and spaced max 12 in. OC in the field. For horizontal application, fastened to studs and runners with 1 in. long screws spaced max 8 in. OC. Vertical joints staggered one stud cavity from cement board vertical joints on opposite side of studs. Horizontal edge joints and horizontal butt joints on opposite sides of studs need not be staggered. **1-Hr System with ULDC**: fastened with 1 in. long screws, spaced 12 in. OC in the field and perimeter when panels are applied horizontally or vertically. Vertical joints staggered one stud cavity from cement board vertical joints on opposite side of studs. Horizontal edge joints and horizontal butt joints on opposite sides of studs need not be staggered. **2-Hr System** - Base layer with an overlying gypsum board face layer, fastened with 1 in. long screws spaced max 16 in. OC to studs and runners. Base layer with an overlying cement board face layer, fastened with 1 in. long screws spaced max 12 in. OC to studs and runners. Face layers fastened with 1-5/8 in. long screws spaced max 16 in. OC to studs and runners with screws offset 8 in. from face layer screws. Face layer joints offset min 12 in. from base layer joints. Joints in either layer need not be staggered from joints on the opposite side of the wall. When used in widths other than 48 in., gypsum panels to be installed horizontally.
CGC INC — Types AR, C, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, SGX, ULIX, ULX, USGX, WRC or WRX (Joint tape and compound, Items 6 and 7, optional for use with Type USGX).

UNITED STATES GYPSUM CO — Type AR, C, FRX-G, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, ULIX, ULX, WRC, WRX, USGX (Joint tape and compound, Items 6 and 7, optional for use with Type USGX).

USG BORAL DRYWALL SFZ LLC — Types C, SCX, SGX, USGX (Joint tape and compound, Items 6 and 7, optional for use with Type USGX).

USG MEXICO S A DE C V — Types AR, C, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, ULX, USGX, WRC, WRX (Joint tape and compound, Items 6 and 7, optional for use with Type USGX).

5A. **Gypsum Board*** — (As an alternate to Item 5 may be used as the base layer on one or both sides of wall. For direct attachment only) - Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-1/4 in. long Type S-12 steel screws spaced 8 in. OC at perimeter and 12 in. OC in the field.
RAY-BAR ENGINEERING CORP — Type RB-LBG

5B. **Gypsum Board*** — (As an alternate to Item 5 may be used as the base layer on one or both sides of wall. For direct attachment only). Nominal 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-1/4 in. long Type S-12 (or #6 by 1-1/4 in. long bugle head fine driller) steel screws spaced 8 in. OC at perimeter and 12 in. OC in the field.
NEW ENGLAND LEAD BURNING CO INC, DBA NELCO — Nelco

5C. **Gypsum Board*** — (As an alternate to Item 5) For Direct Application to Studs Only- For use as the base layer or as the face layer. Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type S-12 steel screws spaced 8 in. OC at perimeter and 12 in. OC in the field when applied as the base layer. When applied as the face layer screw length to be increased to 2-1/2 in. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 10 ft long with a max thickness of 0.140 in. placed on the face of studs and attached to the stud with two 1 in. long Type S-8 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, max 5/16 in. diam by max 0.140 in. thick. compression fitted or adhered over the screw heads. Lead batten strips and discs to have a purity of 99.5% meeting the Federal specification QQ-L-201f, Grades "B, C or D". Fasteners for face layer gypsum panels (Item 5) when installed over lead backed board to be min 2-1/2 in.
MAYCO INDUSTRIES INC — Type X-Ray Shielded Gypsum

5D. **Gypsum Board*** — ((As an alternate to Items 5 may be used as the base layer on one or both sides of wall. For direct attachment only)) For Direct Application to Studs Only– Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-1/4 in. long Type S-12 steel screws spaced 8 in. OC at perimeter and 12 in. OC in the field. Lead batten strips, min 2 in. wide, max 8 ft long with a max thickness of 0.14 in. placed on the face of studs and attached to the stud with construction adhesive and two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, nominal 3/8 in. diam by max 0.085 in. thick. Compression fitted or adhered over the screw heads. Lead batten strips and discs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Fasteners for face layer gypsum panels (Item 5) when installed over lead backed board to be min 2-1/2 in. Type S-12 bugle head steel.
RADIATION PROTECTION PRODUCTS INC — Type RPP - Lead Lined Drywall

6. **Joints** — Covered with glass fiber mesh tape and latex modified Portland cement mortar or basecoat, or Type I organic adhesive.

7. **Joints** — When tapered edge gypsum board is used, face layer joints covered with joint compound and paper tape. As an alternate, gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard with joints reinforced. When square-edge gypsum board is used, treatment of joints is optional.

8. **Vapor Retarder, Water Barrier or Weather Resistive Barrier** — (Optional — Not shown) — As required.

9. **Lead Batten Strips** — (Not Shown, For use With Item 5A) - Lead batten strips, min 1-1/2 in. wide, max 10 ft long with a max thickness of 0.125 in. Strips placed on the interior face of studs and attached from the exterior face of the stud with two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead batten strips to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Lead batten strips required behind vertical joints of lead backed gypsum wallboard (Item 5A) and optional at remaining stud locations. Required behind vertical joints.

9A. **Lead Batten Strips** — (Not Shown, for use with Item 5C) Lead batten strips, 2 in. wide, max 10 ft long with a max thickness of .0140 in. Strips placed on the face of studs and attached to the stud with two min. 1 in. long min. Type S-8 pan head steel screws, one at the top of the strip and one at the bottom of the strip or with one min. 1 in. long min. Type S-8 pan head steel screw at the top of the strip. Lead batten strips to have a purity of 99.5% meeting the Federal specification QQ-L-201f, Grades "B, C or D". Lead batten strips required behind vertical joints of lead backed gypsum wallboard (Item 5) and optional at remaining stud locations.

10. **Lead Discs or Tabs** — (Not Shown, For use With Item 5A) - Used in lieu of or in addition to the lead batten strips (Item 9) or optional at other locations - Max 3/4 in. diam by max 0.125 in. thick lead discs compression fitted or adhered over steel screw heads or max 1/2 in. by 1-1/4 in. by max 0.125 in. thick lead tabs placed on gypsum boards (Item 5A) underneath screw locations prior to the installation of the screws. Lead discs or tabs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C".

10A. **Lead Discs** — (Not Shown, for use with Item 5C) Max 5/16 in. diam by max 0.140 in. thick lead discs compression fitted or adhered over steel screw heads. Lead discs to have a purity of 99.5% meeting the Federal Specification QQ-L-201f, Grades "B, C or D".

11. **Lead Batten Strips** — (Not Shown, For Use With Item 5B) Lead batten strips, 2 in. wide, max 10 ft long with a max thickness of 0.142 in. Strips placed on the face of studs and attached to the stud with two min. 1 in. long min. Type S-8 pan head steel screws, one at the top of the strip and one at the bottom of the strip or with one min. 1 in. long min. Type S-8 pan head steel screw at the top of the strip. Lead batten strips to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Lead batten strips required behind vertical joints of lead backed gypsum wallboard (Item 5B) and optional at remaining stud locations.

12. **Lead Tabs** — (Not Shown, For Use With Item 5B) 2 in. wide, 5 in. long with a max thickness of 0.142 in. Tabs friction-fit around front face of stud, the stud folded back flange, and the back face of the stud. Tabs required at each location where a screw (that secures the gypsum boards, Item 5B) will penetrate the steel stud. Lead tabs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Lead tabs may be held in place with standard adhesive tape if necessary.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

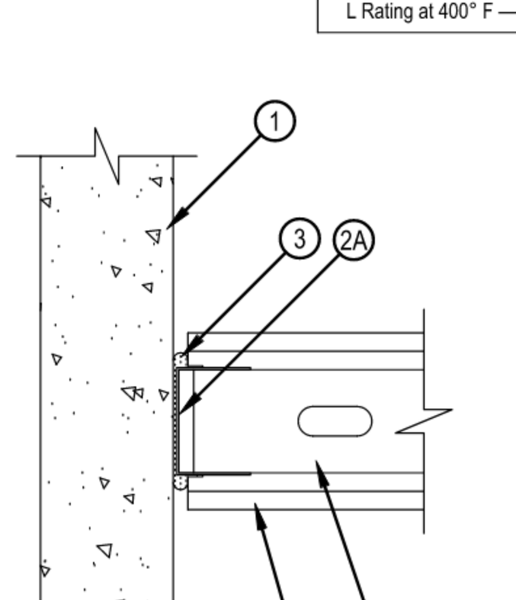
Last Updated on 2020-12-22

System No. WW-S-0074

WWS 0074

Classified by Underwriters Laboratories, Inc. to UL 2079 and CAN/ULC-S115

ANSI/UL2079	CAN/ULC S115
Assembly Ratings — 1 and 2 Hr (See Items 1 and 2)	F Ratings — 1 and 2 Hr (See Items 1 and 2)
Joint Width - 3/4 In. Max	FT Ratings — 1 and 2 Hr (See Items 1 and 2)
L Rating at Ambient — Less than 1 CFM/Lin Ft	FH Ratings — 1 and 2 Hr (See Items 1 and 2)
L Rating at 400° F — Less than 1 CFM/Lin Ft	FTH Ratings — 1 and 2 Hr (See Items 1 and 2)
	Joint Width -19 mm Max
	L Rating at Ambient — Less than 1.55 L/s/lin m
	L Rating at 400° F — Less than 1.55 L/s/lin m



Hilti Firestop Systems

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Page: 1 of 2

System No. WW-S-0074

WWS 0074

1. Concrete Wall Assembly — Min 4-1/2 in. (114 mm) and 6 in. (152 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) structural concrete for 1 and 2 hr rated assemblies, respectively. Wall may also be constructed of any UL Classified Concrete Blocks*. See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Gypsum Wall Assembly — The 1 or 2 h fire rated gypsum board/steel stud wall assembly shall be constructed of the materials and in the manner specified in the individual U400, V400 or W400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
   A. Steel Runners — Steel runners of wall assembly shall consist of min No. 25 gauge galv steel channels sized to accommodate steel studs (Item 2B). Runners to be provided with min 1-1/4 in. (32 mm) flanges and secured to concrete wall assembly with steel concrete fasteners spaced max 24 in. (610 mm) OC.
   B. Studs — Steel studs to be min 3-1/2 in. (89 mm) wide. Studs cut 3/4 to 1 in. (19 to 25 mm) less in length than assembly height with bottom nesting in, resting on and fastened to the floor runner with sheet metal screws. Stud spacing not to exceed 24 in. (610 mm) OC.
   C. Gypsum Board* — For 1 hr assembly, single layer of 5/8 in. (16 mm) thick gypsum board is required on each side of wall as specified in the individual Wall and Partition Design. For 2 hr assembly, two layers of 5/8 in. (16 mm) thick gypsum board are required on each side of the wall as specified in the individual Wall and Partition Design. Wall to be constructed as specified in the individual U400, V400 or W400 Series Design except that a max 3/4 in. (19 mm) gap shall be maintained between the side of gypsum board and the face of concrete wall assembly.
   The hourly fire rating of the joint system is equal to the hourly fire rating of the gypsum wall assembly.
3. Fill, Void or Cavity Material* — Track Seal — Max separation between side of gypsum board and face of concrete wall assembly is 3/4 in. (19 mm). Factory supplied foam seal installed over the steel runners (Item 2A) prior to attachment to concrete wall in accordance with the installation instructions.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-TTS 358, CFS-TTS 600, CFS-TTS R or CFS-TTS-OS

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Hilti Firestop Systems

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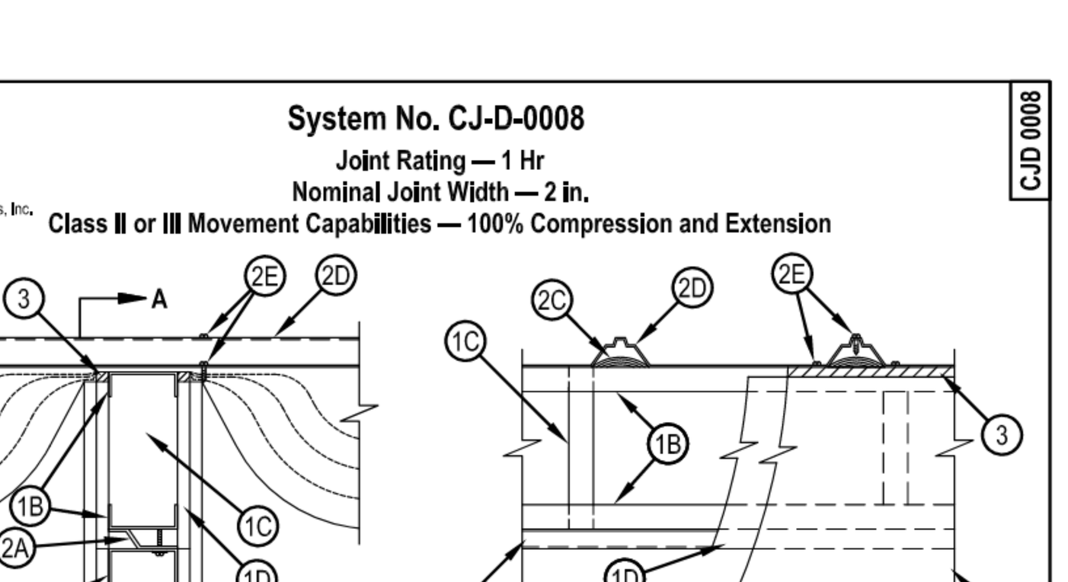
Page: 2 of 2

System No. CJ-D-0008

CJD 0008

Classified by Underwriters Laboratories, Inc. to ASTM E2837

Joint Rating — 1 Hr
Nominal Joint Width — 2 in.
Class II or III Movement Capabilities — 100% Compression and Extension



1. Wall Assembly — The minimum 1 hr fire rated gypsum board/steel stud wall assembly shall be constructed of the materials and in the manner specified in the individual U400, V400 or W400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
   A. Ceiling Deflection Channel — U-shaped channel formed from min 16 ga steel sized to accommodate steel studs (Item 1C) and provided with nom 5 in. (127 mm) flanges. Deflection channel installed parallel with and aligned with web of purlin and secured to bottom flange of purlin with min No. 14 self-tapping, hex-head, plated steel or stainless steel screws spaced max 24 in. (610 mm) OC.
   B. Steel Floor and Ceiling Runners — Floor runner of the wall assembly and the floor and ceiling runners of the cripple wall above the wall assembly shall consist of min 1-1/4 in. (32 mm) deep min 25 ga galv steel channels sized to accommodate steel studs (Item 1C). Floor runner of cripple wall aligned with and resting atop flange of purlin. Ceiling runner of cripple wall installed to compress insulation (Item 2C) to min thickness of 3/8 in. (10 mm) by wedging lengths of stud (Item 1C) between the runners. Steel studs of cripple wall attached to web of purlin with steel screws driven through opposite side of purlin web.
   C. Studs — Steel studs to be min 3-1/2 in. (89 mm) wide. Studs cut max 2 in. (51 mm) less in length than the wall assembly height with bottom nesting in and resting on the floor runner and with top nesting in ceiling deflection channel without attachment. Width of stud to be equal to or greater than width of purlin flange. Stud spacing not to exceed 24 in. (610 mm) O.C. Studs of cripple wall cut to length as required to compress insulation (Item 2C) to min thickness of 3/8 in. (10 mm) and spaced max 24 in. (610 mm) OC.
   D. Gypsum Board* — (CKNX) — Min 5/8 in. (16 mm) thick gypsum board sheets installed on each side of wall. Wall to be constructed as specified in the Individual U400, V400 or W400 Series Design in the UL Fire Resistance Directory except that a max 2 in. (51 mm) wide gap shall be maintained between the gypsum board of the wall assembly below the purlin and the gypsum board of the cripple wall. Top edge of gypsum board of wall assembly to be max 2 in. (51 mm) below top of ceiling deflection channel. Bottom edge of gypsum board of cripple wall to be flush with top of ceiling deflection channel. Screws securing gypsum board to steel studs of wall assembly to be located 2-1/4 in. to 2 1/2 in. (57 to 64 mm) below flange of ceiling deflection channel. Screws securing gypsum board of cripple wall to be driven into web of purlin and into studs and runners of cripple wall. No screws are to be driven into flanges of ceiling deflection channel.

Hilti Firestop Systems

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System No. CJ-D-0008

CJD 0008

   E. Gypsum Board* — (CKNX) — Min 5/8 in. (16 mm) thick "rip strip" of gypsum board installed to cover first layer of gypsum board on cripple wall and to lap min 3 in. (76 mm) onto gypsum board of wall assembly on each side of wall. The "rip strip" of gypsum board is to be the same material used for the wall assembly and is to be secured to the web of purlin and into studs and runners of the cripple wall. No screws are to be driven into flanges of ceiling deflection channel. Joints of "rip strip" to be offset from joints of gypsum board on wall assembly. Max separation between top of wall assembly gypsum board and bottom of cripple wall gypsum board (at time of installation of joint system) is 2 in. (51 mm). The joint system is designed to accommodate a max 100 percent compression or extension from its installed width.
2. Nonrated Horizontal Assembly — The nonrated horizontal assembly shall be constructed of the materials and in the manner described in the Individual Roof Deck Constructions (Guide TGKX) in the UL Roofing Materials and Systems Directory and shall include the following construction features:
   A. Purlin — Min 16 ga coated steel. Max spacing as specified in the individual Roof Deck Construction.
   B. Lateral Bracing — (Not Shown) - As required.
   C. Batts and Blankets* - Insulation — Any faced compressible glass-fiber blanket insulation having a min 6 in. (152 mm) thickness before compression and a min density of 0.6 pcf (9.6 kg/m3). Insulation draped over purlins prior to installation of panel clips (Item 2F) and/or metal roof deck panels (Item 2D). Side edges of the batts shall be butted or overlapped a max of 3 in. (76 mm).
   See Batts and Blankets (BZJZ) category in the UL Fire Resistance Directory or Batts and Blankets (BKNV) category in the UL Building Materials Directory for names of manufacturers.
   D. Metal Roof Deck Panels* — Min 26 ga coated steel. Panels continuous over two or more spans. Roof panel end laps, if required, centered over purlins with min 3 in. (76 mm) panel overlap as specified in the Individual Roof Deck Construction. A line of tube sealant or tape sealant may be used at panel end and side laps.
   See Metal Roof Deck Panels (TJPV) category in the UL Roofing Materials and Systems Directory for names of manufacturers.
   E. Fasteners — Fasteners used for panel-to-purlin and panel-to-panel connections to be self-tapping, hex-head, plated steel or stainless steel screws with either an integral or a separate steel washer fitted with a compressible sealing washer. Fastener type, length, pilot hole diam and spacing to be as specified in the Individual Roof Deck Construction.
   F. Roof Deck Fasteners* - Panel Clips — (Not Shown) - Panel clips used for panel-to-purlin connections to be secured to purlin through insulation as specified in the individual Roof Deck Construction.
   See Roof Deck Fasteners (TLSX) category in the UL Roofing Materials and Systems Directory for names of manufacturers.
   G. Thermal Spacer Blocks — (Not Shown) - Expanded polystyrene strips cut to fit between panel clips (Item 2F) as specified in the individual Roof Deck Construction. Thermal spacer blocks, when used, are to be installed between insulation (Item 2C) and metal roof deck panels (Item 2D) over purlins.
3. Fill, Void or Cavity Material* (XHHW) — Caulk — Min 5/8 in. (16 mm) thickness of fill material installed to fill any gap between top of cripple wall gypsum board and insulation (Item 2C) or purlin flange on each side of the wall.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP601S, CFS-S SIL GG, CP606, FS-ONE Sealant or FS-ONE Max Intumescent Sealant

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 26, 2015

Page: 2 of 2

1/13/23, 1:29 PM XHEZ.W-L-7154 - Through-penetration Firestop Systems | UL Product iQ

UL Product iQ®

XHEZ.W-L-7154 - Through-penetration Firestop Systems

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

XHEZ - Through-penetration Firestop Systems
XHEZ7 - Through-penetration Firestop Systems Certified for Canada

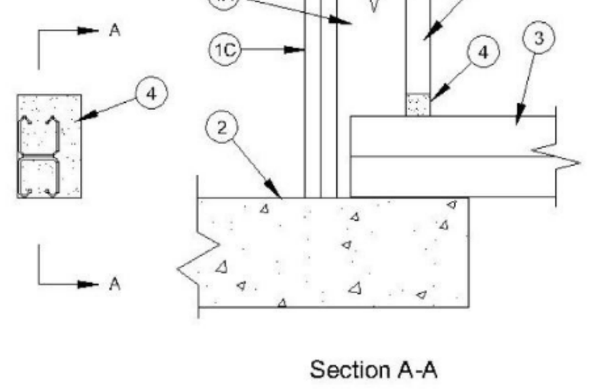
See General Information for Through-penetration Firestop Systems

See General Information for Through-penetration Firestop Systems Certified for Canada

System No. W-L-7154

January 27, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Items 1 and 2)	F Ratings - 1 and 2 Hr (See Items 1 and 2)
T Rating - 0 Hr	FT Rating - 0 Hr
	FH Ratings - 1 and 2 Hr (See Items 1 and 2)
	FTH Rating - 0 Hr



1. **Wall Assembly** — The 1 or 2 hr fire rated shaft wall assembly shall be constructed of the materials and in the manner specified in the individual U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. **Steel Studs** — C-H -shaped studs, 2-1/2 in. (64 mm) wide by 1-1/2 in. (38 mm) deep, spaced 24 in. (610 mm) OC.
   B. **Gypsum Board*** — 1 in. (25 mm) thick gypsum board liner panels, supplied in nom 24 in. (610 mm) widths as specified in the individual Wall and Partition Design. Max area of opening is 8.6 sq in. (55 sq cm) with a max dimension of 6-7/8 in. (175 mm). The opening cutout shall follow the contour of the penetrant when steel angle or steel channel is used.
   C. **Gypsum Board*** — One or two layers of 5/8 in. (16 mm) thick gypsum board for 1 or 2 hr rated assemblies, respectively, as specified in the individual Wall and Partition Design.

1A. **Alternate Wall Assembly** — (Not shown) As an alternate to the shaft wall described above, the 1 or 2 hr fire rated wall assembly shall be constructed of the materials and in the manner specified in the individual U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. **Studs** — Wall framing shall consist of min 2-1/2 in. (64 mm) steel channel studs spaced max 24 in. (610 mm) OC.
   B. **Gypsum Board*** — Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max area of opening is 8.6 sq in. (55 sq cm) with a max dimension of 6-7/8 in. (175 mm). The opening cutout shall follow the contour of the penetrant when steel angle or steel channel is used.

The hourly F and FH Ratings of the firestop system are equal to the hourly rating of the wall.

2. **Floor Assembly** — Min 2-1/2 and 4-1/2 in. (64 or 114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete for 1 and 2 hr rated assemblies, respectively. Floor may also be constructed of any min 6 in. (152 mm) UL Classified **Precast Concrete Units***.
   See **Precast Concrete Units** (CFTV) category in the Fire Resistance Directory for names of manufacturers.

3. **Penetrants** — One metallic strut, steel angle or steel channel to be installed within the firestop system. An annular space of min 0 in. (point contact) to max 7/8 in. (22 mm) is required within the firestop system. Penetrant to terminate within the stud cavity and shall be secured to floor assembly within 2 in. (51 mm) of the fill material (Item 4) on either side of the fill material with at least one min 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long steel masonry anchor in conjunction with steel washers or Hilti 1/4 in. diam by 1-3/4 in. long KWIK-BOLT 3 steel expansion anchor. The following types and sizes of metallic struts, angles or channels may be used:
   A. **Steel Strut** — Max 1-5/8 by 1-5/8 in. (41 by 41 mm) channel strut formed from min 0.105 in. (2.7 mm) thick galv or painted steel.
   B. **Steel Strut** — Max 3-1/4 by 1-5/8 in. (83 by 41 mm) H strut formed from min 0.105 in. (2.7 mm) thick galv or painted steel.
   C. **Steel Angle** — Max 2 by 2 in. (51 by 51 mm) by min 1/8 in. (3.2 mm) thick or max 3 by 3 in. (76 by 76 mm) by min 1/4 in. (6 mm) thick steel angle.

   D. **Steel Channel** — C6 x 8.2 (or smaller) steel channel.

4. **Fill, Void or Cavity Material* - Sealant** — Fill material to be installed to completely fill the annular space, flush with the surface of the wall. The thickness of the fill material shall be the thickness of the gypsum board(s) in which it is installed. An additional min 1/2 in. (13 mm) diam bead of sealant to be installed at the point contact location at the penetrant/gypsum board interface.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2015-01-27

TABLE 721.1(2)
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a, o, p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches) 4 hours	3 hours	2 hours	1 hour
1. Brick of clay or shale	1-1.1	Solid brick of clay or shale[c].	6	4.9	3.8	2.7
	1-1.2	Hollow brick, not filled.	5.0	4.3	3.4	2.3
	1-1.3	Hollow brick unit wall, grout or filled with perlite vermiculite or expanded shale aggregate.	6.6	5.5	4.4	3.0
	1-2.1	4" nominal thick units not less than 75 percent solid backed with a hat-shaped metal furring channel 3/4" thick formed from 0.021" sheet metal attached to the brick wall on 24" centers with approved fasteners, and 1/2" Type X gypsum wallboard attached to the metal furring strips with 1"-long Type S screws spaced 8" on center.	—	—	5[d]	—
2. Combination of clay brick and load-bearing hollow clay tile	2-1.1	4" solid brick and 4" tile (not less than 40 percent solid).	—	8	—	—
	2-1.2	4" solid brick and 8" tile (not less than 40 percent solid).	12	—	—	—
3. Concrete masonry units	3-1.1[f, g]	Expanded slag or pumice.	4.7	4.0	3.2	2.1
	3-1.2[f, g]	Expanded clay, shale or slate.	5.1	4.4	3.6	2.6
	3-1.3[f]	Limestone, cinders or air-cooled slag.	5.9	5.0	4.0	2.7
	3-1.4[f, g]	Calcareous or siliceous gravel.	6.2	5.3	4.2	2.8
		Siliceous aggregate concrete	7.0	6.2	5.0	3.5

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY
CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
CAL FIRE SINCE 1885
12/07/21
20-1059
Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

CONSULTANT

nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

LICENSED ARCHITECT
MICHAEL J. PARROTT
No. C-27624
Dec 31, 2023
STATE OF CALIFORNIA

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 005	01/13/23

DATE 04/08/2020

JOB NO. DGS 140724

SHEET TITLE

UL ASSEMBLIES

SHEET NO.

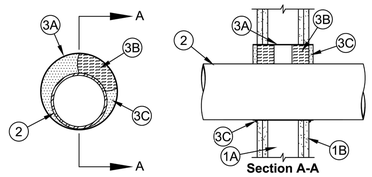
1

T0.3

Classified by
Underwriters Laboratories, Inc.
to ASTM/UL1479 (ASTM E814)

System No. W-L-1079

F Ratings - 1 and 2 Hr (See Item 1B)
T Rating - 0 Hr
L Rating At Ambient - Less Than 1 CFM/sq ft
L Rating At 400 F - Less Than 1 CFM/sq ft



Section A-A

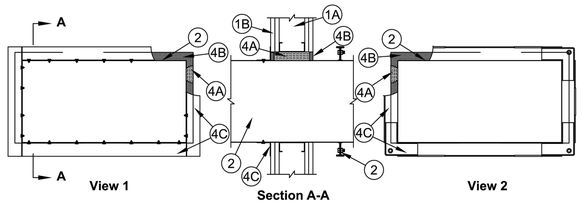
1. **Wall Assembly -** The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 or U400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
   A. **Studs -** Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC with nom 2 by 4 in. lumber end plates and cross braces. Steel studs to be min 3-5/8 in. wide and spaced max 24 in. OC.
   B. **Gypsum Board* -** 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is in wood stud walls is 13 in. Max diam of opening in steel stud walls is 16 in.

      The hourly F rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
2. **Through Penetrant -** One metallic pipe or conduit to be installed either concentrically or eccentrically within the firestop system. The annular space between pipes or conduits and periphery of opening shall be min 0 in. (point contact) to max 3 in. Pipe or conduit to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or conduits may be used:
   A. **Steel Pipe -** Nom 12 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. **Iron Pipe -** Nom 12 in. diam (or smaller) cast or ductile iron pipe.
   C. **Conduit -** Nom 4 in. diam (or smaller) electrical metallic tubing, nom 6 in. diam (or smaller) steel conduit or nom 1 in. diam (or smaller) flexible steel tubing.
   D. **Copper Pipe -** Nom 6 in. diam (or smaller) Regular (or heavier) copper pipe.
   E. **Copper Tube -** Nom 6 in. diam (or smaller) Type L (or heavier) copper tube.

Classified by
Underwriters Laboratories, Inc.
to ANSI/UL 1479 (ASTM E814) and CAN/ULC S115

System No. W-L-7202

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr	F Ratings - 1 and 2 Hr
T Rating - 0 Hr	FT Rating - 0 Hr
L Rating At Ambient - Less Than 1 CFM/sq ft	FH Ratings - 1 and 2 Hr
L Rating At 400 F - Less Than 1 CFM/sq ft	FTH Rating - 0 Hr
	L Rating At Ambient - Less Than 5.1 L/s/m3
	L Rating At 204 C - Less Than 5.1 L/s/m3



View 1 Section A-A View 2

1. **Wall Assembly -** The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described within the individual U400, V400 or W400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:
   A. **Studs -** Wall framing shall consist of steel channel studs. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC. Additional studs shall be installed horizontally to form a rectangular box around the through penetrant.
   B. **Gypsum Board* -** Thickness, type, number of layers and fasteners as specified in the individual Wall and Partition Design. Min separation between penetrants to be 1 in. (25 mm). Max area of opening 17.8 sq ft (1.65 m2) with one dimension of opening being 64 in. (1.6 m) or less.

      The hourly F and FH Ratings of the firestop system are dependent upon the hourly rating of the wall in which it is installed.
2. **Steel Duct -** One max 60 by 36 in. (1524 by 914 mm) steel duct passing through opening. Steel gauge of duct shall conform with SMACNA requirements. The annular space between steel duct and edges of opening shall be min 0 in. (point contact) to max 2-1/2 in. (64 mm). Two sections of duct may be connected together on one side of the wall. Duct connection to be located max 4 in. (102 mm) from one surface of the wall. Nom 2 in. (51 mm) flanges formed on the end of both duct sections. Min 6 in. (152 mm) long by 2 in. (51 mm) wide by 16 gauge (min 0.056 in. or 1.42 mm thick) "L" shaped steel corner pieces installed at each corner of the flanges on both sides of the connection. Corner pieces attached together with 3/8 in. (10 mm) steel nuts and bolts at each corner. Min 22 gauge (min 0.029 in. or 0.74 mm thick) by 6 in. (152 mm) long steel clips attached to duct flanges at connection max 15 in. (381 mm) OC. Steel duct to be rigidly supported on both sides of wall assembly.

2A. **Coated Ducts* -** As an alternate to Item 2, max 60 by 36 in. (1524 by 914 mm) steel duct coated with BW11 coating material. Duct sections shall be assembled using bolted flanges or SMACNA approved Transverse Joint Reinforcements. Annular space between duct and periphery of opening shall be shall be min 0 in. (point contact) to max 2-1/2 in. (64 mm). Duct to be rigidly supported on both sides of wall assembly.

FIRESPRAY INTERNATIONAL LTD - FLAMEBAR BW11 fire rated ductwork

GENERAL NOTES:

1. DETAILS SHOWN APPLY TO ALL WALL PENETRATIONS OF COMMUNICATION ROOM 111.

3. **Firestop System -** The firestop system shall consist of the following:
   A. **Metallic Sleeve -** Cylindrical sleeve fabricated from 0.0165 in. thick (28 gauge) galv sheet steel and having a min 2 in. lap along the longitudinal seam. Length of steel sleeve to be equal to or max 6 in. greater than the thickness of wall. Sleeve installed by coiling the sheet steel to a diam smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers. The ends of the steel sleeve shall be flush with or extend max 3 in. beyond each surface of the wall.
   B. **Packing Material -** Min 2 in. thickness of min 4 pcf mineral wool batt insulation tightly packed into annular space between metallic pipe, conduit or tubing and steel sleeve on both sides of the wall assembly+. Packing material to be recessed from each end of steel sleeve as required to accommodate the required thickness of fill material.
   C. **Fill, Void or Cavity Material* - Sealant -** Min 1/2 in. thickness of fill material within annulus, flush with ends of steel sleeve. A min 1/4 in. diam bead of fill material shall be applied at the metallic penetrant/steel sleeve interface on both sides of wall assembly. A min 1/4 in. bead of fill material shall be applied at the steel sleeve/gypsum board interface on both surfaces of wall.

      SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

      * Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

3. **Batts and Blankets* -** (Optional, Not shown) - Nom 2 in. (51 mm) thick light density (min 3/4 pcf or 12 kg/m3) glass fiber blanket insulation jacketed on the outside with a foil-scrim-kraft facing. Longitudinal and transverse joints sealed with foil-scrim-kraft tape. Nom annular space between insulated steel duct and periphery of opening to be point contact to max 1/2 in. (13 mm) prior to installation of packing material (Item 4A).

   See Batts and Blankets (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket meeting the above specifications and bearing the UL Classification Marking with a Flame Spread value of 25 or less and a Smoke Developed value of 50 or less may be used.
4. **Firestop System -** The firestop system shall consist of the following:
   A. **Packing Material -** Min 4 in. (102 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into annular space such that glass fiber blanket insulation on steel duct is compressed to a maximum overall thickness of 1/2 in. (13 mm). Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material.
   B. **Fill, Void or Cavity Material* - Sealant -** Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall.

      SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant, SpecSeal LCI Sealant
   C. **Retaining Angles -** Min 16 gauge (min 0.056 in. or 1.42 mm thick) galv steel angles sized to lap duct a min of 2 in. (51 mm) and to lap periphery of opening a min of 1 in. (25 mm). Angles attached to all four sides of steel duct on both sides of wall with No. 10 (or larger) steel sheet metal screws spaced 1 in. (25 mm) from each end and max 4 in. (102 mm) OC. When steel duct connection (Item 2) is located within 4 in. (102 mm) of wall surface, steel retaining angle only required on side of wall opposite steel duct connection. When optional insulation is present, angles attached to all four sides through glass fiber blanket insulation

      *** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY
12/07/21
20-1059
Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER
GORDON HO-MAN FONG
C 87304
CIVIL
STATE OF CALIFORNIA
01/13/2023

AECOM
CONSULTANT

nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

REGISTERED ARCHITECT
No. C-27624
Dec 31, 2023
ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 005	01/13/23

DATE 01/13/2023

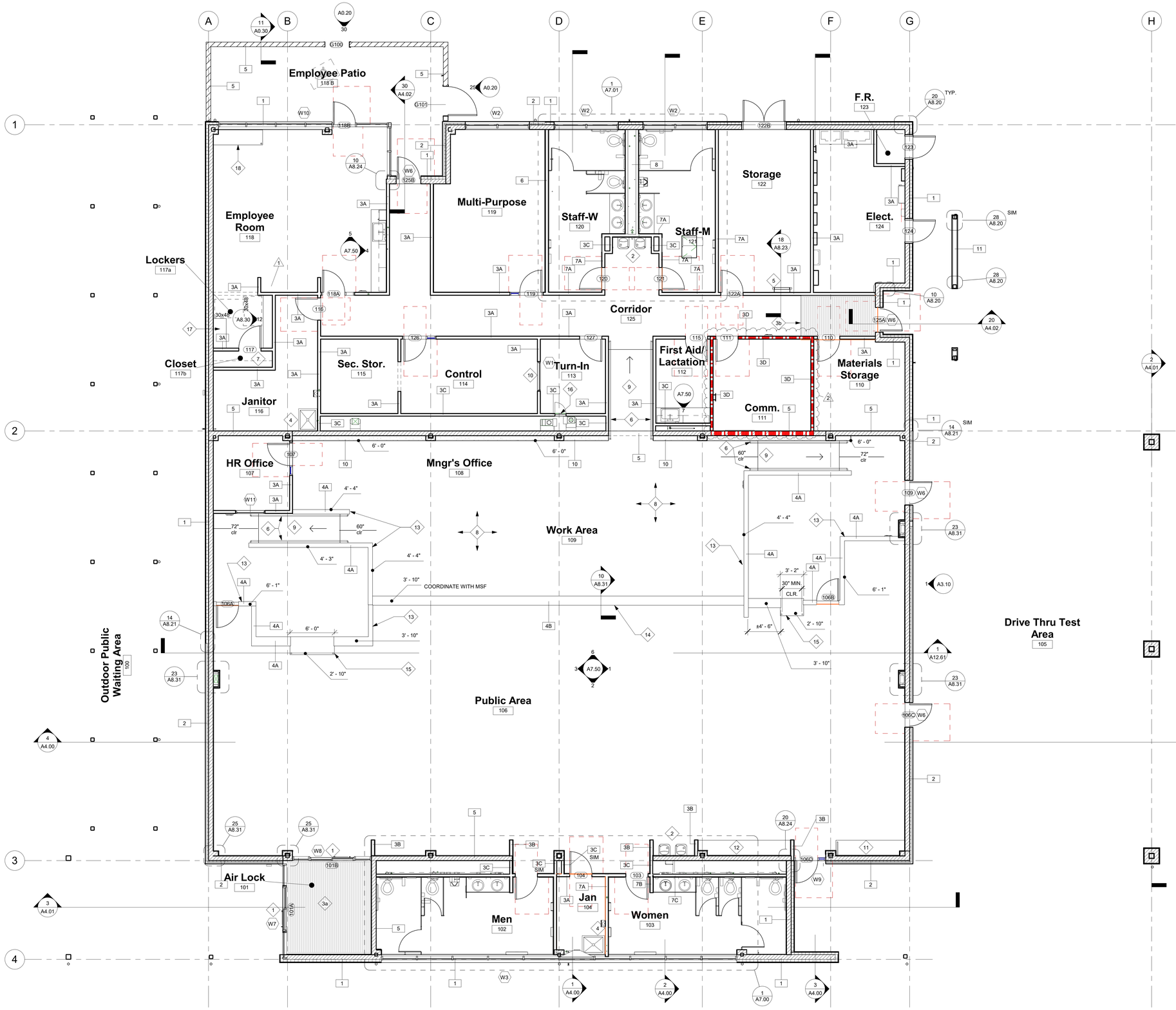
JOB NO. DGS 140724

SHEET TITLE

UL DETAILS

SHEET NO.

T0.4



1 FLOOR PLAN
3/16" = 1'-0"

N

KEYNOTES:

THESE KEYNOTES APPLY TO THIS SHEET ONLY

1. AUTOMATIC SLIDING ENTRY DOORS, SEE DOOR SCHEDULE ON A6.00.
2. HIGH LOW DRINKING FOUNTAIN. SEE ENLARGED PLAN ON SHEETS A7.00 AND A7.01 AND PLUMBING DRAWINGS.
3a. 10 FT X 10 FT ENTRANCE FLOOR MAT, SEE SPEC SECTION 12 48 16.
3b. 5 FT 6 IN X 10 FT ENTRANCE FLOOR MAT, SEE SPEC SECTION 12 48 16.
4. MOP SINK, SEE PLUMBING DRAWINGS.
5. ROOF ACCESS LADDER. SEE DETAIL 18/A8.23.
6. WALL MOUNTED HANDRAIL. SEE DETAIL 13/A8.31. PROVIDE BACKING PER DETAIL 5/A8.30.
7. SHELF AND ROD, SEE.....
8. COMPUTER ACCESS FLOOR, SEE DETAIL 27 / A8.30
9. COMPUTER ACCESS FLOOR RAMP, SEE DETAIL 28 / A8.30
10. PASS THRU WINDOW WITH SOLID SURFACE COUNTERTOP. SEE ....
11. ACCESSIBLE WRITING COUNTERTOP. SEE INTERIOR ELEVATIONS AND FINISH SCHEDULE. SEE ELECTRICAL DRAWINGS FOR POWER LOCATIONS.
12. WRITING COUNTERTOP. SEE INTERIOR ELEVATIONS AND FINISH SCHEDULE. SEE ELECTRICAL DRAWINGS FOR POWER LOCATIONS.
13. 8" SOLID SURFACE WALL CAP, SOSU-1. SEE DETAIL 20A/A8.31 AND FINISH PLAN AND SCHEDULE ON A11 SERIES.
14. 15" DEEP SOLID SURFACE PONY WALL COUNTER, SOSU-1. SEE DETAIL 20B/A8.31 AND FINISH PLAN AND SCHEDULE ON A11 SERIES.
15. 29" DEEP SOLID SURFACE ACCESSIBLE PONY WALL COUNTER, SOSU-1. SEE DETAIL 20C/A8.31 AND FINISH PLAN AND SCHEDULE ON A11 SERIES.
16. 16" x 16" ACCESS DOOR; BOTTOM OF DOOR: 6'-6" A.F.F., COORDINATE HEIGHT AND LOCATION WITH HVAC INSTALLER TO PROVIDE ACCESS TO HVAC CONTROLS.
17. ACCESSIBLE CHANGING BENCH. SEE EQUIPMENT PLAN SHEET A10.00
18. PROVIDE GROMMETS IN COUNTERTOP.

SHEET NOTES:

THESE SHEET NOTES APPLY TO THIS SHEET ONLY

1. FOR PARTITION TYPES, SEE SHEET A8.00.
2. FOR MOUNTING HEIGHTS AND CLEARANCES OF ALL ACCESSORIES SEE SHEET A8.30
3. FOR DOOR AND WINDOW SCHEDULE, SEE SHEET A6.00.
4. FOR CASEWORK DETAILS SEE SHEET A8.40
5. FOR FURNITURE AND EQUIPMENT, SEE SHEET A10.00.
6. FOR FINISH SCHEDULE AND PLAN, SEE SHEET A11 SERIES.
7. FOR WALL AND OPENING LOCATIONS, SEE DIMENSION PLAN ON SHEET A1.02.
8. ALL DIMENSIONS ARE GIVEN FROM FACE OF STRUCTURE (CONCRETE, BLOCK, STUD) OR CENTERLINE OF PARTITION UNLESS OTHERWISE NOTED.

LEGEND:

- 1i — WALL TAG, SEE SHEET A8.00
- 101 — DOOR TAG, SEE SHEET A6.00 FOR DOOR SCHEDULE
- W01 — WINDOW TAG, SEE SHEET A6.00 FOR WINDOW TYPES

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL APPROVED FIRE AND PANIC ONLY

12/07/21
20-1059

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SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

CONSULTANT
nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

REGISTERED ARCHITECT — No. C-27624 — Dec 31, 2023 — STATE OF CALIFORNIA

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	DSA PLAN CHECK	7/15/20
2	ADI 005	01/13/23

DATE 04/08/2020

JOB NO. DGS 140724

SHEET TITLE

FLOOR PLAN

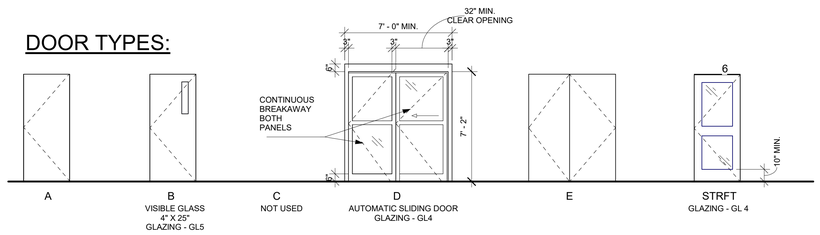
SHEET NO.

A1.00

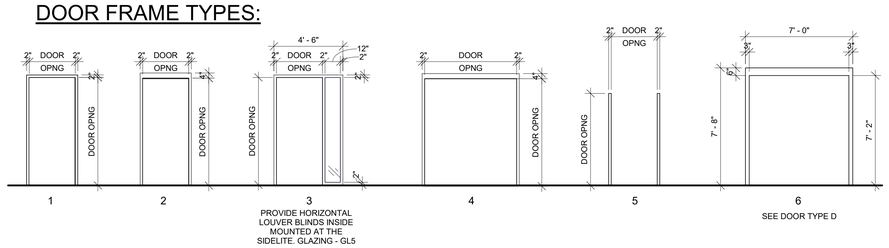
WT	ROOM NAME/LOCATION	NOMINAL DOOR SIZE (W X H) INSIDE OF DOOR FRAME	DOOR			FRAME			DETAILS (REF. A8.10 & A8.31)			HARDWARE GROUP	DOOR OPENING	SPECIAL REQUIREMENTS
			TYPE	MAT.	FINISH	TYPE	MAT.	FINISH	HEAD	JAMB	SILL			
101A	Air Lock	3'-0" X 7'-4"	D	ALUM	DARK BRONZE	W7	ALUM	DARK BRONZE	15/A8.11	5/A8.11, 9/A8.11	1/A8.31	15	101A	SEE WINDOW TYPE W7
101B	Public Area	3'-0" X 7'-4"	D	ALUM	DARK BRONZE	W8	ALUM	DARK BRONZE	11/A8.11	15/A/8.10	--	15	101B	SEE WINDOW TYPE W8
102	Men	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10 SIM	1	102	
103	Women	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10 SIM	1	103	
104	Jan	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10 SIM	2	104	
106A	Work Area	3'-0" x 6'-0"	A	WD	ST	5	HM	P5	-	1/A8.10	10/A8.10	16	106A	
106B	Work Area	3'-0" x 6'-0"	A	WD	ST	5	HM	P5	-	1/A8.10	10/A8.10	16	106B	
106C	Public Area	3-0" x 7'-0"	STRFT	ALUM	DARK BRONZE	W6	ALUM	DARK BRONZE	22/A8.10	22/A8.10	3/A8.10	17	106C	SEE WINDOW TYPE W6, PANIC HARDWARE
106D	Public Area	3'-0" x 7'- 0"	STRFT	ALUM	DARK BRONZE	W9	ALUM	DARK BRONZE	-	12/A8.10	3/A8.10	18	106D	SEE WINDOW TYPE W9
107	HR Office	3'-0" x 7'- 0"	A	WD	ST	3	HM	P5	1/A8.10	1/A8.10	5/A8.10	3	107	1
109	Work Area	3-0" x 7'-0"	STRFT	ALUM	DARK BRONZE	W6	ALUM	DARK BRONZE	22/A8.10	22/A8.10	3/A8.10	4	109	SEE WINDOW TYPE W6
110	Materials Storage	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10	5	110	
111	Comm.	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10	6	111	SPECIAL REQUIREMENTS: DOOR AND FRAME TO BE 3/4 HR FIRE RATED PER UL252 FOR FIRE ASSEMBLY & HOSE STREAM (3)
115	First Aid/ Lactation	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10	7	115	
116	Janitor	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	10/A8.10	8	116	
117	Closet	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10 SIM	9	117	
118A	Employee Room	3'-0" x 7'- 0"	A	WD	ST	3	HM	P5	1/A8.10	1/A8.10	5/A8.10	19	118A	
118B	Employee Room	3-0" x 7'-0"	STRFT	ALUM	DARK BRONZE	W10	ALUM	DARK BRONZE			3/A8.10	4	118B	SEE WINDOW TYPE W10
119	Multi-Purpose	3'-0" x 7'- 0"	A	WD	ST	3	HM	P5	1/A8.10	1/A8.10	5/A8.10	10	119	
120	Staff-W	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10	11	120	
121	Staff-M	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10	11	121	
122A	Storage	3'-0" x 7'-0"	A	WD	ST	1	HM	P5	1/A8.10	1/A8.10	10/A8.10	20	122A	1
122B	Storage	PR. 3'-0", 2'-8" x 7'-0"	E	HM	EXT P1	4	HM	EXT P1	7/A8.10	7/A8.10	3/A8.10	21	122B	WITH VIEWER
123	F.R.	3'-0" x 7'-0"	A	HM	EXT P1	2	HM	EXT P1	7/A8.10	7/A8.10	3/A8.10	12	123	
124	Elect.	3'-0" x 7'-0"	A	HM	EXT P1	2	HM	EXT P1	7/A8.10	7/A8.10	3/A8.10	12	124	PANIC HARDWARE
125A	Corridor	3-0" x 7'-0"	STRFT	ALUM	DARK BRONZE	W6	ALUM	DARK BRONZE	27/A8.10	27/A8.10	8/A8.10	22	125A	SEE WINDOW TYPE W6
125B	Corridor	3-0" x 7'-0"	STRFT	ALUM	DARK BRONZE	W6	ALUM	DARK BRONZE	27/A8.10	27/A8.10	3/A8.10	22	125B	SEE WINDOW TYPE W6
126	Control	3'-0" x 7'- 0"	A	WD	ST	3	HM	P5	1/A8.10	1/A8.10	5/A8.10	13	126	
127	Turn-In	3'-0" x 7'-0"	B	WD	ST	1	HM	P5	1/A8.10	1/A8.10	5/A8.10	14	127	

NOTE: SEE SHEET A12.01 FOR LOCATIONS AND TYPES OF SIGNAGE

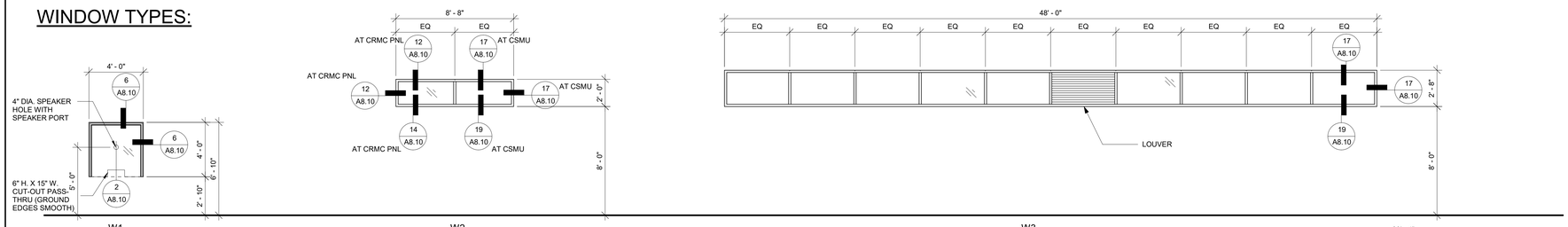
DOOR TYPES:



DOOR FRAME TYPES:

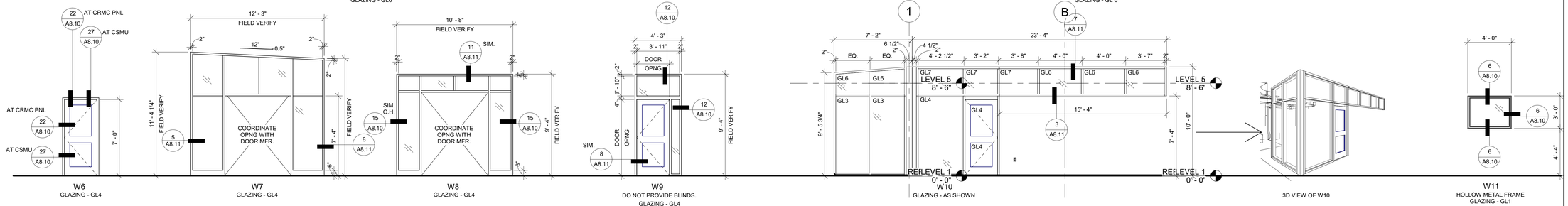


WINDOW TYPES:



GLAZING SCHEDULE:

GL1 = 1/2" MIRROR GLASS
GL2 = 1" INSULATING CLEAR LOW E GLAZING WITH FROSTED GLASS ON 3RD FACE.
GL3 = 1" INSULATING CLEAR LOW E GLAZING
GL4 = 1" INSULATING CLEAR LOW E GLAZING TEMPERED
GL5 = 1/4" TEMPERED GLASS
GL6 = ACID-ETCHED SATIN, 1" INSULATING CLEAR LOW E GLAZING
GL7 = ACID-ETCHED SATIN, 1" INSULATING CLEAR LOW E GLAZING TEMPERED
GL8 = 1" INSULATING CLEAR LOW E GLAZING WITH SPANDREL



IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL APPROVED FIRE AND PANIC ONLY

12/07/21
20-1059

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SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

CONSULTANT

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600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

REGISTERED ARCHITECT MICHAEL J PERRONE No. C-27624 Dec 31, 2023 STATE OF CALIFORNIA

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	SFM PLAN CHECK	7/15/20
2	BID CLARIFICATION	2/25/22
3	ADI 005	01/13/23

DATE 04/08/2020

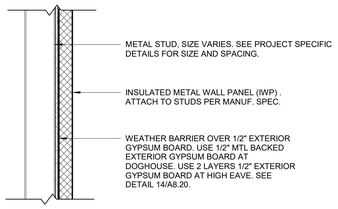
JOB NO. DGS 140724

SHEET TITLE

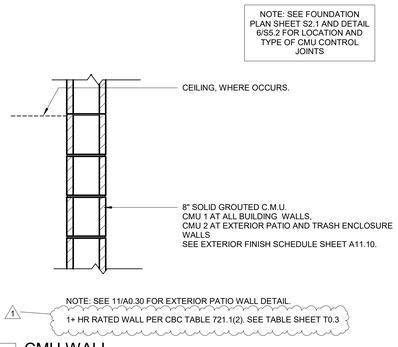
DOOR AND WINDOW SCHEDULE

SHEET NO.

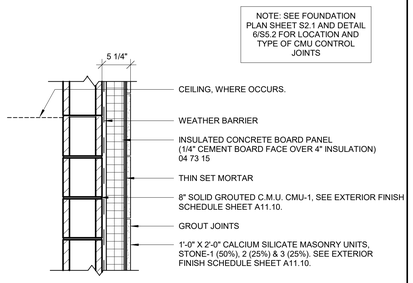
A6.00



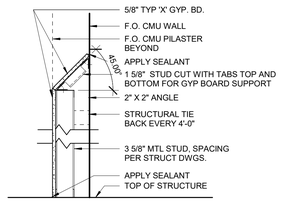
9 INSULATED METAL WALL PANEL
1" = 1'-0"



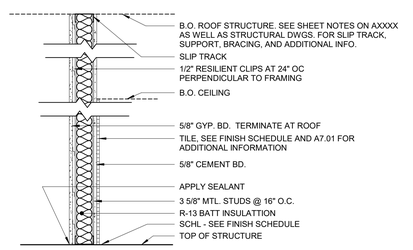
5 CMU WALL
1" = 1'-0"



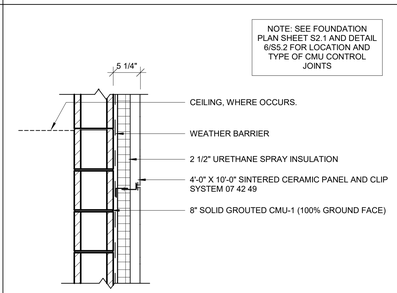
1 CSMU @ CMU WALL
1" = 1'-0"



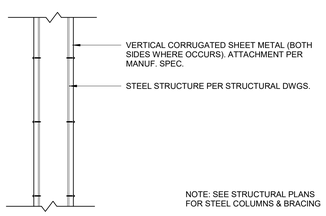
10 PARTIAL HEIGHT CHASE WALL
1" = 1'-0"



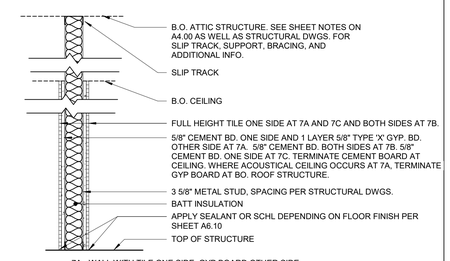
6 3 5/8" FULL HEIGHT ACOUSTICAL PARTITION AT RESTROOM
1" = 1'-0"



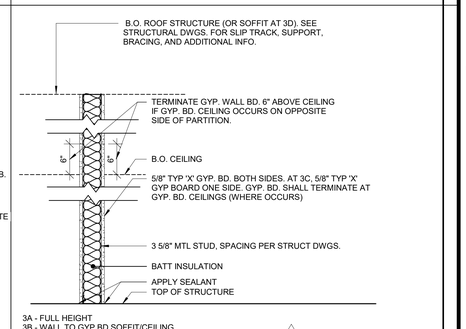
2 SCFS @ CMU WALL
1" = 1'-0"



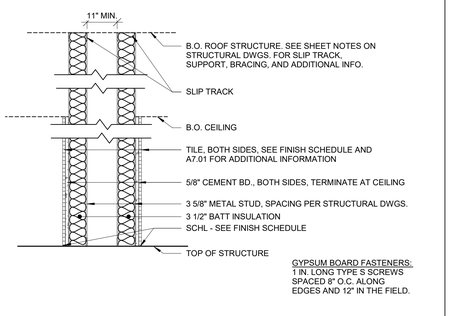
11 SCREEN WALL
1" = 1'-0"



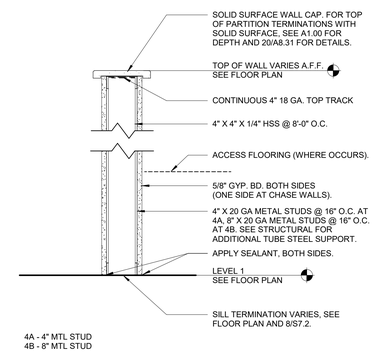
7 3 5/8" FULL HEIGHT PARTITION WITH TILE
1" = 1'-0"



3 3 5/8" PARTITION
1" = 1'-0"



8 3 5/8" FULL HEIGHT CHASE WALL AT BACK TO BACK PLUMBING WITH TILE
1" = 1'-0"



4 PARTIAL HEIGHT PARTITION
1 1/2" = 1'-0"

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY
12/07/21
20-1059
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SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

CONSULTANT

nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

No. C-21624 Dec 31, 2023

ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
1	ADI 005	01/13/23

DATE 04/08/2020

JOB NO. DGS 140724

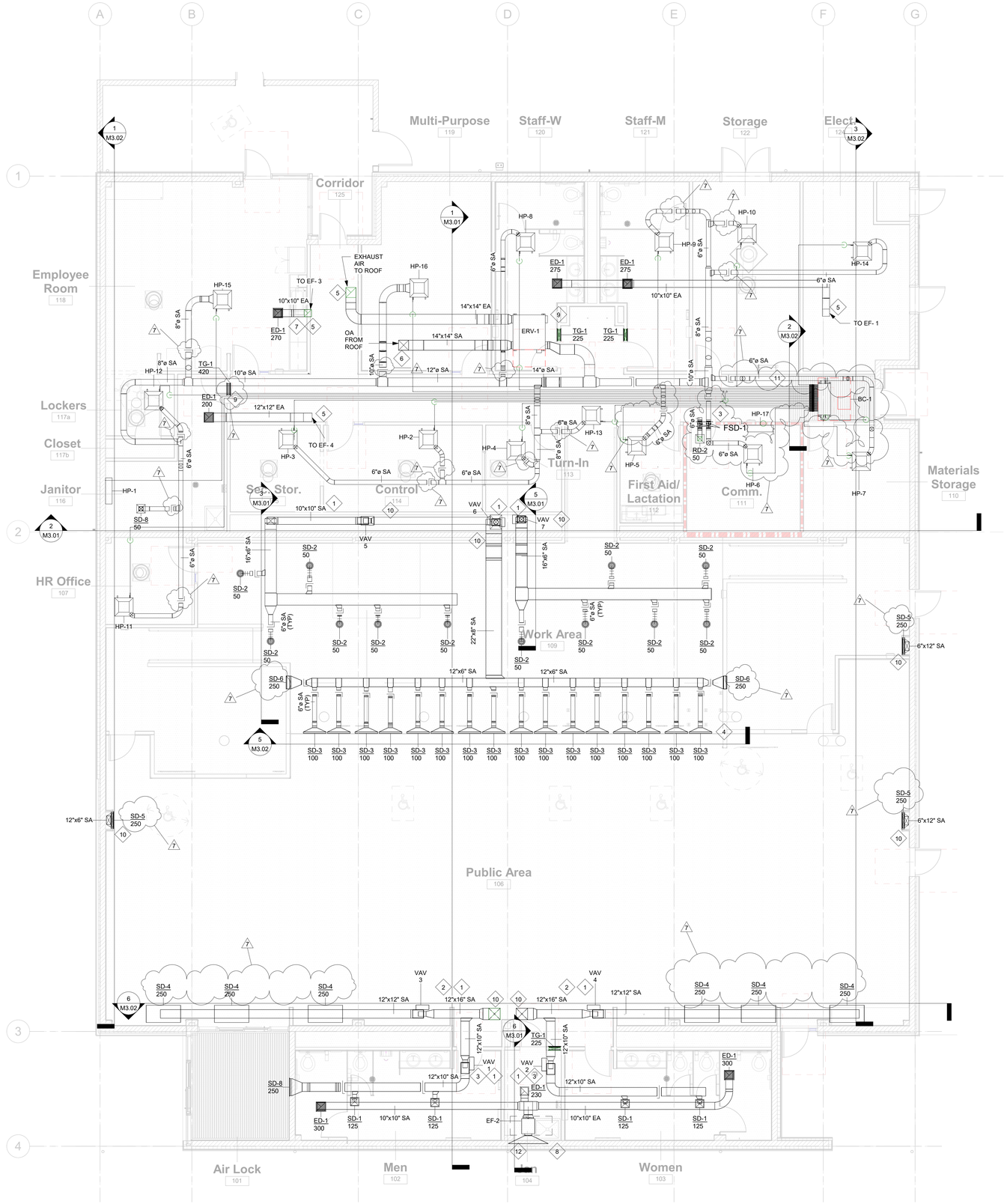
SHEET TITLE

PARTITION TYPES

SHEET NO.

A8.00

ONE INCH = TWENTY FEET 0 5 10 20 40 60 80
ONE-SIXTEENTH INCH = ONE FOOT 0 4 8 16 32
ONE-EIGHTH INCH = ONE FOOT 0 4 8 16
ONE-QUARTER INCH = ONE FOOT 0 4 8
ONE-HALF INCH = ONE FOOT 0 4
THREE-QUARTERS INCH = ONE FOOT 0 6 2
ONE INCH = ONE FOOT 0 6
ONE AND ONE-HALF INCH = ONE FOOT 0 6 1



1 MECHANICAL PLAN
3/16" = 1'-0"

KEYNOTES:

THESE KEYNOTES APPLY TO THIS SHEET ONLY

1. 18" x 18" WALL ACCESS PANEL AT EACH VAV.
2. ACCESS PANEL IN SOFFIT.
3. ACCESS PANEL IN CEILING.
4. COORDINATE DIFFUSERS WITH ARCHITECTURE WALL THICKNESS AND TERRAZO BASE.
5. EXHAUST THRU ROOF.
6. SUPPLY THRU ROOF.
7. WALL SWITCH FOR EXHAUST FAN.
8. EXHAUST THRU LOUVER.
9. PROVIDE A 1'X4' OPENING FOR PLENUM RETURN.
10. SUPPLY AIR FROM AHU-1
11. FOR VRF PIPING SIZE SEE MECHANICAL CONTROLS SHEET M7.01
12. COORDINATE WITH ARCHITECTURAL ON LOCATION/SIZE OF LOUVER

SHEET NOTES:

THESE SHEET NOTES APPLY TO THIS SHEET ONLY

A. PROVIDE ACCESS PANELS IN ALL HARD LID CEILINGS FOR SERVICE ACCESS AT INDOOR VRF UNITS AS REQUIRED BY MANUFACTURER

B. COORDINATE SD-2 WITH FURNITURE AND FLOOR ACCESS.

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
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SS ☐ FLS ☐ ACS ☒
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AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL APPROVED FIRE AND PANIC ONLY

12/07/21
20-1059

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SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV
448 DOVER PARKWAY, DELANO, CA

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REGISTERED PROFESSIONAL ENGINEER
VISHAL KEDIA
No. 31124
EXP. SEPT 2024
MECHANICAL
STATE OF CALIFORNIA

AECOM
CONSULTANT

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REGISTERED ARCHITECT
MICHAEL J. PARKER
No. C-27624
Dec 31, 2023
STATE OF CALIFORNIA
ARCHITECT

REVISIONS		
NO.	DESCRIPTION	DATE
7	ADI 005	01/13/23

DATE 01/13/2023

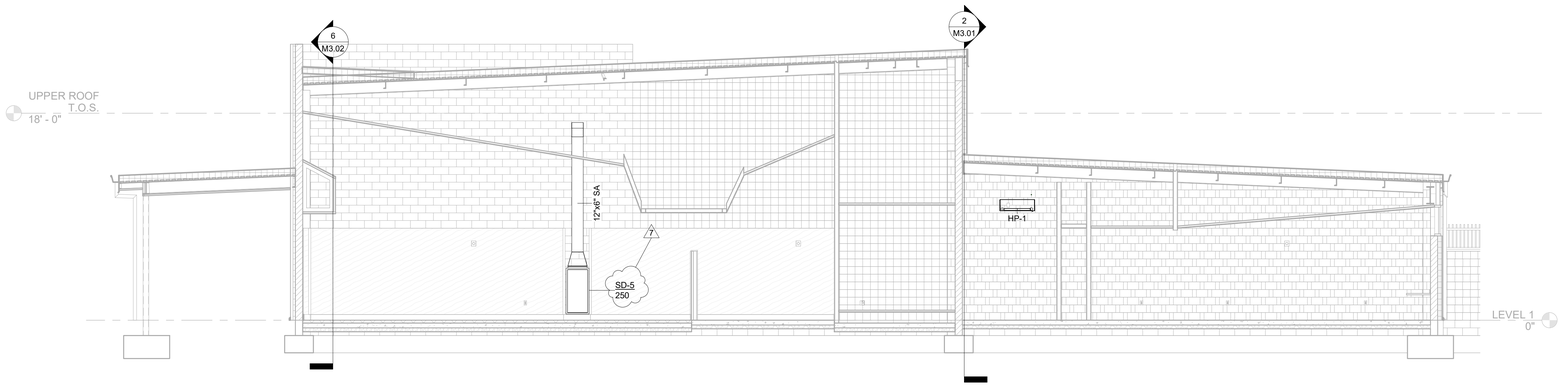
JOB NO. DGS 140724

SHEET TITLE

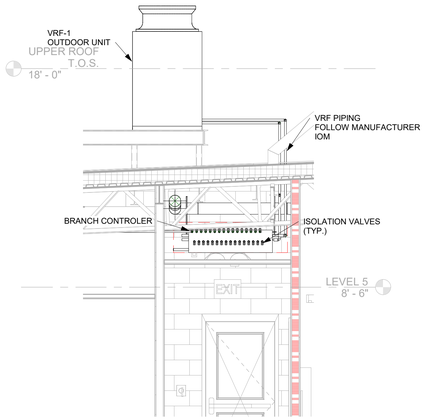
MECHANICAL PLAN

SHEET NO.

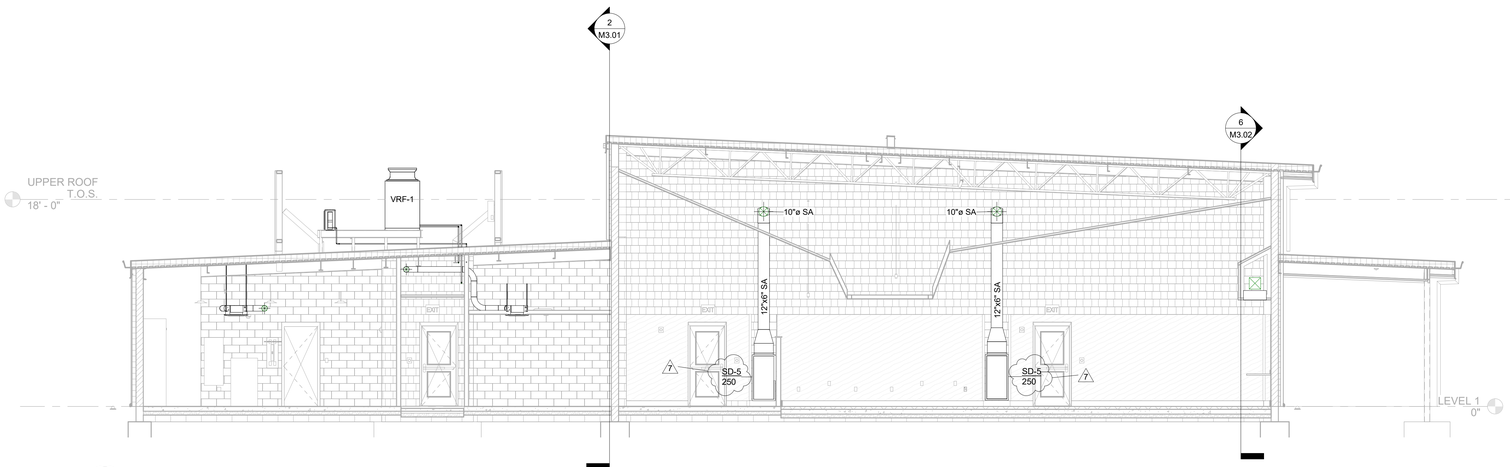
M1.01



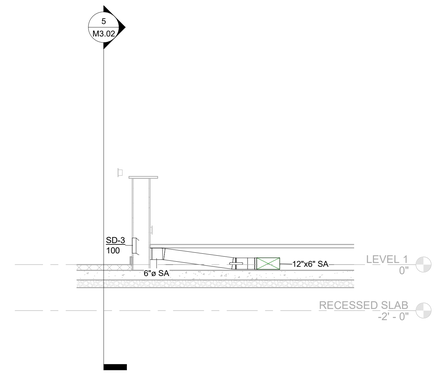
1 WEST WALL
3/16" = 1'-0"



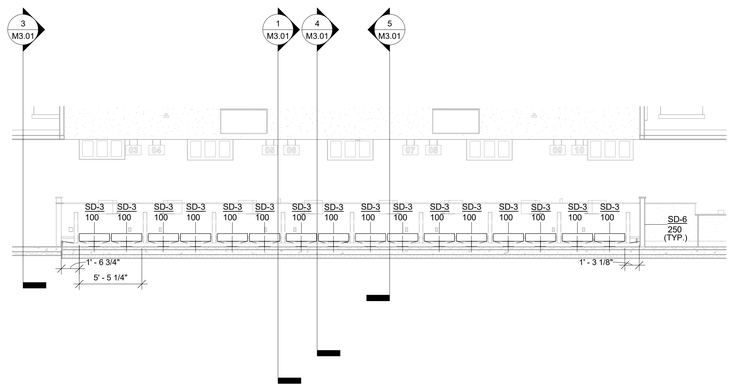
2 BRANCH CONTROLER
N.T.S



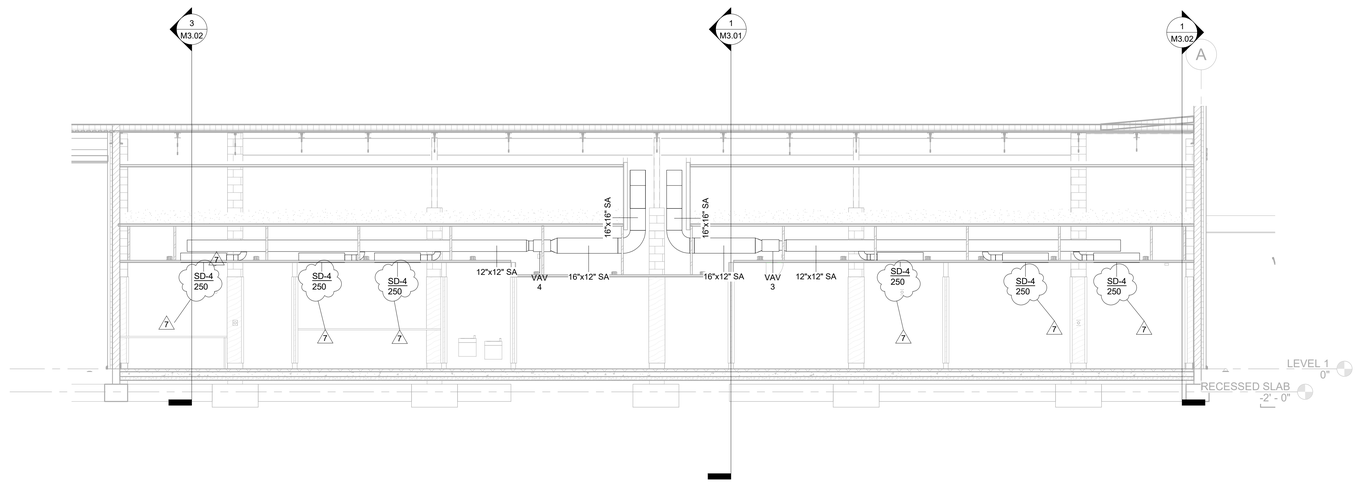
3 EAST WALL
3/16" = 1'-0"



4 SECTION COUNTER VIEW
3/8" = 1'-0"



5 FRONT VIEW AT COUNTER
3/16" = 1'-0"



6 SOUTH WALL
3/16" = 1'-0"

IDENTIFICATION STAMP
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APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
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AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL APPROVED FIRE AND PANIC ONLY

12/07/21
20-1059

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SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV

448 DOVER PARKWAY, DELANO, CA

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REGISTERED PROFESSIONAL ENGINEER
SHANE E. RUSSELL
No. 33415
EXP. JUNE 2024
MECHANICAL
STATE OF CALIFORNIA
12 JAN 2023

AECOM
CONSULTANT

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REGISTERED ARCHITECT
MICHAEL J. PARKINSON
No. C-27624
Dec 31, 2023
STATE OF CALIFORNIA
ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADI 005	01/13/23

DATE 01/13/2023

JOB NO. DGS 140724

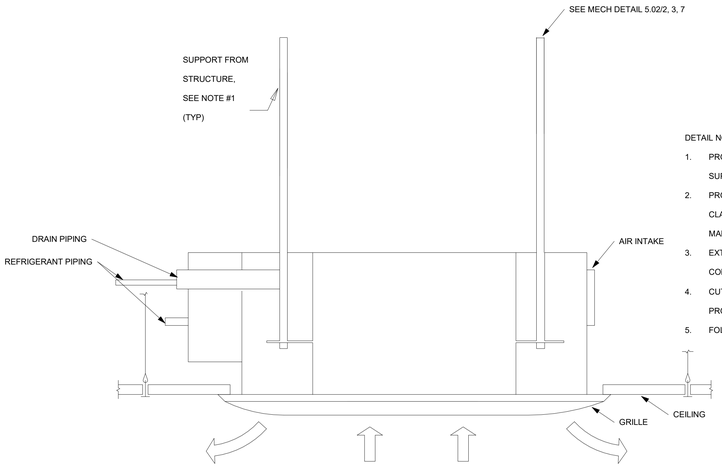
SHEET TITLE

MECHANICAL SECTIONS

SHEET NO.

M3.02

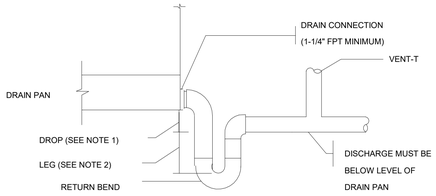
ONE INCH = TWENTY FEET
ONE-HALF INCH = ONE FOOT
THREE-QUARTERS INCH = ONE FOOT
ONE AND ONE-HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE-QUARTER INCH = ONE FOOT
ONE-EIGHTH INCH = ONE FOOT
ONE-SIXTEENTH INCH = ONE FOOT



DETAIL NOTES :

1. PROVIDE THREADED ROD AND RESTAINED SPRING ISOLATORS TO SUPPORT UNIT.
2. PROVIDE UNI-STRUT (OR SIMILAR) TRAPEZE HANGERS AND PIPE CLAMPS. INSTALL PIPEWORK IN A NEAT AND WORKMANLIKE MANNER. RUN PARALLEL TO BUILDING STRUCTURE.
3. EXTEND REFRIGERANT LINE SETS TO ASSOCIATED BRANCH CIRCUIT CONTROLLER.
4. CUT/PATCH FOR INSTALLATION OF CEILING-MOUNTED UNITS. PROVIDE ADDITIONAL GRID-TEE AS REQUIRED.
5. FOLLOW MANUFACTURER IOM GUIDANGE TO SUPPORT.

1 CASSETTE
N.T.S



NOTES

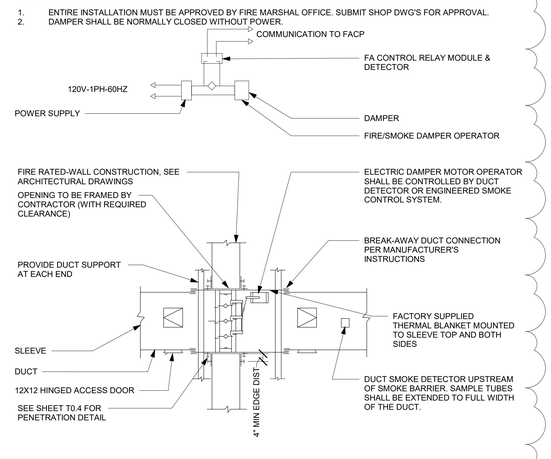
1. MIN. DROP REQUIRED USE OF STANDARD FITTINGS SHOWN EXCEEDS THIS MINIMUM.
2. X/2 + 1" = LEG FOR DRAW THRU UNIT WHERE X=NEGATIVE STATIC PRESSURE AT FAN INLET. (MIN 5")
3. ADD STRUCTURAL STEEL TO RAISE THE BOTTOM OF THE UNIT TO ACCOMMODATE TRAP HEIGHT.
4. PITCH DRAIN FOR PROPER RUN-OFF AND DISCHARGE TO APPROVED RECEPTABLE.
5. SUPPORT DRAIN LINES TO PREVENT SAG AND CONDENSATE OVERFLOW.
6. MANUALLY PRIME FILL TRAP BEFORE START-UP TO FORM INITIAL DRAIN SEAL.

PIPE SIZING CHART	
PIPE SIZE	MAX. COOLING LOAD
3/4"	2 TONS
1"	5 TONS
1-1/4"	30 TONS
1- 1/2"	50 TONS

2 CONDENSATE DRAIN PIPING FOR RTU
N.T.S

NOTES:

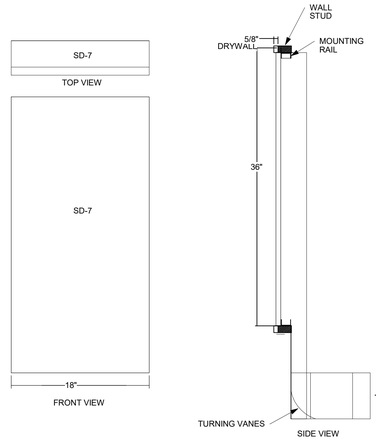
1. ENTIRE INSTALLATION MUST BE APPROVED BY FIRE MARSHAL OFFICE. SUBMIT SHOP DWG'S FOR APPROVAL.
2. DAMPER SHALL BE NORMALLY CLOSED WITHOUT POWER.

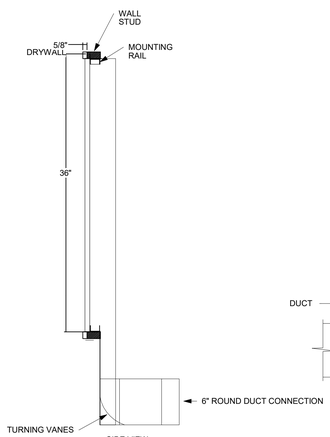


WHERE INSTALLATION DETAIL AND MANUFACTURER'S INSTALLATION INSTRUCTIONS CONFLICT, MFR'RS INSTRUCTIONS SHALL PREVAIL.

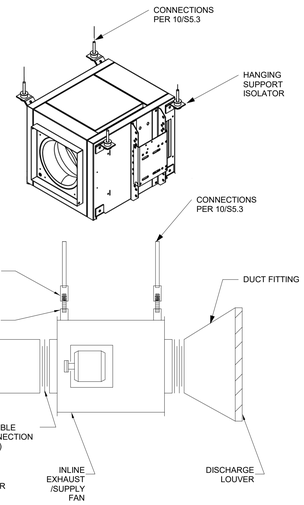
10 FIRE & SMOKE DAMPER
N.T.S

7

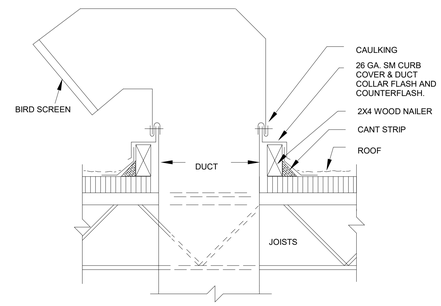




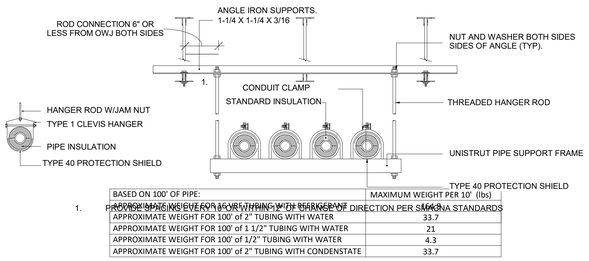
3 AFR DIFFUSER
N.T.S



4 INLINE EXHAUST FAN
N.T.S



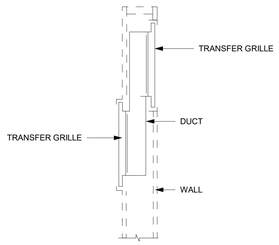
5 ROOF DUCT PENETRATION
N.T.S



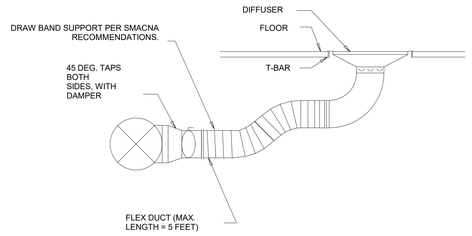
BASED ON 100' OF PIPE:	MAXIMUM WEIGHT PER 10' (lbs)
APPROXIMATE WEIGHT FOR 100' of 2" TUBING WITH WATER	33.7
APPROXIMATE WEIGHT FOR 100' of 1 1/2" TUBING WITH WATER	21
APPROXIMATE WEIGHT FOR 100' of 1/2" TUBING WITH WATER	4.3
APPROXIMATE WEIGHT FOR 100' of 2" TUBING WITH CONDENSTATE	33.7

1. PROVIDE SPACING EVENLY & ON WITHIN 15° OF ORANGE OF DIRECTION PER SMACNA STANDARDS

6 PIPE HANGER DETAIL
N.T.S



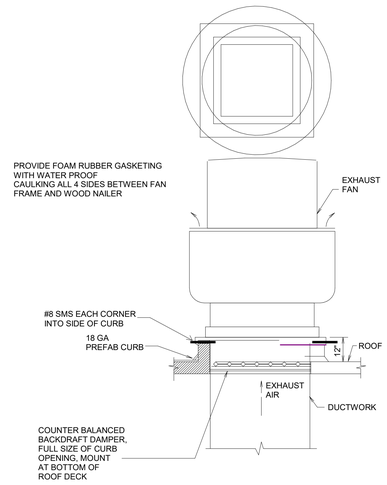
7 TRANSFER AIR GRILLE
N.T.S



NOTE:

1. INNER FLEXIBLE DUCT SHALL BE BANDED TO DUCT. INSULATION AND VAPOR BARRIER SHALL BE EXTENDED OVER DUCT AND TAPED.
2. NO BENDS GREATER THAN 15 DEGS. PERMITTED IN FLEXIBLE DUCT.

8 FLEX DUCT TO UNDERFLOOR DIFFUSER
N.T.S



9 EXHAUST FAN MOUNTING DETAIL
N.T.S

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL APPROVED FIRE AND PANIC ONLY

12/07/21
20-1059

Approval of this plan does not authorize or approve any omission or deviation from applicable requirements. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV
448 DOVER PARKWAY, DELANO, CA

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REGISTERED PROFESSIONAL ENGINEER
VISHAL KEDIA
No. 41124
EXP. SEPT 2024
MECHANICAL
STATE OF CALIFORNIA

AECOM
CONSULTANT

nacht&lewis
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Sacramento, CA 95811
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P 916.329.4000

REGISTERED ARCHITECT
MICHAEL J. PRIMEAU
No. C-27624
Dec 31, 2023
STATE OF CALIFORNIA

ARCHITECT

REVISIONS		
NO.	DESCRIPTION	DATE
7	ADI 005	01/13/23

DATE 01/13/2023

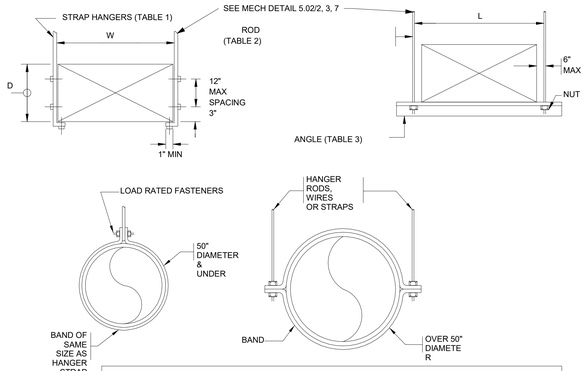
JOB NO. DGS 140724

SHEET TITLE

MECHANICAL DETAILS

SHEET NO.

M5.01



SMACNA ROUND DUCT HANGERS (MINIMUM SIZE)

DIA.	MAXIMUM SPACING	WIRE DIA.	ROD	STRAP
10" DN.	12'	ONE 12 ga.	1/4"	1"X22 ga.
11-18"	12'	TWO 12 ga. OR ONE 8 ga.	1/4"	1"X22 ga.
19-24"	12'	TWO 10 ga.	1/4"	1"X22 ga.
25-36"	12'	TWO 8 ga.	3/8"	1"X20 ga.
37-50"	12'	〃	TWO 3/8"	TWO 1"X20 ga.
51-60"	12'	〃	TWO 3/8"	TWO 1"X18 ga.
61-84"	12'	〃	TWO 3/8"	TWO 1"X16 ga.

NOTES:

1. STRAPS ARE GALVANIZED STEEL; RODS ARE UNCOATED OR GALVANIZED STEEL; WIRE IS BLACK ANNEALED, BRIGHT BASIC OR GALVANIZED STEEL. ALL ARE ALTERNATIVES.
2. TABLE ALLOWS FOR CONVENTIONAL WALL THICKNESS, AND JOINT SYSTEMS PLUS ONE lb./SF OF INSULATION WEIGHT. IF HEAVIER DUCTS ARE TO BE INSTALLED. ADJUST HANGER SIZES TO BE WITHIN THEIR LOAD LIMITS.
3. DESIGNERS: FOR INDUSTRIAL GRADE SUPPORTS, INCLUDING SADDLES, SINGLE POINT TRAPEZE LOADS, LONGER SPANS AND FLANGED JOINT LOADS, SEE SMACNA'S ROUND INDUSTRIAL DUCT CONSTRUCTION STANDARDS.

1 DUCT HANGERS
N.T.S

SMACNA RECTANGULAR DUCT HANGERS (MINIMUM SIZE)

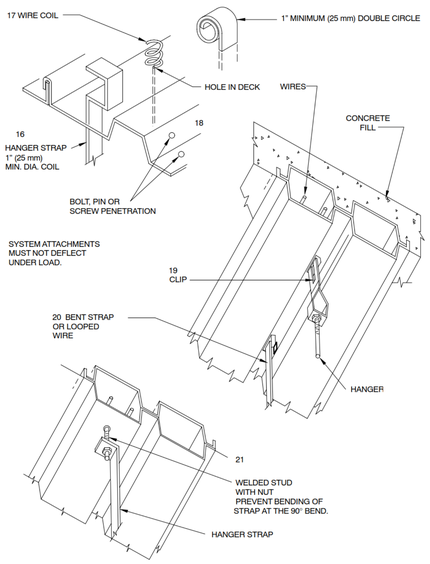
MAXIMUM HALF OF DUCT PERIMETER	PAIR AT 10 FT. SPACING	PAIR AT 8 FT. SPACING	PAIR AT 5 FT. SPACING	PAIR AT 4 FT. SPACING	
	STRAP	WIRE/ STRAP ROD	WIRE/ STRAP ROD	WIRE/ STRAP ROD	WIRE/ ROD
P/2 = 30"	1"x22 ga.	10 ga. (.135") 1"x22 ga.	10 ga. (.135") 1"x22 ga.	12 ga. (.106") 1"x22 ga.	12 ga. (.106")
P/2 = 72"	1"x18 ga.	3/8" 1"x20 ga.	1/4" 1"x22 ga.	1/4" 1"x22 ga.	1/4"
P/2 = 96"	1"x16 ga.	3/8" 1"x18 ga.	3/8" 1"x20 ga.	3/8" 1"x22 ga.	1/4"
P/2 = 120"	1-1/2"X16 ga.	1/2" 1"x16 ga.	3/8" 1"x18 ga.	3/8" 1"x20 ga.	1/4"
P/2 = 168"	1-1/2"X16 ga.	1/2" 1-1/2"X16 ga.	1/2" 1"X16 ga.	3/8" 1"X18 ga.	3/8"
P/2 = 192"		1/2" 1-1/2"X16 ga.	1/2" 1"X16 ga.	3/8" 1"X16 ga.	3/8"
P/2 = 193 UP	SPECIAL ANALYSIS REQUIRED				

WHEN STRAPS ARE LAP JOINTED USE THESE MINIMUM FASTENERS:	SINGLE HANGER MAXIMUM ALLOWABLE LOAD	
	STRAP	WIRE OR ROD (DIA.)
1"X18,20,22 ga. - TWO #10 OR ONE 1/4" BOLT	1"x22 ga. - 260 lbs.	0.106" - 80 lbs.
1"X16 ga. - TWO 1/4" DIA.	1"x20 ga. - 320 lbs.	0.135" - 120 lbs.
1-1/2"X16 ga. - TWO 3/8" DIA.	1"x18 ga. - 420 lbs.	0.162" - 160 lbs.
PLACE FASTENERS IN SERIES, NOT SIDE BY SIDE.	1"x16 ga. - 700 lbs.	1/4" - 270 lbs.
	1-1/2"x16 ga. - 1100 lbs.	3/8" - 680 lbs.
		1/2" - 1250 lbs.
		5/8" - 2000 lbs.
		3/4" - 3000 lbs.

NOTES:

1. DIMENSIONS OTHER THAN GAUGE ARE IN INCHES.
2. TABLE ALLOWS FOR DUCT WEIGHT, 1lb./SF INSULATION WEIGHT AND NORMAL REINFORCEMENT AND TRAPEZE WEIGHT, BUT NO EXTERNAL LOADS!
3. FOR CUSTOM DESIGN OF HANGERS, DESIGNERS MAY CONSULT SMACNA'S RECTANGULAR INDUSTRIAL DUCT STANDARDS, THE AISI COLD FORMED STEEL DESIGN MANUAL AND THE AISI STEEL CONSTRUCTION MANUAL.
4. STRAPS ARE GALVANIZED STEEL; OTHER MATERIALS ARE UNCOATED STEEL.
5. ALLOWABLE LOADS FOR P/2 ASSUME THAT DUCTS ARE 16 ga. MAX., EXCEPT THAT WHEN MAXIMUM DUCT DIMENSION (W) IS OVER 60" THEN P/2 MAXIMUM IS 1.25W.
6. 12,10 OR 8 ga. WIRE IS STEEL OF BLACK ANNEALED, BRIGHT BASIC OR GALVANIZED TYPE.

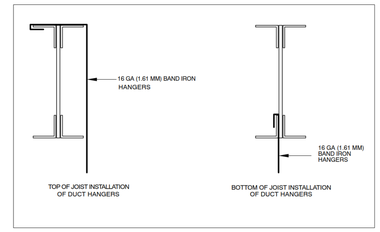
UNLESS OTHERWISE APPROVED ALLOWABLE LOAD ON UPPER ATTACHMENT IS 1/4 OF FAILURE LOAD.



AVOID PENETRATION OF ELECTRICAL ENCLOSURES

SOURCED FROM SMACNA: HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE.
FIGURE 5-4 UPPER ATTACHMENTS - TYPICAL

2 UPPER ATTACHMENTS - TYPICAL
N.T.S



SOURCED FROM SMACNA: HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE.
FIGURE 5-3 ALTERNATIVE JOIST ATTACHMENTS

3 ALTERNATE JOIST ATTACHMENTS
N.T.S

Bernards
1781 E Fir Avenue
Fresno, California 93720
P: (559) 420-7505
F: (559) 412-4744

Project: 1793 Delano DMV
448 Dover Parkway
Delano, California 93215

RFI #057: VRF FC Unit Seismic Bracing Clarification

Status	Closed on 01/12/23		
To	Matt King (Cumming Group) Jeffrey Janssen (Nacht & Lewis) Gordon Fong (AECOM)	**From**	Luis Ceja (Bernards) 1781 E Fir Avenue, Suite 205 Fresno, California 93720
Date Initiated	Jan 5, 2023	**Due Date**	Jan 25, 2023
Location		**Project Stage**	
Cost Impact		**Schedule Impact**	
Spec Section	23 81 29 - Variable-Refrigerant-Flow HVAC Systems	**Cost Code**	
Drawing Number	M5.02 / 10	**Reference**	
Linked Drawings	M5.02, M6.01		
Received From	Nick Barragan (Sheldon Mechanical Corp)		
Copies To	Ryan Beck (Department of General Services - Real Estate Service Division), Julie Bettencourt (Nacht & Lewis), Tim Brady (Bernards), Luis Ceja (Bernards), Charlie Her (Bernards), Jeffrey Janssen (Nacht & Lewis), Matt King (Cumming Group), Gabe Montoya (Bernards), Danette Smith (Department of General Services - Real Estate Service Division), Mike Smith (Nacht & Lewis)		

ADDITIONAL INFORMATION

Contract Number

Activity

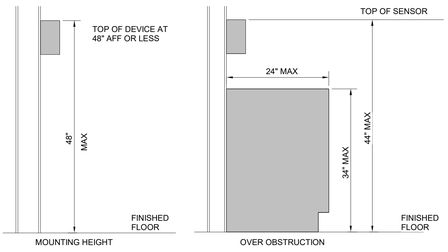
Question
Question from Luis Ceja Bernards *on Thursday, Jan 5, 2023 at 08:54 AM PST*
Ref: M5.02 / 10
Per mechanical sheet M5.02 detail 10, seismic bracing is only required for the EF, ERV, and BC. No seismic bracing is indicated for the VRF FC unit. Please advised if seismic bracing is required for the VRF FC Unit. Please see the attached documents for your reference.
Attachments
RFI 057 Attachments.pdf

Official Response
Response from Gordon Fong AECOM *on Monday, Jan 9, 2023 at 03:22 PM PST*
Seismic bracing per Detail 10/M5.02 is required for VRF Evaporators denoted by Mark **HP-18 and HP-16**. All other VRF Evaporators **do not** require seismic bracing.
Response for Shane Russell, P.E.

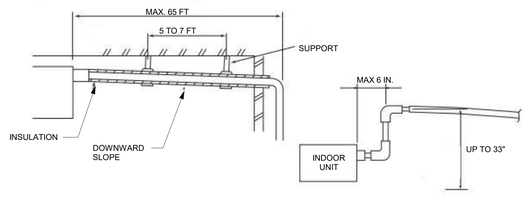
All Replies
Response from Gordon Fong AECOM *on Monday, Jan 9, 2023 at 03:22 PM PST*
Seismic bracing per Detail 10/M5.02 is required for VRF Evaporators denoted by Mark **HP-18 and HP-16**. All other VRF Evaporators **do not** require seismic bracing.
Response for Shane Russell, P.E.

Please review and advise Bernards, WITHIN 7 days, if there are any additional costs or schedule impacts associated with incorporating the RFI response with the Contract Work. If no response is received within 7 days, Bernards shall trust that there is no impact to your Contract Price or Schedule.

Bernards — Page 1 of 1 — Printed On: Feb 9, 2023 10:52 AM PST

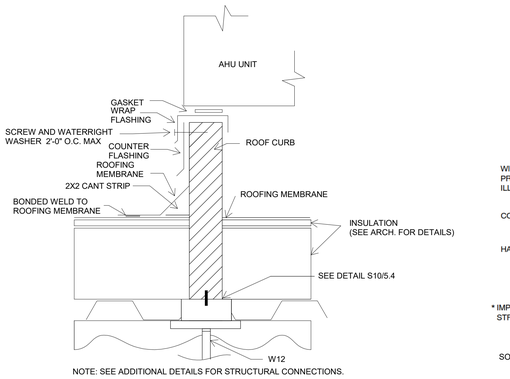


4 MECHANICAL SENSOR MOUNTING DETAIL
N.T.S



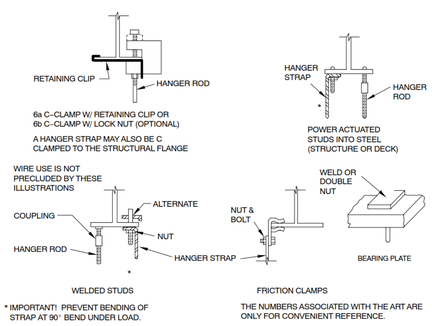
NOTE:
1. SEE MANUFACTURER INSTALLATION MANUAL FOR ADDITIONAL INSTALLATION GUIDLINES AND INSTRUCTIONS.

5 CASSETTE DRAIN PIPING
12" = 1'-0"



NOTE: SEE ADDITIONAL DETAILS FOR STRUCTURAL CONNECTIONS.

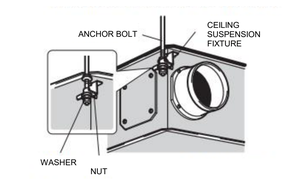
6 ROOF CURB FOR AHU UNIT
N.T.S



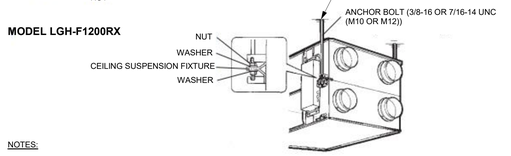
SOURCED FROM SMACNA: HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE.
FIGURE 5-2 UPPER ATTACHMENT DEVICES - TYPICAL

7 UPPER ATTACHMENTS DEVICES - TYPICAL
N.T.S

MODEL LGH-F1200RX

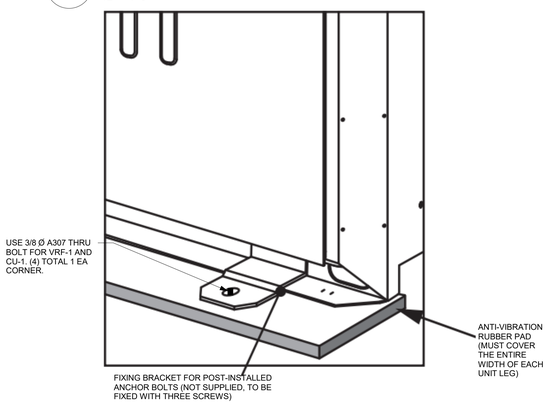


MODEL LGH-F1200RX

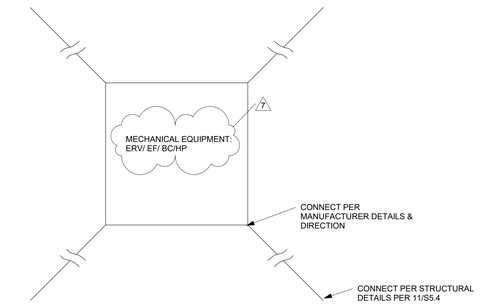


NOTES:
1. SEE MANUFACTURER INSTALLATION MANUAL FOR ADDITIONAL GUIDLINES AND INSTRUCTIONS.

8 ERV LOSSNAY MOUNTING DETAIL
N.T.S

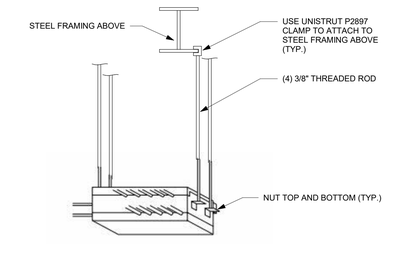


9 MOUNTING DETAIL VRF-1 AND CU-1
N.T.S



EQUIPMENT	EF (INLINE FAN)	ERV	BC
CABLE	1/8" Ø	1/8" Ø	1/8" Ø
MAX ANGLE FROM HORIZONTAL	45-60 DEGREES	45-60 DEGREES	45-60 DEGREES

10 SEISMIC BRACING WIRES
N.T.S



1. ENSURE A PULL OUT STRENGTH OF AT LEAST 133lbs PER BOLT FOR HANGING BOLTS.
2. BE SURE TO INSTALL BC CONTROLLERS LEVEL.
3. SEE MANUFACTURER DETAIL FOR ADDITIONAL INSTALLATION AND OPERATION GUIDLINES.

11 MOUNTING DETAIL BC-1
N.T.S

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL APPROVED FIRE AND PANIC ONLY
12/07/21
20-1059
Approval of this plan does not authorize or approve any omission or deviation from applicable requirements. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV
448 DOVER PARKWAY, DELANO, CA

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REGISTERED PROFESSIONAL ENGINEER
SHANE E. RUSSELL
No. 33415
EXP. JUNE 2024
MECHANICAL
STATE OF CALIFORNIA
12 JAN 2023

AECOM
CONSULTANT

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Sacramento, CA 95811
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REGISTERED ARCHITECT
MICHAEL J. PARKINSON
No. C-27624
Dec 31, 2023
STATE OF CALIFORNIA
ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADI 005	01/13/23

DATE 01/13/2023

JOB NO. DGS 140724

SHEET TITLE

MECHANICAL DETAILS

SHEET NO.

M5.02

OUTDOOR AIR HANDLER

MARK	MANUFACTURER	MODEL	NOMINAL TONNAGE	TOTAL CFM	OUTSIDE AIR				FAN DATA		COOLING COIL				HEATING CAPACITY	ELECTRICAL						SYSTEM REFRIGERANT	WEIGHT	LOCATION	NOTES
					AIRFLOW (CFM)	SUMMER TEMP		WINTER DB TEMP	FAN POWER (HP)	ESP (IN. WG)	SENSIBLE CAPACITY	TOTAL CAPACITY	ENTERING AIR			FLA	MCA	MCOP	VOLTS	PHASE	HZ	TYPE			
						DB	WB						DB	WB											
AHU-1	AAON	RN-018-3-0-EA0A34B	15	6170	1545 CFM	103 °F	70 °F	63 °F	3.4	1.0	170,000 Btu/h	180,900 Btu/h	80 °F	63 °F	150,000 Btu/h	45.0 A	48	60.0 A	208	3	60	R-410A	3091	ROOF	SIDE RETURN AND SUPPLY, MERV 13 FILTERS, SEE DETAIL M5.02/2, 6

VAV SCHEDULE

Mark	MANUFACTURER	MODEL	SIZE	SUPPLY CFM	MAX CFM	SERVICE AREA	CONTROLS SIDE	SCHEDULE NOTES
VAV 1	TITUS	DESV	7	500	650	ROOM 101, 102	LEFT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 2	TITUS	DESV	5	250	350	ROOM 103	RIGHT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 3	TITUS	DESV	8	750	900	ROOM 106	RIGHT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 4	TITUS	DESV	8	750	900	ROOM 106	LEFT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 5	TITUS	DESV	6	300	500	ROOM 109	RIGHT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 6	TITUS	DESV	14	2100	3000	ROOM 109	RIGHT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS
VAV 7	TITUS	DESV	6	300	500	ROOM 109	LEFT SIDE	INLET SIZED PER MANUFACTURE STANDARD, SINGLE DUCT VAV TERMINAL UNIT WITH CONTROLS

1. SEE DETAIL M5.02/2, 3, 7

FIRE & SMOKE DAMPER

MARK	COUNT	MODEL	SIZE	RATING
FSD-1	2	FSDR-25 - RUSKIN	6"ø-6"ø	1.5 HRS

7

AIR TERMINAL SCHEDULE

MARK	COUNT	BASICS OF DESIGN		SIZE	MAX FLOW	THROW	NOTES
		MANUFACTURER	MODEL				
ED-1	8	KRUEGER	5120	12"X12"	300 CFM	-	
RD-1	4	KRUEGER	EGC5	24"X24"	1500 CFM	-	
RD-2	1	KRUEGER	EGC5	12"X12"	300 CFM	-	
SD-1	4	KRUEGER	ASPD-12	12"X12"	250 CFM	4 WAY	
SD-2	12	KRUEGER	FDD	10"	50 CFM	4 WAY	SEE DETAIL M5.01/8
SD-3	16	KRUEGER	AFR	32"X8"	250 CFM	1-WAY	SEE DETAIL M5.01/3
SD-4	9	KRUEGER	AFH	24"X48"	250 CFM	4-WAY	
SD-5	3	KRUEGER	AFE	24"x47"	276 CFM	1-WAY	
SD-6	2	KRUEGER	AFR	18"x36"	250 CFM	1-WAY	
SD-7	1	KRUEGER	5880	24"X12"	250 CFM	4-WAY	SEE DETAIL M5.01/3
SD-8	1	KRUEGER	5885	12"X12"	290 CFM	4 WAY	
TG-1	8	KRUEGER	EGC5	12"X12"	775 CFM	-	SEE DETAIL M5.01/7

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VRF BRANCH CONTROLLER SCHEDULE

MARK	MANUFACTURER	MODEL	ELECTRICAL			WEIGHT	LOCATION	NOTES
			VOLTAGE	PHASE	MCA			
BC-1	MITSUBISHI ELECTRIC	CMB-P1016NU-HA1	208	1	1.3	138	ROOF	SEE DETAIL M5.02/10

VRF CONDENSING UNIT SCHEDULE

MARK	MANUFACTURER	MODEL	NOMINAL TONNAGE	COOLING CAPACITY	HEATING CAPACITY	ELECTRICAL			LOCATION	WEIGHT	NOTES
						VOLTAGE	PHASE	MCA			
VRF-1	MITSUBISHI ELECTRIC	PURY-P72TLMU-A	6	72000	80000	208	3	24	ROOF	444	SEE DETAIL M5.02/9

DX CONDENSING UNIT

MARK	MANUFACTURER	MODEL	NOMINAL TONNAGE	COOLING CAPACITY	HEATING CAPACITY	ELECTRICAL			LOCATION	WEIGHT	NOTES
						VOLTAGE	PHASE	MCA			
CU-1	MITSUBISHI ELECTRIC	PUY-A12NKA7(-BS)	1	12000	0	208	1	11	ROOF	92	SEE DETAIL M5.02/9

VRF EVAPORATOR SCHEDULE

MARK	MANUFACTURER	MODEL	TYPE	SERVICE AREA (ROOM)	RL SIZE (IN)	RS SIZE (IN)	AIRFLOW (CFM)				COOLING (BTU/H)	HEATING (BTU/H)	ELECTRICAL			WEIGHT	NOTES
							OA	LOW	MEDIUM	HIGH			VOLTAGE	PHASE	MCA		
HP-1	Mitsubishi Electric	PKFY-P06NBMU-E	WALL MOUNT	ROOM-116 JANITOR	1/4	1/2	50	170	190	210	6000	6700	208	1	0.19	22	1, 3
HP-2	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-114 CONTROL	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-3	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-115 SEC. STORAGE	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-4	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-113 TURN-IN	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-5	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-112 FIRST AID/LAC.	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-6	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-111 COMM.	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-7	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-110 MATERIAL STG.	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-8	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-120 STAFF-W	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-9	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-121 STAFF-M	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-10	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-122 STORAGE	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-11	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-107 HR OFFICE	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-12	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-117A LOCKERS	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-13	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-125 CORRIDOR	1/4	1/2	100	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-14	MITSUBISHI ELECTRIC	PLFY-P05NFMU-E	CEILING CASSETTE	ROOM-124 ELECTRICAL	1/4	1/2	50	230	265	280	5000	5600	208	1	0.24	34.2	1, 3
HP-15	MITSUBISHI ELECTRIC	PLFY-EP12NEMU-E	CEILING CASSETTE	ROOM-118 EMPLOYEE ROOM	1/4	1/2	200	245	280	335	12000	13500	208	1	0.29	36.6	1, 3
HP-16	MITSUBISHI ELECTRIC	PLFY-EP12NEMU-E	CEILING CASSETTE	ROOM-119 MULTI-PURPOSE	1/4	1/2	225	245	280	335	12000	13500	208	1	0.29	36.6	1, 3
HP-17	Mitsubishi Electric	PKFY-P06NBMU-E	WALL MOUNT	ROOM-111 COMM.	1/4	1/2	50	170	190	210	6000	6700	208	1	0.19	22	2, 3

1. PROVIDE 3D-i-SEE SENSOR AT EACH CEILING CASSETTE.
2. REDUNDANT SYSTEM FOR COMM ROOM, SUBSYSTEM OF CU-1.
3. SEE DETAIL M5.01/1 AND M5.02/2, 3, 5,7

ERV SCHEDULE

MARK	MANUFACTURER	MODEL	AIRFLOW		ENTHALPY RECOVERY EFFICIENCY		LEAVING AIR TEMPERATURE			FAN MOTORS		ELECTRICAL			WEIGHT (LB)	LOCATION	SCHEDULE NOTES
			CFM	ESP	HEATING	COOLING	COOLING DB	COOLING WB	HEATING DB	QUANTITY	FAN HP	VOLTAGE	PHASE	MCA			
ERV-1	Mitsubishi Electric	LGH-F1200RXS-E	1175	0.2	68	56	81 °F	71 °F	64 °F	2	0.52	208 V	1	7 A	265	ROOF	MERV 13 FILTERS, SEE DETAIL M5.02/8, 10

EXHAUST FAN SCHEDULE

MARK	MANUFACTUER	Model	CFM	Count	ESP	Volts	Phase	HZ	MOTOR ENCLOSURE	WEIGHT (LB)	SERVICE AREA	UNIT LOCATION	COMMENTS
EF-1	Greenheck	CUE-090-VG	550	1	0.25	120	1	60	STEEL	37	ROOM 120 & 122 STAFF	ROOF	DIRECT DRIVE, UPBLAST, SEE DETAIL M5.01/9 AND M5.02/5
EF-2	Greenheck	SQ-100-VG	830	1	0.75	120	1	60	STEEL	69	ROOM - 104 JANITOR	ROOM 104	DIRECT DRIVE, INLINE, SEE DETAIL M5.01/4,10
EF-3	Greenheck	CUE-090-E	300	1	0.25	120	1	60	STEEL	31	ROOM - 118 EMPLY ROOM	ROOF	DIRECT DRIVE, UPBLAST, SEE DETAIL M5.01/9 AND M5.02/5
EF-4	Greenheck	CUE-090-VG	200	1	0.25	120	1	60	STEEL	37	ROOM - 116 JANITOR	ROOF	DIRECT DRIVE, UPBLAST, SEE DETAIL M5.01/9 AND M5.02/5

AIR BALANCE SCHEDULE

UNIT TAG	LOCATION	SUPPLY CFM	RETURN CFM	MINIMUM OSA	EXHAUST CFM	NET POSITIVE/NEG CFM
HP 1-17	FRONT OF HOUSE	1225	1200	1225	1020	205
AHU-1	BACK OF HOUSE	6170	4625	1545	830	715
TOTAL		7395	5825	2770	1850	920
					BUILDING IS POSITIVE BY	**920**

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL APPROVED FIRE AND PANIC ONLY

12/07/21
20-1059

Approval of this plan does not authorize or approve any omission or deviation from applicable requirements. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

SFM APPROVAL

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES- DMV
448 DOVER PARKWAY, DELANO, CA

CALIFORNIA DEPARTMENT OF GENERAL SERVICES

REGISTERED PROFESSIONAL ENGINEER
SHANE E. RUSSELL
No. 33415
EXP. JUNE 2024
MECHANICAL
STATE OF CALIFORNIA
12 JAN 2023

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No. C-27624
Dec 31, 2023
ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADI 005	01/13/23

DATE 01/13/2023
JOB NO. DGS 140724
SHEET TITLE

MECHANICAL SCHEDULES

SHEET NO.

M6.01

ONE INCH = TWENTY FEET
ONE - SIXTEENTH INCH = ONE FOOT
ONE - EIGHTH INCH = ONE FOOT
ONE - QUARTER INCH = ONE FOOT
ONE - HALF INCH = ONE FOOT
THREE - QUARTERS INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE AND ONE - HALF INCH = ONE FOOT

ABBREVIATIONS:

#	NUMBER
AC	ALTERNATING CURRENT
ADN	AREA DISTRIBUTION NODE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLER UNIT
AIC	AMPS INTERRUPTING CURRENT
ALIS	AUTONOMIC LOGISTICS INFORMATION SYSTEM
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AV	AUDIO VISUAL
AWG	AMERICAN WIRE GAUGE
BFC	BELOW FINISHED CEILING
BFF	BELOW FINISHED FLOOR
BFG	BELOW FINISHED GRADE
C	CONDUIT
CEC	CALIFORNIA ELECTRICAL CODE
CCTV	CLOSED CIRCUIT TELEVISION
CAT	CATEGORY
CH	CHILLER
CHWP	CHILLED WATER PUMP
CKT	CIRCUIT
CO	CONDUIT ONLY
COMM	COMMUNICATIONS (TELECOMM)
CRAC	COMPUTER ROOM AIR CONDITIONER
CRI	COLOR RENDITION INDEX
CT	CONDENSER TOWER
CT	CURRENT TRANSFORMER
CU	COPPER
CWP	CONDENSER WATER PUMP
DC	DIRECT CURRENT
DISC	DISCONNECT
(E)	EXISTING
ECC	EMERGENCY COMMUNICATIONS CENTER
EF	EXHAUST FAN
ELEC	ELECTRICAL
EM	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
EPO	EMERGENCY POWER OFF
EUG	ELECTRICAL UNDERGROUND
EVAC	FIRE ALARM EVACUATION CONTROL
EVC	EVAPORATIVE COOLER
(F)	FUTURE
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FATC	FIRE ALARM TERMINATION CABINET
FLA	FULL LOAD AMPS
FLEX	FLEXIBLE METAL CONDUIT
FLMC	LIQUIDTIGHT METALLIC CONDUIT
FO	FIBER OPTIC
G, GND	GROUND
GA	GAUGE
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GRC	GALVANIZED RIGID CONDUIT
HP	HORSE POWER
HID	HIGH INTENSITY DISCHARGE
HVAC	HEATING, VENTILATING & AIR CONDITIONING
HWP	HOT WATER PUMP
IDF	INTERMEDIATE DISTRIBUTION FRAME
IES	INTERNATIONAL ELECTROTECHNICAL STANDARDS
IG	ISOLATED GROUND
INF	INFORMATION
ISP	INSIDE PLANT
ITE	INFORMATION TECHNOLOGY EQUIPMENT
JB	JUNCTION BOX
KVA	KILOVOLT AMPS
LCP	LIGHTING CONTROL PANEL
LED	LIGHT EMITTING DIODE
LV	LOW VOLTAGE
MC	METAL CLAD
MDC	MODULAR DATA CENTER
MDP	MAIN DISTRIBUTION PANEL
MDP	MODULAR DEVICE PANEL
MM	MILLIMETER
MTD	MOUNTED
(N)	NEW
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
N.I.E.S.	NOT IN ELECTRICAL SCOPE
NIPR	NON-CLASSIFIED INFORMATION PROTOCOL ROUTER
N.O.	NORMALLY OPEN
NTS	NOT TO SCALE
OTS	OPEN TO STRUCTURE
PH, ∅	PHASE
PA	PUBLIC ADDRESS SYSTEM
PB	PULL BOX
PDU	POWER DISTRIBUTION UNIT
POP	POST OFFICE PROTOCOL
(R)	REMOVE
RAH	RETURN AIR HANDLER
RF	RADIO FREQUENCY
RFP	REQUEST FOR PROPOSAL
RM	ROOM
RNG	RANDOM NUMBER GENERATOR
RSC	RIGID STEEL CONDUIT
SAH	SUPPLY AIR HANDLER
SAN	STORAGE AREA NETWORK
SEC	SECURITY
SCE	SOUTHERN CALIFORNIA EDISON (UTILITY COMPANY)
SF	SUPPLY FAN
SFD	SMOKE/FIRE DAMPER
SM	SINGLE MODE
SPD	SURGE PROTECTIVE DEVICE
TEL	TELEPHONE
THRU	THROUGH
TMGB	TELECOM MAIN GROUND BUS
TTB	TELECOM TERMINAL BOARD
TX	TRANSFORMER
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
TYP	TYPICAL
UFC	UNIFORM FIRE CODE
UFER	A CONCRETE ENCASED GROUND ELECTRODE METHOD
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORY
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLT
VA	VOLTAMPERES
VDC	VOLTS DIRECT CURRENT
VFD	VARIABLE FREQUENCY DRIVE
WP	WEATHERPROOF
XFMR	TRANSFORMER
XP	EXPLOSIONPROOF

GENERAL NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR ROOM NAME LIST.
2. THE ELECTRICAL SPECIFICATIONS ARE AN INTEGRAL PART OF THE ELECTRICAL CONSTRUCTION DOCUMENTS. THE CONTRACTOR SHALL THOROUGHLY REVIEW ALL INFORMATION PROVIDED IN BOTH THESE DRAWINGS AND THE ASSOCIATED ELECTRICAL SPECIFICATIONS PRIOR TO PREPARING A BID FOR THE ELECTRICAL WORK AND SHALL AFFIRM HAVING DONE SO BY THE SUBMISSION OF A BID FOR STATED WORK.
3. FURNISH AND INSTALL ALL NECESSARY LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED TO INSTALL COMPLETE AND OPERATIONAL ELECTRICAL SYSTEMS ACCORDING TO THE INTENT OF THESE DRAWINGS AND ASSOCIATED SPECIFICATIONS WHETHER ITEMIZED OR NOT.
4. REFER TO THE MECHANICAL DRAWINGS FOR EQUIPMENT AND PROVIDE STARTERS, CIRCUIT BREAKERS,SWITCHES, PUSH BUTTONS AND AUXILIARY DEVICES AS REQUIRED. MAKE ALL ELECTRICAL CONNECTIONS TO PLACE THE EQUIPMENT IN COMPLETE OPERATION.
5. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY EXISTING AND LOCAL CONDITIONS PRIOR TO THE BEGINNING OF ANY WORK. CONTRACTOR SHALL HAVE MADE ALLOWANCE THEREFORE IN PREPARING HIS PROPOSAL. INSPECTING PREVIOUSLY INSTALLED WORK IN ANTICIPATION OF SUBSEQUENT WORK. FAILURE TO VISIT THE SITE SHALL IN NO WAY RELIEVE THE CONTRACTOR FROM ANY RESPONSIBILITY.
6. THE ELECTRICAL DRAWINGS ARE DIAGRAMMATIC AND THE LOCATION OF THE ELECTRICAL DEVICES SHALL BE COORDINATED WITH THE ARCHITECT.
7. IN THE EVENT OF DISCREPANCIES BETWEEN SPECIFICATIONS AND THE DRAWINGS, THE ELECTRICAL CONTRACTOR SHALL BID NEW CONDITIONS, WIRES AND NECESSARY EQUIPMENT IN ORDER TO COMPLETE THE JOB AND PROVIDE A FULLY OPERABLE AND ACCEPTABLE SYSTEM. EXTRAS WILL NOT BE ALLOWED FOR WORK NOT INDICATED OR NOTED ON THE DRAWINGS.
8. ELECTRICAL WORK SHALL COMPLY WITH THE 2019 EDITIONS OF THE CALIFORNIA ELECTRICAL CODE AND ALL APPLICABLE DGS STANDARDS.
9. FIRE SEAL AROUND ALL CONDUIT PENETRATIONS THROUGH FIRE BARRIERS WITH AN APPROVED FIRE SEALANT EQUAL TO THE RATING OF THE SURFACE PENETRATED. FIRE SEAL INSIDE OF CONDUIT AFTER CONDUCTOR INSTALLATION. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATIONS OF FIRE RATED FLOORS AND WALLS.
10. RETURN TO OWNER, AT THEIR DISCRETION, ALL UNUSED ELECTRICAL EQUIPMENT (I.E. FIXTURES, PANELS, ETC).
11. THE TELECOMMUNICATIONS SPECIFICATIONS ARE AN INTEGRAL PART OF THE TELECOMMUNICATIONS CONSTRUCTION DOCUMENTS. THE CONTRACTOR SHALL THOROUGHLY REVIEW ALL INFORMATION PROVIDED IN BOTH THESE DRAWINGS AND THE ASSOCIATED TELECOMMUNICATIONS SPECIFICATIONS PRIOR TO PREPARING A BID FOR THE TELECOMMUNICATIONS WORK AND SHALL AFFIRM HAVING DONE SO BY THE SUBMISSION OF A BID FOR STATED WORK.
12. PROVIDE ALL NECESSARY LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED TO INSTALL COMPLETE AND OPERATIONAL TELECOMMUNICATIONS SYSTEMS ACCORDING TO THE INTENT OF THESE DRAWINGS AND ASSOCIATED SPECIFICATIONS WHETHER ITEMIZED OR NOT.
13. TELECOMMUNICATIONS WORK SHALL COMPLY WITH THE LATEST ENACTED EDITIONS OF BICSI STANDARDS.
14. FOR TELECOMMUNICATIONS PATCH PANELS AND FACEPLATES LABELING ADHERE TO THE DEPOT STANDARD.

ELECTRICAL LEGEND:

Symbol	Description
	2' x 2' LED FIXTURE. SHADING INDICATES EMERGENCY FIXTURES ON INVERTER POWER.
	LINEAR LED FIXTURE. SHADING INDICATES EMERGENCY FIXTURES ON INVERTER POWER.
	WALL MOUNTED LED EXTERIOR LIGHT FIXTURE.
X	EXIT SIGN WITH DIRECTIONAL ARROWS AS INDICATED, CEILING MOUNTING. SHADING INDICATES FACE DIRECTION.
	DOWNLIGHT LED FIXTURE. SHADING INDICATES EMERGENCY FIXTURES ON INVERTER POWER.
$ LV	LOW VOLTAGE ZONE ON/OFF SWITCH MOUNTED AT 42" AFF.
$ LVD	LOW VOLTAGE ZONE RAISE/LOWER AND ON/OFF DIMMER SWITCH MOUNTED AT 42" AFF.
$	SINGLE POLE WALL SWITCH MOUNTED AT 42" AFF.
OC D	WALL MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR AND DIMMING CONTROL
OC	LOW VOLTAGE CEILING MOUNTED 360° DUAL TECHNOLOGY OCCUPANCY SENSOR. DEVICE TO BE CAPABLE OF BOTH OCCUPANCY AND VACANCY. DEVICE TO BE SET TO OCCUPANCY. VERIFY LAYOUT WITH MANUFACTURER SPACING REQUIREMENTS.
PC	LOW VOLTAGE CEILING MOUNTED PHOTOCELL VERIFY LAYOUT WITH MANUFACTURER. p1 - SKYLIT DAYLIT ZONE s1 - PRIMARY SIDELIT DAYLIT ZONE s2 - SECONDARY SIDELIT DAYLIT ZONE
J	JUNCTION BOX, SIZE & TYPE AS INDICATED OR AS REQUIRED
	NEMA 6-30 R OUTLET
	20 AMP 125V 3W DUPLEX RECEPTACLE, @ +18" UON
IG	20 AMP 125V 3W DUPLEX RECEPTACLE, WITH IG (ISO GND)
	20 AMP 125V 3W DUPLEX RECEPTACLE WITH AFCI (ARC FAULT CIRCUIT INTERRUPTER) TYPE, @ +18" UON
	20 AMP 125V QUAD RECEPTACLE WITH AFCI (ARC FAULT CIRCUIT INTERRUPTER) TYPE, @ +18" UON
	20 AMP 125V QUAD RECEPTACLE, @ +18" UON
	FLUSH FLOOR BOX SERVICE FOR POWER AND TELECOM. SEE ALSO ASSOCIATED COMM & SECURITY PLAN DRAWING
	FLUSH FLOOR BOX SERVICE FOR POWER AND TELECOM. PROVIDE WITH HALF SWITCHED (CONTROLLED) QUAD REPECTACLE
G	20 AMP 120V DUPLEX RECEPTACLE, WITH GFCI, @ +18" UON
G/WP	20 AMP 120V DUPLEX RECEPTACLE, WEATHER-PROOF WITH GFCI, @ +18" UON
	RETRACTABLE CORD REEL WITH DUPLEX POWER RECEPTACLE
	COMBINATION BREAKER/STARTER, SIZE PER UNIT LABEL
	NON-FUSED DISCONNECT SWITCH, SIZE PER UNIT LABEL
F	FUSED DISCONNECT SWITCH, SIZE PER UNIT LABEL
	EQUIPMENT STARTER, SIZE PER UNIT LABEL
	HALF CONTROLLED DUPLEX RECEPTACLE, @ +18" UON
	HALF CONTROLLED QUAD RECEPTACLE, @ +18" UON
	HALF CONTROLLED DOUBLE DUPLEX FLOOR BOX WITH FLUSH MOUNTED DEVICE
EV	ELECTRIC VEHICLE CHARGING CONNECTION POINT
$M	MOTOR RATED SWITCH
	WALL STANDARD COMMUNICATION OUTLET
	FLOOR STANDARD COMMUNICATION OUTLET
TV	TELEVISION OUTLET
J WAP	WIRELESS COMMUNICATION OUTLET
	BASKET CABLE TRAY
	LADDER TYPE CABLE TRAY
	FIRE ALARM STROBE
	FIRE ALARM STROBE WITH HORN
FS	FLOW SWITCH
TS	TAMPER SWITCH
PS	PULL STATION
	EMERGENCY POWER OFF (EPO) BUTTON

7

Symbol	Description
	PUSH BUTTON SWITCH
5	MOTOR, N.I.E.S. CONNECT AS REQUIRED, NUMBER INDICATES HP
	PANELBOARD - SURFACE MOUNTED - SEE SCHEDULE
	PANELBOARD - FLUSH MOUNTED - SEE SCHEDULE
	MAIN SWITCHBOARD OR MOTOR CONTROL CENTER, SEE ONE LINE DIAGRAM
	CONDUIT CONCEALED IN CEILING OR WALL. BRANCH CIRCUIT WITHOUT FURTHER DESIGNATION INDICATES #12 AWG WIRE CIRCUIT AND 3/4" CONDUIT. ALL CONDUITS AND RACEWAY MUST HAVE ANINSULATED GROUND WIRE SIZED PER NEC 250.122.
	WIRE 'TICK MARKS' INDICATE: 2 #12 AWG + 1 #12 NEUTRAL + GND, UON. (GROUND WIRE NOT SHOWN, BUT REQUIRED FOR ALL CIRCUITS)
	HOMERUN TO RESPECTIVE PANEL OR TERMINAL CABINET - OVERHEAD
	HOMERUN TO RESPECTIVE PANEL OR TERMINAL CABINET - UNDERGROUND
	CONDUIT RISER - UP
	CONDUIT RISER - DOWN
	FLEXIBLE CONDUIT CONECTION
	CONDUIT RUN CONCEALED BELOW FLOOR OR FINISHED GRADE BRANCH CIRCUIT WITHOUT FURTHER DESIGNATION INDICATES #12 AWG WIRE CIRCUIT AND 3/4" CONDUIT. ALL CONDUITS AND RACEWAY MUST HAVE AN INSULATED GROUND WIRE SIZED PER NEC 250.122.
EF-1	INDICATES MECHANICAL, EQUIPMENT DESIGNATION TAG.SEE MECHANNICAL SCHEDULES FOR ADDITIONAL INFO. (EXAMPLE: EF-1 = EXHAUST FAN, - UNIT NO. 1)
A / EC-1	SECTION DESIGNATION; TOP LETTER INDICATES SECTION, BOTTOM LETTER/NUMBER INDICATES SHEET
2 / EC-1	DETAIL DESIGNATION; TOP NUMBER INDICATES DETAIL, BOTTOM LETTER/NUMBER INDICATES SHEET
	CALL OUT SHEET NOTE REFERENCE TAG
	GROUND ROD
	TESTING GROUND WELL WITH GROUND ROD
	EXOTHERMIC WELD CONNECTION
	TRANSFORMER, MOUNTING AS NOTED

SINGLE LINE LEGEND:

Symbol	Description
60B	INDICATES ELECTRICAL FEEDER SIZE. REFER TO FEEDER SCHEDULE.
3 XXAF / XXAT	CIRCUIT BREAKER. AMP SIZE AND POLES, AS INDICATED
	CURRENT TRANSFORMER
	CIRCUIT SWITCH, SINGLE BREAK
	FUSED BREAKER
	TERMINAL(S)
	DIESEL GENERATOR
	AUTOMATIC TRANSFER SWITCH
DM	ELECTRICAL METER WITH CURRENT TRANSFORMERS
	POTENTIAL TRANSFORMER
	FUSE
	VOLTAGE TRANSFORMER
	EARTH GROUND
	FEEDER
	EXISTING UNDERGROUND CONDUIT

NOTE:
SYMBOLS INDICATED ABOVE MAY NOT NECESSARILY APPEAR AS PART OF THESE DRAWINGS IF NOT REQUIRED.

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SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1
OFFICE OF THE STATE FIRE MARSHAL
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12/07/21
20-1059
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STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

LICENSED PROFESSIONAL ENGINEER
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E22311
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LICENSED ARCHITECT
MICHAEL J. PARROTT
No. C-27624
Dec 31, 2023
STATE OF CALIFORNIA

ARCHITECT

REVISIONS

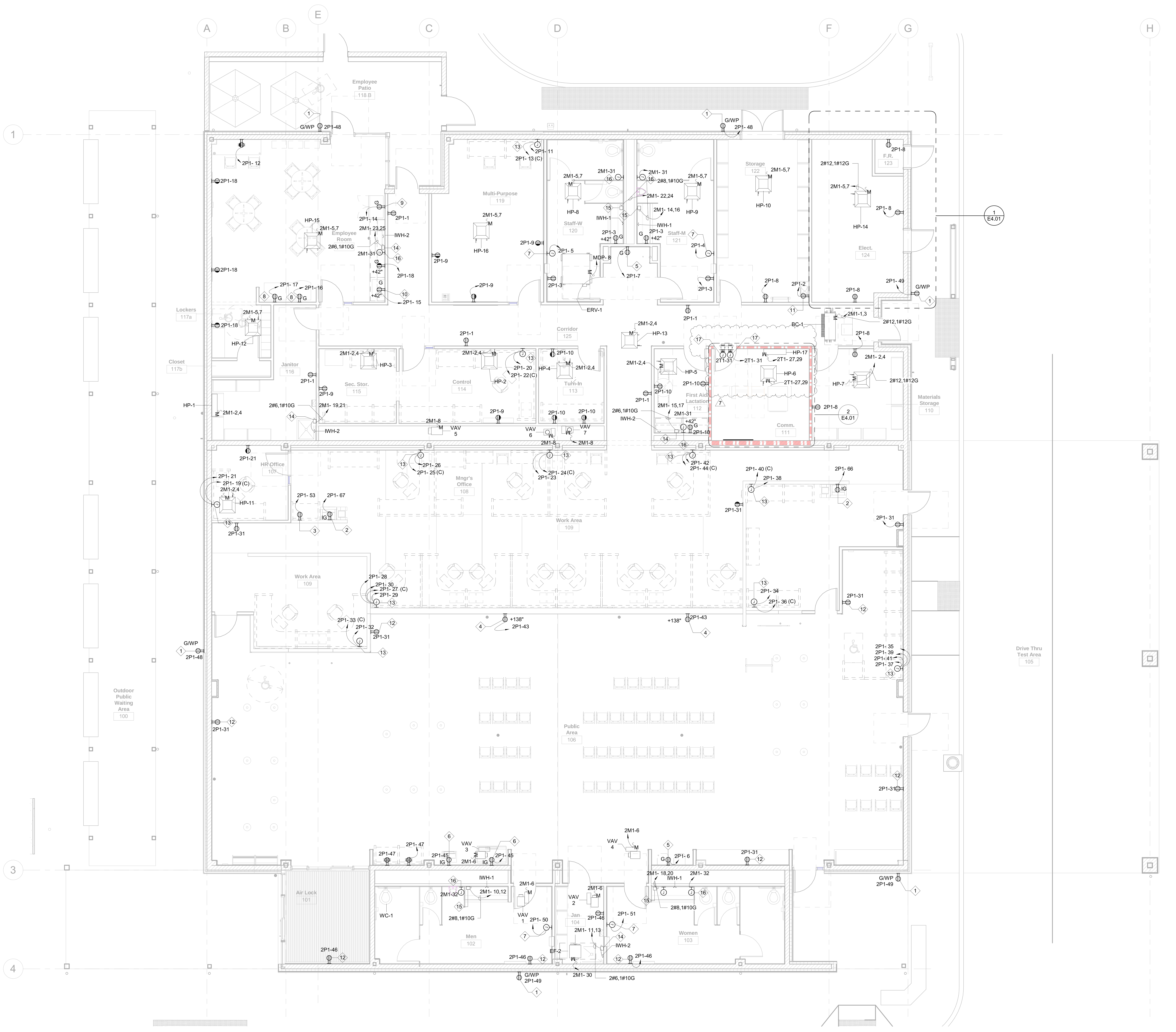
NO.	DESCRIPTION	DATE
7	ADI 005	01/13/2023

DATE 01/13/2023
JOB NO. DGS 140724
SHEET TITLE

ELECTRICAL LEGEND, NOTES AND ABBREVIATIONS

SHEET NO.

E0.01



ELECTRICAL POWER PLAN

1 ELECTRICAL POWER PLAN
3/16" = 1'-0"

GENERAL NOTES

1. ALL GENERAL RECEPTACLE AND LIGHTING CIRCUITS SHALL BE FED BY 20A BREAKERS MINIMUM.
2. RECEPTACLES ON OPPOSITE SIDES OF COMMON WALLS SHALL BE HORIZONTALLY OFFSET.
3. ALL CIRCUITS SHALL HAVE DEDICATED GROUND WIRES.
4. ALL CONDUITS SHALL BE 3/4"C MINIMUM.
5. PROVIDE PERMANENT LABEL TO EACH RECEPTACLE, SHOWING PANEL NAME AND CIRCUIT NUMBER USED FOR POWER SOURCE.
6. EACH CIRCUIT SHALL BE PROVIDED WITH ITS OWN DEDICATED NEUTRAL.
7. ALL EXTERIOR RECEPTACLES SHALL BE GFCI, WEATHER RESISTANT TYPE AND HAVE IN - USE WEATHER PROOF COVERS.
8. REFER TO SINGLE LINE DIAGRAM, PANEL SCHEUDLE, AND FLOOR PLANS FOR ADDITIONAL REQUIRMENT AND INFORMATION. COORDINATE WITH ARCHITECTURAL DRAWINGS.
9. ALL JUNCTION BOXES SHALL BE SIZED PER NEC.
10. ALL CONDUITS SHALL BE CONCEALED IN WALLS OR ABOVE CEILING.
11. ALL MOTOR RATED SWITCHES AND DISCONNECTS MUST BE READILY ACCESSIBLE.
12. ALL MOTOR RATED SWITCHES AND DISCONNECTS SERVING MECHANICAL EQUIPMENT TO BE MOUNTED AT SAME ELEVATION AS THE UNIT IT SERVES. COORDINATE ELEVATIONS AND LOCATIONS WITH MECHANICAL PLANS.
13. ALL EXTERIOR EQUIPMENT SHALL BE NEMA 3R WET LISTED SUITIBLE FOR INSTALLATION LOCATION, UNLESS OTHERWISE NOTED.
14. PERMANENT AND DURABLE MARKING FOR CONTROLLED RECEPTACLES OR CIRCUITS TO DIFFERENTIATE THEM FROM UNCONTROLLED RECEPTACLES OR CIRCUITS SHALL BE PROVIDED TO MEET SECTION 130.5(D)(3) OF THE CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS.
15. AUTOMATIC CONTROLLED RECEPTACLES IN WORK AREA SHALL BE CONTROLLED BY BUILDING AUTOMATIC SYSTEM TIME OF DAY SCHEDULE.
16. PROVIDE STEEL KEYED LOCKABLE COVER PLATES ON ALL EXTERIOR RECEPTACLES.
17. ALL BOXES AND CONDUIT INSTALLED IN FIRE-RATED WALLS SHALL BE FIRE SEALED AS REQUIRED TO MAINTAIN THE PARTITION'S FIRE RATING.

7

KEYNOTES

KEY	DESCRIPTION
1	PROVIDE GFCI WEATHER RESISTANT TYPE RECEPTACLE WITH WHILE IN USE WEATHER PROOF COVER.
2	PROVIDE POWER AS REQUIRED FOR COPIER. INSTALL (1) DEDICATED NEMA 5-20R DUPLEX OUTLET, 120V, 20A, 60HZ, SINGLE PHASE, 3-WIRE, PARALLEL BLADE, WITH ISOLATED GROUND. VERIFY LOCATION PRIOR TO ROUGH IN.
3	PROVIDE POWER AS REQUIRED FOR MAIL MACHINE. VERIFY LOCATION PRIOR TO ROUGH IN.
4	PROVIDE POWER AS REQUIRED FOR TV. VERIFY LOCATION PRIOR TO ROUGH IN.
5	PROVIDE POWER AS REQUIRED FOR DRINKING FOUNTAIN. VERIFY LOCATION PRIOR TO ROUGH IN.
6	PROVIDE POWER AS REQUIRED FOR SELF SERVICE KIOSK. INSTALL (1) DEDICATED NEMA 5-20R DUPLEX OUTLET, 120V, 20A, 60HZ, SINGLE PHASE, 3-WIRE, PARALLEL BLADE, WITH ISOLATED GROUND, LABEL AS "DSST". VERIFY LOCATION PRIOR TO ROUGH IN.
7	PROVIDE POWER AS REQUIRED FOR HAND DRYER. VERIFY LOCATION PRIOR TO ROUGH IN.
8	PROVIDE POWER AS REQUIRED FOR VENDING MACHINE. VERIFY LOCATION PRIOR TO ROUGH IN.
9	PROVIDE POWER AS REQUIRED FOR REFRIGERATOR. VERIFY LOCATION PRIOR TO ROUGH IN.
10	PROVIDE POWER AS REQUIRED FOR MICROWAVE. VERIFY LOCATION PRIOR TO ROUGH IN.
11	PROVIDE POWER AS REQUIRED FOR SHREDDER. VERIFY LOCATION PRIOR TO ROUGH IN.
12	PROVIDE CONVENIENCE RECEPTACLE WITH LOCKABLE COVER.
13	WALL MOUNTED JUNCTION BOXES FOR POWER CONNECTION TO MODULAR FURNITURE SYSTEM. COORDINATE EXACT LOCATION IN THE FIELD WITH FURNITURE VENDOR AND PROVIDE NEW CONDUIT, WIRE, ETC. AS NEEDED TO ACCOMMODATE THE NEW LAYOUT. CIRCUIT MARKED WITH "C" TO BE CONTROLLED VIA LOCAL OCCUPANCY SENSOR. REFER TO DETAIL #8 ON SHEET E8.01 FOR MODULAR FURNITURE WIRING.
14	PROVIDE 60A TOGGLE DISCONNECT SWITCH UNDERNEATH SINK AND CONNECTION TO INSTANTANEOUS WATER HEATER. COORDINATE EXACT LOCATION WITH PLUMBING CONTRACTOR PRIOR TO INSTALLATION.
15	PROVIDE 40A TOGGLE DISCONNECT SWITCH UNDERNEATH SINK AND CONNECTION TO INSTANTANEOUS WATER HEATER. COORDINATE EXACT LOCATION WITH PLUMBING CONTRACTOR PRIOR TO INSTALLATION.
16	PROVIDE POWER AS REQUIRED FOR HARD WIRED FLUSH VALVES.
17	PROVIDE 120V POWER AND CONNECTION TO FIRE SMOKE DAMPERS (FSDs). PROVIDE CONNECTION TO THE IT ROOM'S SMOKE DETECTOR TO SIGNAL THE DAMPERS TO CLOSE IN ACCORDANCE WITH NEC 645.4(2)b.3. COORDINATE FINAL LOCATION AND CONNECTIONS WITH THE MECHANICAL AND FIRE ALARM CONTRACTORS.

7

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SHEET TITLE

ELECTRICAL POWER PLAN

SHEET NO.

E1.02

2 ELECTRICAL LIGHTING PLAN

3/16" = 1'-0"

GENERAL NOTES

1. COORDINATE LOCATIONS OF ALL LIGHT FIXTURES AND DEVICES WITH ARCHITECTURAL PLANS AND ELEVATIONS PRIOR TO INSTALLATION.
2. PROVIDE FAIL-SAFE TYPE OCCUPANCY SENSORS WHERE LIGHTING WILL STAY "ON" IN THE EVENT OF SENSOR FAILURE.
3. ALL RECESSED LIGHT FIXTURES SHALL BE SUPPORTED INDEPENDENTLY OF THE SUSPENDED CEILING GRID. REFER TO LIGHTING FIXTURE FOR MOUNTING DETAILS.
4. THE LIGHTING CONTROL SYSTEM SHALL BE NETWORK BASED (nLIGHT ACUITY CONTROL OR APPROVED EQUAL). REFER TO DETAILS ON SHEET E8.02.
5. ACCEPTANCE TESTER SHALL BE PRESENT DURING COMMISSIONING. ALL LIGHTING FIXTURES AND DEVICES SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
6. LIGHT FIXTURES CONTROLLED BY OCCUPANCY SENSOR SHALL BE TURNED OFF WITHIN A MAXIMUM OF 20 MINUTES OF NOT DETECTING AN OCCUPANT.
7. ALL EMERGENCY LIGHTING SHALL BE PROVIDED WITH A UL924 RELAY TO OVERRIDE CONTROLS AND ALLOW FIXTURE TO GO FULL BRIGHT UPON NORMAL POWER LOSS.
8. PROVIDE UN-SWITCHED CONSTANT HOT FROM NORMAL POWER SOURCE TO ALL EXIT SIGNS AND ALL UL924 RELAYS TO SENSE NORMAL POWER LOSS.
9. IN THE EVENT OF POWER SUPPLY FAILURE AN EMERGENCY ELECTRICAL SYSTEM SHALL ILLUMINATE THE MEANS OF EGRESS SYSTEM FOR A DURATION OF NOT LESS 90 MINUTES IN ACCORDANCE WITH THE PROVISIONS SET FORTH IN CALIFORNIA BUILDING CODE 1008.3 & 1008.3.4.
10. APPROVED EXIT SIGNS SHALL BE LOCATED AS NECESSARY TO CLEARLY INDICATE THE DIRECTION OF EGRESS TRAVEL AS REQUIRED BY CALIFORNIA BUILDING CODE 1013.1; AND SHALL BE INTERNALLY OR EXTERNALLY ILLUMINATED AS REQUIRED BY SECTION 1013.3 IN ACCORDANCE WITH THE PROVISIONS SET FORTH IN SECTIONS 1013.5 AND NOTE: ADDITIONAL EXIT SIGNS MAY BE REQUIRED AT TIME OF FIELD INSPECTION.
11. ALL WALL MOUNTED OCCUPANCY SENSORS SHALL BE EQUIPPED WITH MANUAL ON/OFF SWITCH.
12. COORDINATE ALL LIGHTING CONTROL DEVICE LOCATIONS AND QUANTITIES WITH THE MANUFACTURER AND PROVIDE ALL COMPONENTS REQUIRED FOR A FULLY FUNCTIONAL LIGHTING CONTROL SYSTEM.
13. LIGHT FIXTURES ON THIS FLOOR SHALL BE CIRCUITED TO PANEL '2L1' UNLESS OTHERWISE NOTED. THE CIRCUIT NUMBER AND CONTROL ZONES ARE INDICATED ON THE PLAN.
14. EMERGENCY LIGHT FIXTURES (NOTED WITH 'EM') AND EXIT SIGN FIXTURES ON THIS FLOOR SHALL BE CIRCUITED TO INVERTER 'INV' UNLESS OTHERWISE NOTED.
15. ALL OUTDOOR LIGHTING SHALL BE CONTROLLED WITH A PHOTOCELL IN ADDITION TO AN AUTOMATIC TIME-SWITCH CONTROL, OR AN ASTRONOMICAL TIME-SWITCH CONTROL.OUTDOOR LIGHTING SHALL BE CONTROLLED BY EXTERIOR PHOTOCELL THAT AUTOMATICALLY TURNS OFF WHEN SUFFICIENT DAYLIGHT IS AVAILABLE.
16. LIGHT FIXTURES IN PUBLIC AREA, WORK AREA AND AIR LOCK ROOM SHALL BE CONTROLLED BY BUILDING AUTOMATIC SYSTEM TIME OF DAY SCHEDULE.
17. SEE LIGHT FIXTURE SCHEDULE ON SHEET E6.01 FOR FIXTURE TYPE DESCRIPTIONS AND INFORMATION.

KEYNOTES

KEY	DESCRIPTION
1	LIGHTING ABOVE TRANSLUCENT SOFFIT, REFER TO ARCHITECTURAL PLANS.
2	TO CONTROL LIGHTING FIXTURES ON ROOF.
3	PROVIDE LIGHT SWITCH WITH LOCKABLE COVER.

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ELECTRICAL LIGHTING PLAN

SHEET NO.

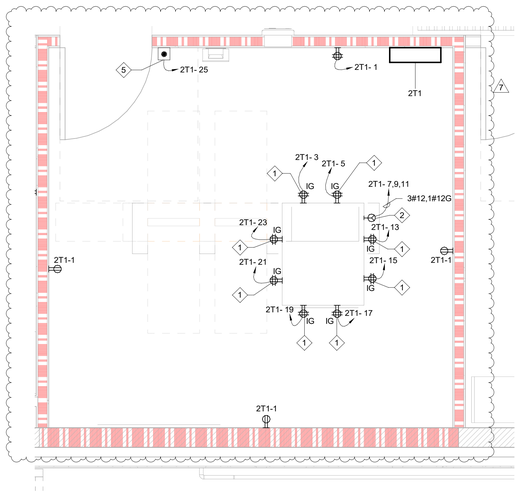
E2.01

ONE INCH = TWENTY FEET 0 5 10 20 40 60 80
ONE - SIXTEENTH INCH = ONE FOOT 0 4 8 16 32
ONE - EIGHTH INCH = ONE FOOT 0 4 8 16
ONE - QUARTER INCH = ONE FOOT 0 4 8
THREE - QUARTERS INCH = ONE FOOT 0 6 2
ONE INCH = ONE FOOT 0 6 1
ONE AND ONE - HALF INCH = ONE FOOT 0 6 1

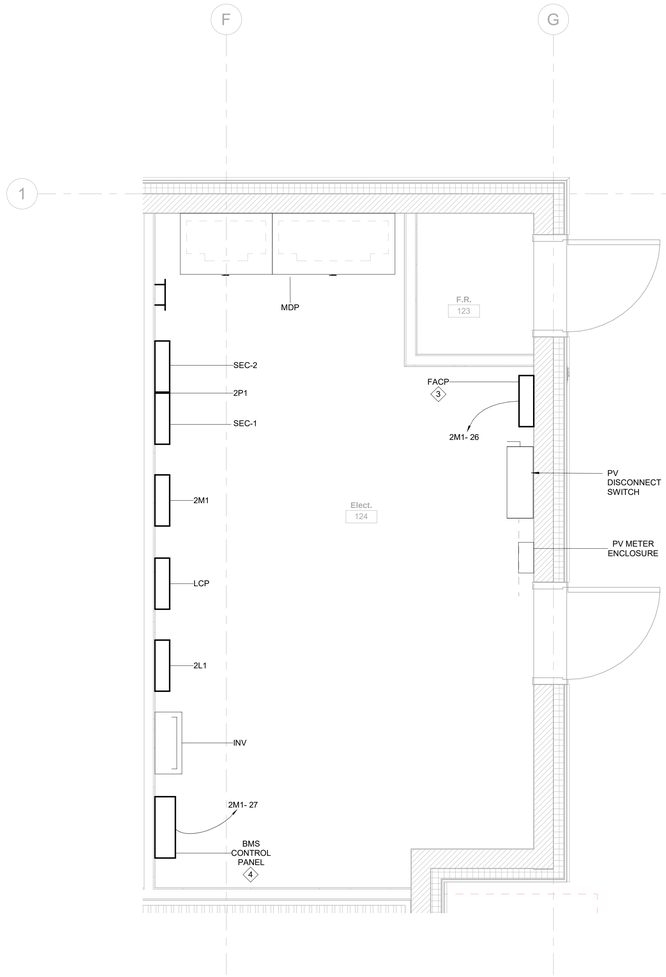
GENERAL NOTES

1. ALL GENERAL RECEPTACLE AND LIGHTING CIRCUITS SHALL BE FED BY 20A BREAKERS MINIMUM.
2. RECEPTACLES ON OPPOSITE SIDES OF COMMON WALLS SHALL BE HORIZONTALLY OFFSET.
3. ALL CIRCUITS SHALL HAVE DEDICATED GROUND WIRES.
4. EACH CIRCUIT SHALL BE PROVIDED WITH ITS OWN DEDICATED NEUTRAL.
5. ALL EXTERIOR RECEPTACLES SHALL BE GFCI, WEATHER RESISTANT TYPE AND HAVE IN - USE WEATHER PROOF COVERS.
6. ALL EXTERIOR EQUIPMENT SHALL BE NEMA 3R WET LISTED SUITIBLE FOR INSTALLATION LOCATION, UNLESS OTHERWISE NOTED.
7. PERMANENT AND DURABLE MARKING FOR CONTROLLED RECEPTACLES OR CIRCUITS TO DIFFERENTIATE THEM FROM UNCONTROLLED RECEPTACLES OR CIRCUITS SHALL BE PROVIDED TO MEET SECTION 130.5(D)(3) OF THE CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS.
8. CABLE RUNWAY: PROVIDE ALL PARTS AND PIECES TO CREATE A CONTINUOUS PATHWAY FOR CABLES WITHIN COMM ROOM. PROVIDE PARTS TO SUPPORT CABLE CONTINUOUSLY FROM THE CONDUITS, CONDUIT CORES, AND CONDUIT SLEEVES ENTERING THE COMM ROOMS TO THE EQUIPMENT RACKS AND BACKBOARDS.
9. INSTALL WITH A MINIMUM OF 36" CLEAR ACCESS IN FRONT OF RACK UNLESS OTHERWISE DIRECTED BY DRAWINGS.
10. MINIMUM CLEARANCE BETWEEN END OF ROW AND WALL SHOULD BE 36".
11. ALL BOXES AND CONDUIT INSTALLED IN FIRE-RATED WALLS SHALL BE FIRE SEALED AS REQUIRED TO MAINTAIN THE PARTITION'S FIRE RATING.

/7



2 ENLARGED PLAN COMM 111
1/2" = 1'-0" /7



1 ENLARGED ELECTRICAL PLAN
1/2" = 1'-0" /7

KEYNOTES

KEY	DESCRIPTION
1	PROVIDE NEMA 5-20R QUAD PLEX RECEPTACLE MOUNTED ON EACH SIDE PANEL OF THE 4-POST DATA RACK, WITH ISOLATED GROUND.
2	PROVIDE NEMA L6-30R ON THE RIGHT SIDE OF THE 4-POST DATA RACK.
3	PROVIDE POWER AS REQUIRED FOR FIRE ALARM CONTROL PANEL.
4	PROVIDE POWER AS REQUIRED FOR BMS CONTROL PANEL.
5	PROVIDE EPO SWITCH WITH TRANSPARENT COVER AND RATED FOR 120V SINGLE PHASE THAT IS TIED TO PANEL "2T1" MAIN BREAKER SHUNT DEVICE. UPON ACTIVATION OF THE SWITCH, THE SHUNT DEVICE SHALL ACTIVATE AND OPEN THE MAIN BREAKER OF PANEL 2T1, TURNING POWER OFF TO THE ROOM IN ACCORDANCE WITH NEC 645.4(1) AND 645.10.

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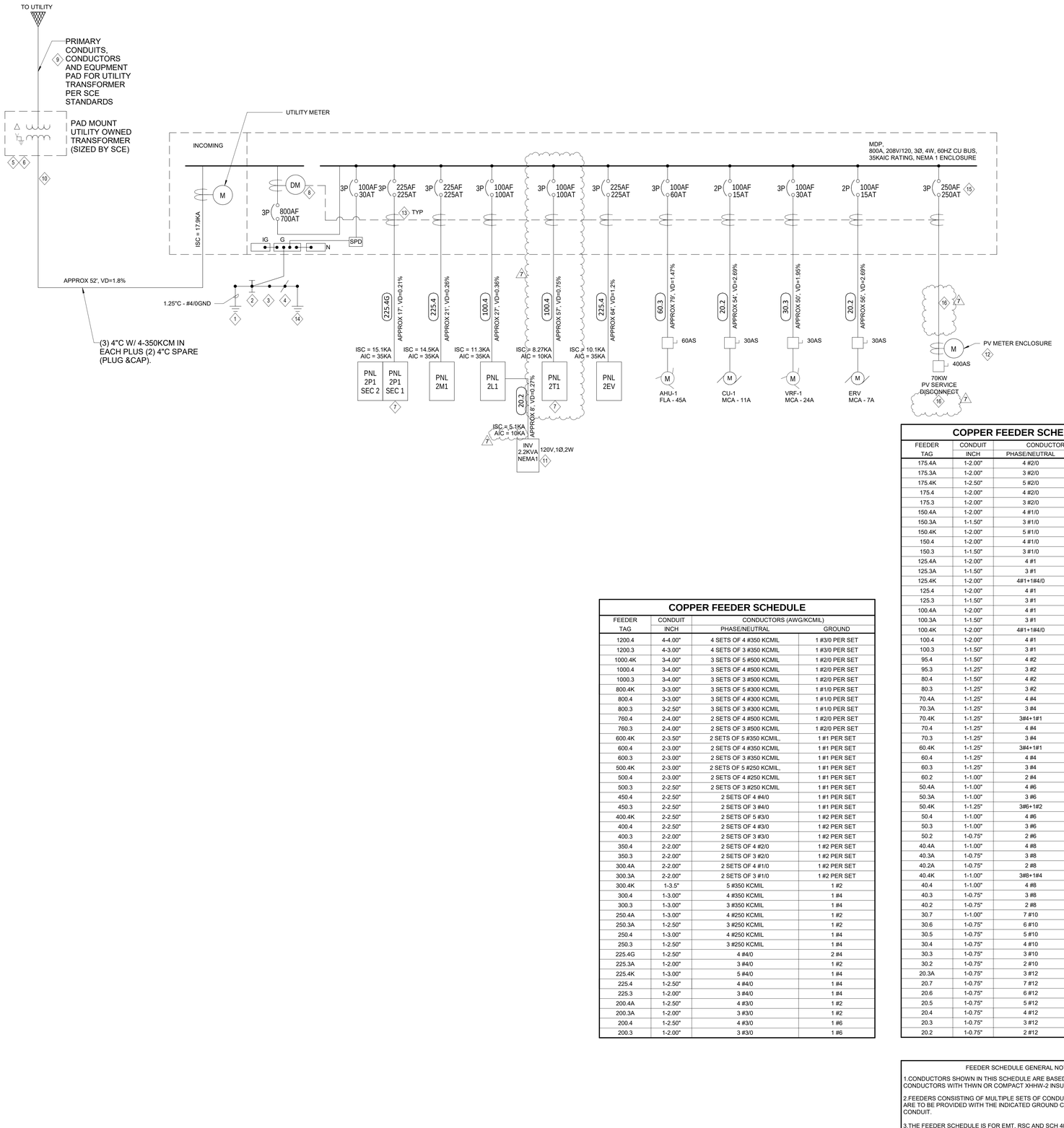
ENLARGED PLANS

SHEET NO.

E4.01



COPPER FEEDER SCHEDULE

FEEDER TAG	CONDUIT INCH	CONDUCTORS (AWG/KCMIL) PHASE/NEUTRAL	GROUND
1200.4	4-4.00"	4 SETS OF 4 #350 KCMIL	1 #3/0 PER SET
1200.3	4-3.00"	4 SETS OF 3 #350 KCMIL	1 #3/0 PER SET
1000.4K	3-4.00"	3 SETS OF 5 #500 KCMIL	1 #2/0 PER SET
1000.4	3-4.00"	3 SETS OF 4 #500 KCMIL	1 #2/0 PER SET
1000.3	3-4.00"	3 SETS OF 3 #500 KCMIL	1 #2/0 PER SET
800.4K	3-3.00"	3 SETS OF 5 #300 KCMIL	1 #1/0 PER SET
800.4	3-3.00"	3 SETS OF 4 #300 KCMIL	1 #1/0 PER SET
800.3	3-2.50"	3 SETS OF 3 #300 KCMIL	1 #1/0 PER SET
760.4	2-4.00"	2 SETS OF 4 #500 KCMIL	1 #2/0 PER SET
760.3	2-4.00"	2 SETS OF 3 #500 KCMIL	1 #2/0 PER SET
600.4K	2-3.50"	2 SETS OF 5 #350 KCMIL,	1 #1 PER SET
600.4	2-3.00"	2 SETS OF 4 #350 KCMIL	1 #1 PER SET
600.3	2-3.00"	2 SETS OF 3 #350 KCMIL	1 #1 PER SET
500.4K	2-3.00"	2 SETS OF 5 #250 KCMIL,	1 #1 PER SET
500.4	2-3.00"	2 SETS OF 4 #250 KCMIL	1 #1 PER SET
500.3	2-2.50"	2 SETS OF 3 #250 KCMIL	1 #1 PER SET
450.4	2-2.50"	2 SETS OF 4 #4/0	1 #1 PER SET
450.3	2-2.50"	2 SETS OF 3 #4/0	1 #1 PER SET
400.4K	2-2.50"	2 SETS OF 5 #3/0	1 #2 PER SET
400.4	2-2.50"	2 SETS OF 4 #3/0	1 #2 PER SET
400.3	2-2.00"	2 SETS OF 3 #3/0	1 #2 PER SET
350.4	2-2.00"	2 SETS OF 4 #2/0	1 #2 PER SET
350.3	2-2.00"	2 SETS OF 3 #2/0	1 #2 PER SET
300.4A	2-2.00"	2 SETS OF 4 #1/0	1 #2 PER SET
300.3A	2-2.00"	2 SETS OF 3 #1/0	1 #2 PER SET
300.4K	1-3.5"	5 #350 KCMIL	1 #2
300.4	1-3.00"	4 #350 KCMIL	1 #4
300.3	1-3.00"	3 #350 KCMIL	1 #4
250.4A	1-3.00"	4 #250 KCMIL	1 #2
250.3A	1-2.50"	3 #250 KCMIL	1 #2
250.4	1-3.00"	4 #250 KCMIL	1 #4
250.3	1-2.50"	3 #250 KCMIL	1 #4
225.4G	1-2.50"	4 #4/0	2 #4
225.3A	1-2.00"	3 #4/0	1 #2
225.4K	1-3.00"	5 #4/0	1 #4
225.4	1-2.50"	4 #4/0	1 #4
225.3	1-2.00"	3 #4/0	1 #4
200.4A	1-2.50"	4 #3/0	1 #2
200.3A	1-2.00"	3 #3/0	1 #2
200.4	1-2.50"	4 #3/0	1 #6
200.3	1-2.00"	3 #3/0	1 #6

COPPER FEEDER SCHEDULE

FEEDER TAG	CONDUIT INCH	CONDUCTORS (AWG/KCMIL) PHASE/NEUTRAL	GROUND
175.4A	1-2.00"	4 #2/0	1 #3
175.3A	1-2.00"	3 #2/0	1 #3
175.4K	1-2.50"	5 #2/0	1 #6
175.4	1-2.00"	4 #2/0	1 #6
175.3	1-2.00"	3 #2/0	1 #6
150.4A	1-2.00"	4 #1/0	1 #3
150.3A	1-1.50"	3 #1/0	1 #3
150.4K	1-2.00"	5 #1/0	1 #6
150.4	1-2.00"	4 #1/0	1 #6
150.3	1-1.50"	3 #1/0	1 #6
125.4A	1-2.00"	4 #1	1 #2
125.3A	1-1.50"	3 #1	1 #2
125.4K	1-2.00"	4#1+1#4/0	1 #6
125.4	1-2.00"	4 #1	1 #6
125.3	1-1.50"	3 #1	1 #6
100.4A	1-2.00"	4 #1	1 #4
100.3A	1-1.50"	3 #1	1 #4
100.4K	1-2.00"	4#1+1#4/0	1 #8
100.4	1-2.00"	4 #1	1 #8
100.3	1-1.50"	3 #1	1 #8
95.4	1-1.50"	4 #2	1 #8
95.3	1-1.25"	3 #2	1 #8
80.4	1-1.50"	4 #2	1 #8
80.3	1-1.25"	3 #2	1 #8
70.4A	1-1.25"	4 #4	1 #6
70.3A	1-1.25"	3 #4	1 #6
70.4K	1-1.25"	3#4+1#1	1 #8
70.4	1-1.25"	4 #4	1 #8
70.3	1-1.25"	3 #4	1 #8
60.4K	1-1.25"	3#4+1#1	1 #8
60.4	1-1.25"	4 #4	1 #8
60.3	1-1.25"	3 #4	1 #8
60.2	1-1.00"	2 #4	1 #8
50.4A	1-1.00"	4 #6	1 #8
50.3A	1-1.00"	3 #6	1 #8
50.4K	1-1.25"	3#6+1#2	1 #10
50.4	1-1.00"	4 #6	1 #10
50.3	1-1.00"	3 #6	1 #10
50.2	1-0.75"	2 #6	1 #10
40.4A	1-1.00"	4 #8	1 #8
40.3A	1-0.75"	3 #8	1 #8
40.2A	1-0.75"	2 #8	1 #8
40.4K	1-1.00"	3#8+1#4	1 #10
40.4	1-1.00"	4 #8	1 #10
40.3	1-0.75"	3 #8	1 #10
40.2	1-0.75"	2 #8	1 #10
30.7	1-1.00"	7 #10	1 #10
30.6	1-0.75"	6 #10	1 #10
30.5	1-0.75"	5 #10	1 #10
30.4	1-0.75"	4 #10	1 #10
30.3	1-0.75"	3 #10	1 #10
30.2	1-0.75"	2 #10	1 #10
20.3A	1-0.75"	3 #12	1 #10
20.7	1-0.75"	7 #12	1 #12
20.6	1-0.75"	6 #12	1 #12
20.5	1-0.75"	5 #12	1 #12
20.4	1-0.75"	4 #12	1 #12
20.3	1-0.75"	3 #12	1 #12
20.2	1-0.75"	2 #12	1 #12

FEEDER SCHEDULE GENERAL NOTES:

1.CONDUCTORS SHOWN IN THIS SCHEDULE ARE BASED ON COPPER CONDUCTORS WITH THWN OR COMPACT XHHW-2 INSULATION.

2.FEEDERS CONSISTING OF MULTIPLE SETS OF CONDUCTORS AND CONDUITS ARE TO BE PROVIDED WITH THE INDICATED GROUND CONDUCTOR IN EACH CONDUIT.

3.THE FEEDER SCHEDULE IS FOR EMT, RSC AND SCH 40 CONDUIT. USE 1 SIZE LARGER IF SCH 80 PVC CONDUIT ARE TO BE USED.

4. CONDUIT SIZES SHOWN ARE MINIMUM. LARGER CONDUIT CAN BE USED AS CONTRACTOR OPTION OR WHEN REQUIRED BY CODE.

GENERAL NOTES

1. NO PIPING, DUCTS OR EQUIPMENT FOREIGN TO THE ELECTRICAL EQUIPMENT SHALL BE PERMITTED TO BE LOCATED WITHIN THE DEDICATED SPACE ABOVE THE ELECTRICAL EQUIPMENT PER NEC 110.26(E).
2. SUFFICIENT ACCESS AND WORKING SPACE SHALL BE PROVIDED AND MAINTAINED AROUND ALL ELECTRICAL EQUIPMENT TO PERMIT READY AND SAFE OPERATION AND MAINTENANCE OF SUCH EQUIPMENT PER NEC 110.26.
3. ALL ELECTRICAL EQUIPMENT SHALL BE LISTED AND IDENTIFIED FOR USE WITH 75°C RATED CONDUCTORS.
4. ALL DISTRIBUTION BOARDS SHALL BE FREE STANDING WITH COPPER BUS BARS, FULL NEUTRAL BUS AND SEPARATE GROUND BUS COMPLYING WITH NEMA STANDARDS.
5. ELECTRICAL DISTRIBUTION EQUIPMENT SHALL BE MARKED TO WARN QUALIFIED PERSONS OF POTENTIAL ELECTRIC ARC FLASH HAZARDS. NEC 110.16.
6. ALL ELECTRICAL DISTRIBUTION AND OVER CURRENT PROTECTIVE DEVICES SHALL BE FULLY RATED FOR AVAILABLE FAULT CURRENT, SERIES RATING NOT PERMITTED.
7. CONTRACTOR SHALL PERFORM AN ARC FLASH ANALYSIS IN ACCORDANCE WITH NFPA 70E AND PROVIDE WARNING SIGNS. ARC FLASH ANALYSIS MUST BE SUBMITTED TO THE CONTRACTING OFFICER FOR REVIEW AND APPROVAL PRIOR TO MANUFACTURE AND/OR INSTALL OF SIGNS.
8. OVER CURRENT AND FAULT PROTECTION DEVICES SHALL BE COORDINATED WITH LINE-SIDE AND LOAD-SIDE FUSES OR CIRCUIT BREAKERS TO ISOLATE ANY ELECTRICAL FAULT OR OVERLOAD FROM THE REST OF THE SYSTEM. PROTECTIVE DEVICE COORDINATION STUDY TO BE SUBMITTED TO THE ENGINEER OF RECORD TO APPROVE THAT THE LEVEL OF COORDINATION IS ACCEPTABLE.
9. PROVIDE SERVICE ENTRANCE EQUIPMENT TESTING PER INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA).
10. SWITCHBOARDS WILL BE DEAD-FRONT, FLOOR MOUNTED, FREESTANDING METAL-ENCLOSED WITH COPPER BUSING. MUST BE FRONT ACCESSIBLE AND MUST BE COMPLETELY ISOLATED BETWEEN SECTIONS BY VERTICAL STEEL BARRIERS. SWITCHBOARDS SHALL HAVE HINGED FRONTS.
11. THE BUILDING ELECTRICAL SERVICE SHALL BE PROVIDED WITH A SURGE PROTECTION SYSTEM THAT SHALL CONSIST OF SURGE PROTECTION PACKAGES CONNECTED TO ALL PANELBOARDS AND SWITCHBOARDS. THE DEVICES SHALL BE EXTERNAL UL 1449 4TH EDITION LISTED, TYPE 1 AND 2 SPD.
12. ALL FEEDER LENGTHS INDICATED ARE FOR DESIGN PURPOSES ONLY AND SHALL BE VERIFIED IN THE FIELD. IF FIELD LENGTHS ARE SIGNIFICANTLY GREATER THAN DESIGN LENGTHS, VOLTAGE DROP CALCULATIONS MUST BE COMPLETED FOR NEW LENGTHS TO VERIFY COMPLIANCE.
13. PROVIDE BACNET GATEWAY PROTOCOM-KT BY ELECTRO INDUSTRIES OR APPROVED EQUAL FOR COMMUNICATION BETWEEN METERS AND ALERTON BMS BACNET.

KEYNOTES

1. PROVIDE 1-#4/0 STRANDED BARE COPPER BONDING JUMPER IN 3/4" MINIMUM NONMETALLIC RIGID CONDUIT FROM SWITCHBOARD TO TWO 3/4" X 10' GROUND RODS. SEVEN FEET APART MINIMUM. GROUNDING AND BONDING SHALL FOLLOW NEC GUIDELINES.
2. BOND SERVICE GROUND TO BLDG STEEL WITH 3/4"C -4/0 BARE COPPER GROUND.
3. BOND SERVICE GROUND TO COLD WATER PIPE WITH 3/4"C -4/0 BARE COPPER GROUND.
4. BOND SERVICE GROUND TO ALL METAL PIPING PER NEC.
5. PROVIDE TRANSFORMER GROUNDING PER UTILITY REQUIREMENTS.
6. REFER TO SITE PLAN FOR LAYOUT OF OUTDOOR ELECTRICAL EQUIPMENT.
7. PANEL TO COME EQUIPPED WITH ISOLATED GROUND BUS.
8. PROVIDE POWER METERING AS PART OF THE SWITCHBOARD SUBMITTAL AS SPECIFIED. THE MANUFACTURER SHALL BE SHARK *ENCSHK250-120-60-10-V4-D2-INP100S-PO1S-X* OR APPROVED EQUAL.
9. PROVIDE (1) 4"C FOR PRIMARY UTILITY CONDUCTORS. CONDUCTORS TO BE PROVIDED AND TERMINATED BY SCE.
10. PROVIDE (3) 4"C FOR SECONDARY UTILITY CONDUCTORS. CONDUCTORS TO BE PROVIDED AND TERMINATED BY SCE.
11. PROVIDE FLOOR MOUNT EMERGENCY LIGHTING INVERTER AS REQUIRED PER NEC ARTICLE 700. THE MANUFACTURER SHALL BE MYERS *3-EM-3-S-B-B-20-8* OR APPROVED EQUAL.
12. UTILITY NGOM METER. COORDIANTE METER SOCKET CONFIGURATION WITH UTILITY COMPANY PRIOR TO PURCHASING.
13. PROVIDE POWER METER TO MEET TITLE-24 LOAD DISAGGREGATION AND ADVANCED METERING REQUIREMENT. THE MANUFACTURER SHALL BE SHARK *ENCMP200-Y-60-10-V4-WIFI-MDLN-X* OR APPROVED EQUAL. DATA CAN BE VIEWED REAL-TIME BY USING COMMEXT SOFTWARE.
14. BOND SERVICE TO CONCRETE-ENCASED ELECTRODE (UFER) WITH 3/4"C-1#4/0. SEE DETAIL 2 ON SHEET E8.01.
15. PV BREAKER SHALL BE LOCATED AT THE OPPOSITE END OF THE BUS FROM THE MAIN OVERCURRENT DEVICE.
16. COORDINATE PV FEEDER AND EQUIPMENT RATINGS WITH PV DESIGN DRAWINGS (DEFERRED SUBMITTAL BY CONTRACTOR).

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL APPROVED FIRE AND PANIC ONLY

12/07/21
20-1059
SINCE 1885

Approval of this plan does not authorize or approve any omission or deviation from applicable requirements. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

REGISTERED PROFESSIONAL ENGINEER
SHEA CULBERTSON
No. 27237
ELECTRICAL
STATE OF CALIFORNIA

AECOM
CONSULTANT

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Sacramento, CA 95811
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REGISTERED ARCHITECT
No. C-27624
Dec. 31, 2023
STATE OF CALIFORNIA

ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADI 005	01/13/2023

DATE 01/13/2023

JOB NO. DGS 140724

SHEET TITLE

ELECTRICAL ONE LINE

SHEET NO.

E5.01

ONE INCH = TWENTY FEET
ONE - SIXTEENTH INCH = ONE FOOT
ONE - EIGHTH INCH = ONE FOOT
ONE - QUARTER INCH = ONE FOOT
THREE - QUARTERS INCH = ONE FOOT
ONE AND ONE - HALF INCH = ONE FOOT

ONE AND ONE - HALF INCH = ONE FOOT
ONE INCH = ONE FOOT
THREE - QUARTERS INCH = ONE FOOT
ONE - HALF INCH = ONE FOOT
ONE - QUARTER INCH = ONE FOOT
ONE - EIGHTH INCH = ONE FOOT
ONE - SIXTEENTH INCH = ONE FOOT
ONE INCH = TWENTY FEET

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

ITEM	ITEM NO.	DESCRIPTION	VOLTAGE	PHASE	HP	FLA	MCA	MOCP	KVA	PANEL	FEEDER SIZE	DISCONNECT SIZE	DISCONNECT PROVIDED BY	NOTES
AHU-1	1	OUTDOOR AIR HANDLER	208	3	-	45	-	60	-	MDP	(1)1.25"C-3#4+1#8 GND	600V 3P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
VAV 1	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 2	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 3	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 4	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 5	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 6	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VAV 7	1	VAV	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
BC-1	1	VRF BRANCH CONTROLLER	208	1	-	-	1.3	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
VRF-1	1	VRF CONDENSING UNIT	208	3	-	-	24	-	-	MDP1	(1)3/4"C-3#10+1#10 GND	600V 3P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
CU-1	1	VRF CONDENSING UNIT	208	1			11	28	-	MDP1	(1)3/4"C-2#10+1#10 GND	600V 2P 30A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
HP-1	1	VRF EVAPORATOR	208	1	-	-	0.19	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-2	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-3	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-4	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-5	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-6	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	2T1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-7	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-8	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-9	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-10	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-11	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-12	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-13	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-14	1	VRF EVAPORATOR	208	1	-	-	0.24	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-15	1	VRF EVAPORATOR	208	1	-	-	0.29	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-16	1	VRF EVAPORATOR	208	1	-	-	0.29	-	-	M1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
HP-17	1	VRF EVAPORATOR	208	1	-	-	0.19	-	-	2T1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
ERV-1	1	ERV	208	1	-	-	7	-	-	MDP1	(1)3/4"C-2#12+1#12 GND	125V 2P 30A MOTOR RATED SWITCH	ELECTRICAL	
EF-1	1	EXHAUST FAN	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
EF-2	1	EXHAUST FAN	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
EF-3	1	EXHAUST FAN	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
EF-4	1	EXHAUST FAN	120	1	-	-	-	-	0.05	M1	(1)3/4"C-2#12+1#12 GND	125V 1P 30A MOTOR RATED SWITCH	ELECTRICAL	
IWH-1	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 3P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-1	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-1	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-1	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-2	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
IWH-2	1	INSTANT WATER HEATER	208	1	-	-	-	-	8	M1	(1)3/4"C-2#6+1#10 GND	600V 2P 60A NON - FUSIBLE DISCONNECT SWITCH	ELECTRICAL	
FSD-1	1	FIRE SMOKE DAMPER	120	1	-	-	-	-	0.05	2T1	(1)3/4"C-2#12+1#12 GND	N/A	N/A	
FSD-1	1	FIRE SMOKE DAMPER	120	1	-	-	-	-	0.05	2T1	(1)3/4"C-2#12+1#12 GND	N/A	N/A	

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120743 INC:
REVIEWED FOR
SS ☐ FLS ☐ ACS ☒
DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY
12/07/21
20-1059
Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

LICENSED PROFESSIONAL ENGINEER
SHEA CULBERTSON
E22311
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STATE OF CALIFORNIA

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Sacramento, CA 95811
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LICENSED ARCHITECT
MICHAEL J PARROTT
No. C-27624
Dec 31, 2023
STATE OF CALIFORNIA

ARCHITECT

REVISIONS

NO.	DESCRIPTION	DATE
7	ADI 005	01/13/2023

DATE 01/13/2023
JOB NO. DGS 140724
SHEET TITLE

EQUIPMENT SCHEDULE

SHEET NO.

E6.02

Switchboard: MDP

Location: Space 11 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: | **Phases:** 3 | **Mains Type:** MCB
Mounting: Floor | **Wires:** 4 | **Mains Rating:** 800 A
Enclosure: 1 | **MCB Rating:** 800 A

Notes:

CKT	Circuit Description	# of Poles	Frame Size	Trip Rating	Load	Remarks
1	PNL 2P1	3	225 A	225 A	40996 VA	
2	PNL 2M1	3	225 A	225 A	72750 VA	
3	PNL 2L1	3	100 A	100 A	7231 VA	
4	PNL 2T1	3	100 A	100 A	5488 VA	
5	PNL 2EV	3	225 A	225 A	33280 VA	
6	VRF-1	3	100 A	30 A	6912 VA	
7	CU-1	2	100 A	15 A	3168 VA	
8	ERV	2	100 A	15 A	1456 VA	
9	AHU-1	3	100 A	60 A	16200 VA	
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20	PV DISCONNECT	3	250 A	250 A	0 VA	
				Total Conn. Load:	187481 VA	
				Total Amps:	520 A	

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	99726 VA	104.06%	103776 VA		
Power	27896 VA	100.00%	27896 VA	**Total Conn. Load:**	187481 VA
Lighting	7299 VA	125.00%	9124 VA	**Total Est. Demand:**	197036 VA
Receptacle	19280 VA	75.93%	14640 VA	**Total Conn. Current:**	520 A
EV	33280 VA	125.00%	41600 VA	**Total Est. Demand Current:**	547 A

Notes:

Branch Panel: INV

Location: Space 11 | **Volts:** 120 Single | **A.I.C. Rating:** 10KA
Supply From: 2L1 | **Phases:** 1 | **Mains Type:**
Mounting: Surface | **Wires:** 2 | **Mains Rating:**
Enclosure: Type 1

Notes:

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	INTERIOR LIGHTING - NORTH	20 A	1	678	411		1	20 A	INTERIOR LIGHTING - SOUTH	2
3	EXTERIOR LIGHTING	20 A	1		268	0	1	20 A	Spare	4
5	Spare	20 A	1			0				6
7	Spare	20 A	1	0	0		1	20 A	Spare	8
		Total Load:		1089 VA	268 VA	0 VA				
		Total Amps:								

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Lighting	1357 VA	125.00%	1696 VA		
				Total Conn. Load:	1357 VA
				Total Est. Demand:	1696 VA
				Total Conn. Current:	11 A
				Total Est. Demand Current:	14 A

Notes:

Branch Panel: 2M1

Location: Space 11 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 225 A
Enclosure: 1

Notes:

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	BC-1	20 A	2	135 970			2	20 A	HP-1,2,3,4,5,7,11	2
3	--	--	--		135 970		--	--	--	4
5	HP-8,9,10,12,14,15,16	20 A	2			945 200	1	20 A	VAV-1,2,3,4	6
7	--	--	--	945 150			1	20 A	VAV-5,6,7	8
9	EF-1,3,4	20 A	1		150 3600		2	35 A	IWH-1	10
11	IWH-2	50 A	2			4500 3600	--	--	--	12
13	--	--	--	4500 3600			2	35 A	IWH-1	14
15	IWH-2	50 A	2		4500 3600		--	--	--	16
17	--	--	--			4500 3600	2	35 A	IWH-1	18
19	IWH-2	50 A	2	4500 3600			--	--	--	20
21	--	--	--		4500 3600		2	35 A	IWH-1	22
23	IWH-2	50 A	2			4500 3600	--	--	--	24
25	--	--	--	4500 500			1	20 A	FACP	26
27	ALERTEN BMS PANEL	20 A	1		200 1000		1	20 A	OUTDOOR GATE	28
29	OUTDOOR GATE	20 A	1			1000 50	1	20 A	EF-2	30
31	HARD WIRED FLUSH VALVES	20 A	1	400 200			1	20 A	HARD WIRED FLUSH VALVES	32
33										34
35	Spare	20 A	1			0 0	1	20 A	Spare	36
37	Spare	20 A	1	0 0			1	20 A	Spare	38
39	Spare	20 A	1		0 0		1	20 A	Spare	40
41	Spare	20 A	1			0 0	1	20 A	Spare	42
		Total Load:		24000 VA	22255 VA	26495 VA				
		Total Amps:		202 A	185 A	223 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	71450 VA	103.15%	73700 VA		
Power	1300 VA	100.00%	1300 VA		
				Total Conn. Load:	72750 VA
				Total Est. Demand:	75000 VA
				Total Conn. Current:	202 A
				Total Est. Demand Current:	208 A

Notes:

Branch Panel: 2P1

Location: Space 11 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 225 A
Enclosure: 1

Notes: PROVIDE PANEL WITH ISOLATED GROUND BUS.

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	RECEPTACLE - RM 116,125	20 A	1	900 1200			1	20 A	SHREDDER	2
3	RECEPTACLE - RM 120,121	20 A	1		720 1200		1	20 A	HAND DRYER - RM 121	4
5	HAND DRYER - RM 120	20 A	1			1200 480	1	20 A	DRINKING FOUNTAIN - RM 106	6
7	DRINKING FOUNTAIN - RM 125	20 A	1	480 1080			1	20 A	RECEPTACLE - RM 110,122,123,124	8
9	RECEPTACLE - RM 114,115,119	20 A	1		900 1080		1	20 A	RECEPTACLE - RM 112,113	10
11	FURNITURE FEED - RM 119	20 A	1			700 360	1	20 A	DESKTOP MONITORS - RM118	12
13	FURNITURE FEED - RM 119 (C)	20 A	1	360 696			1	20 A	REFRIGERATOR RM 118	14
15	MICROWAVE - RM 118	20 A	1		1200 1200		1	20 A	VENDING MACHINE RM 118	16
17	VENDING MACHINE RM 118	20 A	1			1200 720	1	20 A	RECEPTACLE - RM 118,107	18
19	RECEPT, FURNITURE FEED - RM 107 (C)	20 A	1	350 350			1	20 A	FURNITURE FEED - RM 114	20
21	FURNITURE FEED - RM 107	20 A	1		300 120		1	20 A	FURNITURE FEED - RM 114 (C)	22
23	FURNITURE FEED - RM 109	20 A	1			700 360	1	20 A	FURNITURE FEED - RM 109 (C)	24
25	FURNITURE FEED - RM 109 (C)	20 A	1	120 350			1	20 A	FURNITURE FEED - RM 109	26
27	FURNITURE FEED - RM 109 (C)	20 A	1		720 1200		1	20 A	FURNITURE FEED - RM 109	28
29	FURNITURE FEED - RM 109	20 A	1			1200 1200	1	20 A	FURNITURE FEED - RM 109	30
31	RECEPTACLE - RM 106,109	20 A	1	1440 700			1	20 A	FURNITURE FEED - RM 109	32
33	FURNITURE FEED - RM 109 (C)	20 A	1		360 350		1	20 A	FURNITURE FEED - RM 109	34
35	FURNITURE FEED - TEST STATIONS	20 A	1			840 120	1	20 A	FURNITURE FEED - RM 109 (C)	36
37	FURNITURE FEED - TEST STATIONS	20 A	1	840 350			1	20 A	FURNITURE FEED - RM 109	38
39	FURNITURE FEED - TEST STATIONS	20 A	1		1000 120		1	20 A	FURNITURE FEED - RM 109 (C)	40
41	FURNITURE FEED - TEST STATIONS	20 A	1			840 350	1	20 A	FURNITURE FEED - RM 109	42
43	TV - RM 106	20 A	1	720 120			1	20 A	FURNITURE FEED - RM 109 (C)	44
45	SELF SERVICE KIOSKS	20 A	1		360 720		1	20 A	RECEPTACLE - RM 101,102,103,104	46
47	DESKTOP MONITORS - RM109	20 A	1			720 540	1	20 A	RECEPTACLE - EXTERIOR (EAST+NORTH)	48
49	RECEPTACLE - EXTERIOR (WEST+SOUTH)	20 A	1	540 1200			1	20 A	HAND DRYER - RM 102	50
51	HAND DRYER - RM 103	20 A	1		1200 0		1	20 A	Spare	52
53	MAIL MACHINE	20 A	1			1400 0	1	20 A	Spare	54
55	RECEPTACLE - ROOF	20 A	1	720 0			1	20 A	Spare	56
57	Spare	20 A	1		0 0		1	20 A	Spare	58
59	Spare	20 A	1			0 0	3	30 A	Spare	60
61	Spare	20 A	1	0 0			--	--	--	62
63	Spare	20 A	1		0 0		--	--	--	64
65	Spare	20 A	1			0 1400	1	20 A	COPIER	66
67	COPIER	20 A	1	1400 0			1	20 A	Spare	68
69	Spare	20 A	1		0 0		1	20 A	Spare	70
71	Spare	20 A	1			0 0	1	20 A	Spare	72
73	Spare	20 A	1	0 0			1	20 A	Spare	74
75	Spare	20 A	1		0 0		1	20 A	Spare	76
77	Spare	20 A	1			0 0	1	20 A	Spare	78
79	Spare	20 A	1	0 0			1	20 A	Spare	80
81	Spare	20 A	1		0 0		1	20 A	Spare	82
83	Spare	20 A	1			0 0	1	20 A	Spare	84
		Total Load:		13916 VA	12750 VA	14330 VA				
		Total Amps:		117 A	106 A	121 A				

SECTION - 1 / SECTION - 2

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Power	26496 VA	100.00%	26496 VA		
Receptacle	14500 VA	84.48%	12250 VA		
				Total Conn. Load:	40996 VA
				Total Est. Demand:	38746 VA
				Total Conn. Current:	114 A
				Total Est. Demand Current:	108 A

Notes:

Branch Panel: 2L1

Location: Space 11 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: 1

Notes:

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	LIGHTING - RM 113-124	20 A	1	952 933			1	20 A	LIGHTING - RM 107-110	2
3	LIGHTING - RM 106	20 A	1		979 497		1	20 A	LIGHTING - RM 101,102,103,106	4
5	EXTERIOR LTG - DRIVE...	20 A	2			136 323	2	20 A	LIGHTING - EXTERIOR POLES	6
7	--	--	--	136 323			--	--	--	8
9	LTG - EXT. POLES PARKING LOT, PV...	20 A	2		274 309		2	20 A	LIGHTING - EXTERIOR POLES	10
11	--	--	--			274 309	--	--	--	12
13	EXT. LTG - BLD SIGNAGE	20 A	2	296 0			1	20 A	LCP	14
15	--	--	--		0 1089		1	20 A	INV	16
17	LTG-ROOF	20 A	1			133				18
19										20
21										22
23	Spare	20 A	1			0 0	1	20 A	Spare	24
25	Spare	20 A	1	0 0			1	20 A	Spare	26
27	Spare	20 A	1		0 0		1	20 A	Spare	28
29	Spare	20 A	1			0 0	1	20 A	Spare	30
		Total Load:		2640 VA	3148 VA	1443 VA				
		Total Amps:		24 A	28 A	12 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Lighting	7231 VA	125.00%	9039 VA		
				Total Conn. Load:	7231 VA
				Total Est. Demand:	9039 VA
				Total Conn. Current:	20 A
				Total Est. Demand Current:	25 A

Notes:
EXTERIOR LIGHTING TO BE METERED SEPARATELY.

Branch Panel: 2T1

Location: Space 13 | **Volts:** 208/120 Wye | **A.I.C. Rating:** 10KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MCB W/ SHUNT TRIP
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: Type 1 | **MCB Rating:** 100 A

Notes:
PROVIDE MAIN CIRCUIT BREAKER WITH 120V SHUNT TRIP ACCESSORY. SHUNT TRIP SHALL BE ACTIVATED BY THE EPO SWITCH WITHIN THE IT ROOM.
PROVIDE PANEL WITH ISOLATED GROUND BUS.

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	RECEPTACLE - COMM. RM 111	20 A	1	900 0			1	20 A	Spare	2
3	IG RACK RECEPTACLE - COMM. RM 111	20 A	1		360 0		1	20 A	Spare	4
5	IG RACK RECEPTACLE - COMM. RM 111	20 A	1			360 0	1	20 A	Spare	6
7	SPL DATA RACK RECEPTACLE - COMM....	30 A	3	333 0			1	20 A	Spare	8
9	--	--	--		333 0		1	20 A	Spare	10
11	--	--	--			333 0	1	20 A	Spare	12
13	IG RACK RECEPTACLE - COMM. RM 111	20 A	1	360 0			1	20 A	Spare	14
15	IG RACK RECEPTACLE - COMM. RM 111	20 A	1		360 0		1	20 A	Spare	16
17	IG RACK RECEPTACLE - COMM. RM 111	20 A	1			360 0	1	20 A	Spare	18
19	IG RACK RECEPTACLE - COMM. RM 111	20 A	1	360 0			1	20 A	Spare	20
21	IG RACK RECEPTACLE - COMM. RM 111	20 A	1		360 0		1	20 A	Spare	22
23	IG RACK RECEPTACLE - COMM. RM 111	20 A	1			360 0	1	20 A	Spare	24
25	EPO PUSHBUTTON - COMM. RM 111	20 A	1	0 0			1	20 A	Spare	26
27	HP-6,17	20 A	2		270 0		1	20 A	Spare	28
29	--	--	--			270 0	1	20 A	Spare	30
31	FIRE SMOKE DAMPERS - COMM. RM 111	20 A	1	100 0			1	20 A	Spare	32
33	LIGHTING - COMM. RM 111	20 A	1		68 0		1	20 A	Spare	34
35	Spare	20 A	1			0 0	1	20 A	Spare	36
37	Spare	20 A	1	0 0			1	20 A	Spare	38
39	Spare	20 A	1		0 0		1	20 A	Spare	40
41	Spare	20 A	1			0 0	1	20 A	Spare	42
		Total Load:		2053 VA	1751 VA	1683 VA				
		Total Amps:		17 A	15 A	14 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	540 VA	112.50%	608 VA		
Power	100 VA	100.00%	100 VA	**Total Conn. Load:**	5488 VA
Lighting	68 VA	125.00%	85 VA	**Total Est. Demand:**	5573 VA
Receptacle	4780 VA	100.00%	4780 VA	**Total Conn. Current:**	15 A
				Total Est. Demand Current:	15 A

Notes:

Branch Panel: 2EV

Location: | **Volts:** 208/120 Wye | **A.I.C. Rating:** 35KA
Supply From: MDP | **Phases:** 3 | **Mains Type:** MCB
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 225 A
Enclosure: 1

Notes:

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	FUTURE EV CHARGING STATION	40 A	2	3328 3328			2	40 A	FUTURE EV CHARGING STATION	2
3	--	--	--		3328 3328		--	--	--	4
5	FUTURE EV CHARGING STATION	40 A	2			3328 3328	2	40 A	FUTURE EV CHARGING STATION	6
7	--	--	--	3328 3328			--	--	--	8
9	FUTURE EV CHARGING STATION	40 A	2		3328					10
11	--	--	--			3328				12
13										14
15										16
17										18
19										20
21										22
23										24
25										26
27										28
29										30
		Total Load:		13312 VA	9984 VA	9984 VA				
		Total Amps:		111 A	83 A	83 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
EV	33280 VA	125.00%	41600 VA		
				Total Conn. Load:	33280 VA
				Total Est. Demand:	41600 VA
				Total Conn. Current:	92 A
				Total Est. Demand Current:	115 A

Notes: 1. Provide branch breakers for EV chargers capable of being locked in the open position.

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APP: 03-120743 INC:
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DATE: 10/01/2020

AGENCY APPROVAL

SFM# 20-S-1059-CP-P1

OFFICE OF THE STATE FIRE MARSHAL APPROVED FIRE AND PANIC ONLY
12/07/21
20-1059
Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

PROFESSIONAL ENGINEERS — GREGORY GILBERTSON — No. E22211 — ELECTRICAL — STATE OF CALIFORNIA

AECOM
CONSULTANT

nacht&lewis
600 Q Street, Suite 100
Sacramento, CA 95811
www.nachtlewis.com
P 916.329.4000

ARCHITECT

REVISIONS		
NO.	DESCRIPTION	DATE
7	ADI 005	01/13/2023

DATE 01/13/2023
JOB NO. DGS 140724
SHEET TITLE

PANEL SCHEDULES

SHEET NO.

E6.03

1 LOW VOLTAGE FLOOR PLAN
3/16" = 1'-0"

N

GENERAL NOTES

1. ALL TELECOM CONDUIT STUBS WILL BE MINIMUM 1" EMT. ALL WALL OUTLET BOXES FOR TELECOM TERMINATIONS WILL BE SINGLE GANG DEEP BOXES.
2. ALL HORIZONTAL CABLING WILL BE CATEGORY 6 RATED FOR INSTALLATIONENVIRONMENT.
3. CONTRACTOR TO FIELD VERIFY INSTALLATION CONDITIONS PRIOR TO INSTALLATION. CONTRACTOR SHALL MAKE EVERY EFFORT TO PERFORM INSTALLATION FOLLOWING LATEST GUIDELINES OF TIA-568, -569, AND -607.
4. RJ-45 JACKS WILL BE BLUE FOR DATA, WHITE FOR VOICE, GRAY FOR SECURITY.
5. FACEPLATE COLORS TO BE COORDINATED WITH ARCHITECT BEFORE PURCHASING.
6. ALL CATEGORY 6 CABLES WILL BE TERMINATED ON PATCH PANELS AND TERMINATED IN T568A PIN-OUT CONFIGURATION.

TELECOM KEYNOTES

1. MODULAR SYSTEM FURNITURE OUTLETS TO BE SERVED VIA FLOOR OR WALL DEPENDING ON LOCATION TO FURNITURE OUTLET.
2. SLEEVES INSTALLED IN FIRE-RATED WALLS SHALL BE FIRE SEALED AS REQUIRED TO MAINTAIN PARTITION'S FIRE RATING.

TELECOM LEGEND:

- WALL PHONE - (1) CAT 6 VOICE MOUNTED AT 48" A.F.F.
- OUTLET TYPE 1 - (3) CAT 6 DATA, (1) CAT 6 VOICE
- OUTLET TYPE 2 - (2) CAT 6 DATA
- OUTLET TYPE 3 - (1) CAT 6 DATA
- OUTLET TYPE 4 - (1) CAT 6 DATA, (1) CAT 6 VOICE
- OUTLET TYPE 5 - (4) CAT 6 DATA
- QUEUE MONITOR - (1) CAT 6 DATA
- WAP — WIRELESS ACCESS POINT - (1) CAT 6 DATA
- BASKET CABLE TRAY
- S — INDOOR SPEAKER
- S — OUTDOOR SPEAKER
- FIXED CCTV IP CAMERA
- DOOR CONTACT SWITCH
- M — INFRARED DETECTOR
- P — WIRELESS PANIC BUTTON
- KP — KEYPAD
- P — INSTALL SINGLE GANG OUTLET BOX WITH 3/4" CONDUIT AND PULL STRING INTO DROP CEILING FOR INTERCOM DEVICE. MOUNT AT 48" AFF.
- I — INSTALL SINGLE GANG OUTLET BOX WITH 3/4" CONDUIT STUBBED INTO DROP CEILING FOR INTERCOM DEVICE. MOUNT AT 48" AFF.

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STATE FIRE MARSHALL APPROVAL

CALIFORNIA DEPART OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
Bicsi
BRUCE VANDERBUR
REGISTRATION NO: 153311
EXPIRES 12-31-2023
• RCDD •

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Sacramento, CA 95811
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P 916.329.4000

MICHAEL J. PARKER
No. C-27624
Dec 31, 2023
ARCHITECT

AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
7	ADI 005	01/13/2023

DATE 01/13/2023

JOB NO. DGS 140724

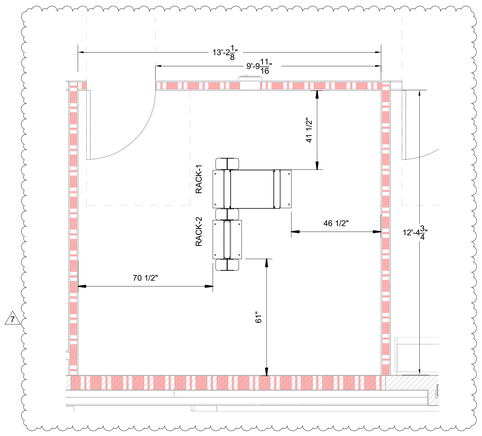
SHEET TITLE

LOW VOLTAGE FLOOR PLAN

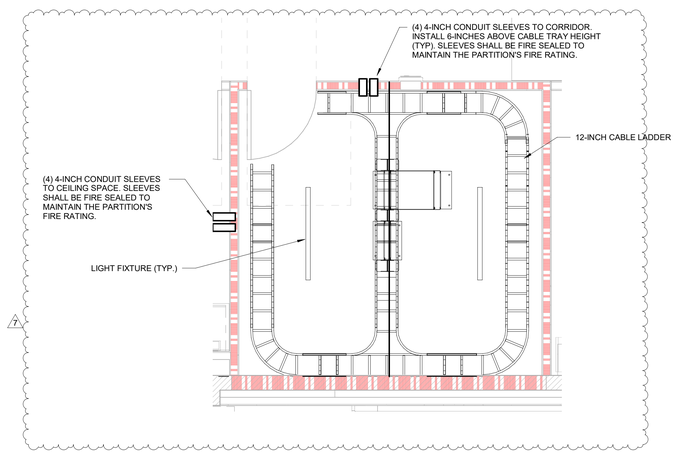
SHEET NO.

LV1.02

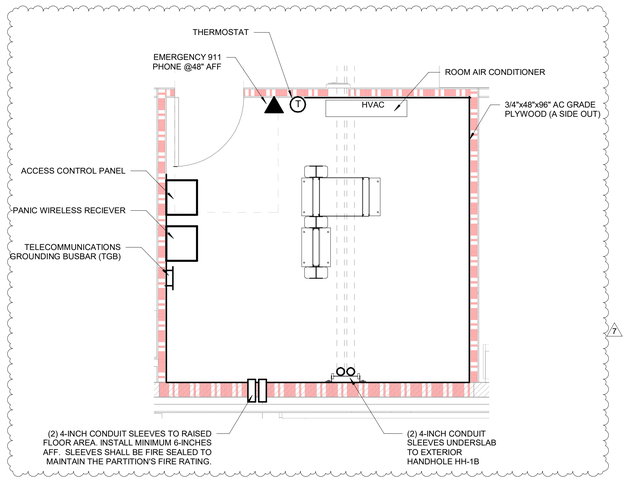
ONE INCH = TWENTY FEET
ONE - SIXTEENTH INCH = ONE FOOT
ONE - EIGHTH INCH = ONE FOOT
THREE - QUARTERS INCH = ONE FOOT
ONE - QUARTER INCH = ONE FOOT
ONE - HALF INCH = ONE FOOT
ONE AND ONE - HALF INCH = ONE FOOT



1 COMM ROOM 111 ROOM DIMENSIONS
3/8" = 1'-0"



2 COMM ROOM 111 REFLECTED CEILING PLAN
3/8" = 1'-0"



3 COMM ROOM 111 ROOM LAYOUT
3/8" = 1'-0"

GENERAL NOTES

1. ALL BOXES AND CONDUIT INSTALLED IN FIRE-RATED WALLS SHALL BE FIRE SEALED AS REQUIRED TO MAINTAIN THE PARTITION'S FIRE RATING.

SIDE VIEW

RACK-1

4 EQUIPMENT RACK - 1
3/8" = 1'-0"

RACK-2

5 EQUIPMENT RACK - 2
3/8" = 1'-0"

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CALIFORNIA DEPART OF MOTOR VEHICLES - DMV
448 DOVER PARKWAY, DELANO, CA

California Department of General Services

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
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REGISTERED ARCHITECT
MICHAEL J. PARKER
No. C-27624
Dec 31, 2023
STATE OF CALIFORNIA

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AGENCY SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE
7	ADI 005	01/13/2023

DATE 01/13/2023

JOB NO. DGS 140724

SHEET TITLE

TELECOM ENLARGED PLANS

SHEET NO.

LV4.01

ONE INCH = TWENTY FEET
ONE - EIGHTH INCH = ONE FOOT
ONE - SIXTEENTH INCH = ONE FOOT
ONE - QUARTER INCH = ONE FOOT
THREE - QUARTERS INCH = ONE FOOT
ONE INCH = ONE FOOT
ONE AND ONE - HALF INCH = ONE FOOT

SECTION 01 11 00

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Work required to be performed by the Contractor comprises:

1. California Department of Motor Vehicles, Delano, California in conformity with the Drawings and Specifications hereinafter identified; including furnishing all material, labor, plant, tools, equipment, and services necessary therefor and incidental thereto, complete and ready for use, except as hereinafter otherwise provided.

1.2 WORK NOT INCLUDED

A. Except for such auxiliary work as is shown or specified or is necessary as a part of the construction, the following work is NOT included in this Contract.

1. Work shown but marked "NIC" (Not in Contract). "BUA" (By Using Agency), or otherwise designated to be done by others.

1.3 PROJECT INFORMATION

A. Project Location: 448 Dover Parkway, Delano, CA

B. Project Identification: #DGS000000140724.

C. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

1. See Sections 01 31 00 "Project Management and Coordination" and 01 31 25 “Web-based Project Management System” for requirements for using web-based project software.

1.4 SPECIFICATIONS

A. The Specifications are those bound in the Project Manual in Books I and II, enumerated in the Table of Contents. The General Conditions of the Contract for Construction, Supplementary Conditions, and Division 01 of the Specifications apply to all Work of this Contract.

1.5 DRAWINGS

A. The Drawings consist of Drawing Sheets as listed in Document 00 01 15 of Project Manual.

1.6 CONTRACTOR'S SET OF DRAWINGS AND PROJECT MANUALS

A. State Furnished Drawings and Project Manuals: Upon award of Contract, the State will provide Drawings and Project Manuals upon Contractor’s request as follows:

1. Electronic Files in PDF format.
2. Drawings: **10** sets
3. Project Manuals: **10** sets.

B. Additional Sets shall be the responsibility of the contractor.

1.7 OWNER-FURNISHED / CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. State’s Responsibilities: State will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor State-reviewed Product Data, Shop Drawings, and Samples.
2. Upon delivery, inspect, with Contractor present, delivered items.

    a. If State-furnished products are damaged, defective, or missing, arrange for replacement.

3. Obtain manufacturer's inspections, service, and warranties.
4. Inform Contractor of earliest available delivery date for State-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Provide for receipt of State-furnished products.
2. Designate delivery dates of State-furnished products in Contractor's construction schedule, utilizing State-furnished earliest available delivery dates.
3. Review State-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for State-furnished products in the Work.
4. Receive, unload, handle, store, protect, and install State-furnished products.
5. Make building services connections for State-furnished products.
6. Protect State-furnished products from damage during storage, handling, and installation and prior to Completion.
7. Repair or replace State-furnished products damaged following receipt.

1.8 SEQUENCE OF CONSTRUCTION OPERATIONS

A. Before starting construction operations, Contractor shall confer with the State to review sequence of construction operations.

B. Contractor shall prepare schedules as set forth in Section 013216 “Progress Schedules and Reports”.

C. Contractor shall coordinate erection of wall framing, wall panels, windows, partitions or other space enclosure with requirements of others for moving large pieces of equipment into building or into room to be enclosed. Contractor shall consult with others as to the necessity for deferring erection of such enclosures and shall deliver to the State a schedule of such deferments and reasons therefor. Cost of deferring construction shall be borne by Contractor.

1.9 PHASED CONSTRUCTION

A. Work of this Contract shall be executed in one phase.

1.10 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7:30 a.m. to 4:30 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by State and authorities having jurisdiction.

1. Weekend Hours and State Holidays: Work may be permitted if approval is received from the State at least 3 working days in advance.
2. Early Morning Hours: Work may be permitted if approval is received from the State at least 3 working days in advance.

C. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

1.11 CONTRACTOR'S USE OF SITE AND PREMISES

A. Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section. Contractor's use of Project site is limited by State’s right to perform work or to retain other contractors on portions of Project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.

1.2 DEFINITIONS

A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.3 SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.4 ALLOWANCE(S)

A. Allowance shall include cost to Contractor of specific products and materials ordered by or selected by the State under allowance and shall include taxes, freight, delivery to, labor, and installation at Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, protection from damage, overhead and profit, other expenses required to complete the Work, and similar costs related to products and materials ordered by or selected by the State under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. The State will review and delineate allowance work with Contractor.

1.5 CONTRACTOR RESPONSIBILITY FOR ALLOWANCE ITEMS

A. Make all arrangements for performance of allowance work.

B. Submit to State certified copies of invoices, bills of sale or other documents authenticating costs incurred by Contractor for allowance items.

1.6 ADJUSTMENT OF COSTS

A. Should net cost be more or less than specified amount of allowance, the Contract Sum will be adjusted accordingly by a Change Order in compliance with requirements of the Document 00 72 00 “General Conditions of the Contract for Construction”.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump-Sum Allowance: Include the sum of $25,000 for furnishing labor, services, equipment, and materials necessary for the transportation of owner provided materials and equipment.

B. Allowance No. 2: Lump-Sum Allowance: Include the sum of $30,000 for Contractor to pay any utility connection fees.

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form acceptable to State.
2. Documentation: Show compliance with requirements for substitutions per Article 3.12.10, Document 00 72 00 “General Conditions of the Contract for Construction”, and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.

h. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change.

B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to State at earliest possible date, but no later than 14 days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. State’s Project number.
c. Contractor's name and address.
d. Date of submittal.

2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

a. Related Specification Section or division.
b. Description of the Work.
c. Change Orders (numbers) that affect value.
d. Dollar value, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
e. Value of work on City of Delano Property
f. Value of work on State Property

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
4. Allowances: Provide a separate line item in the schedule of values for each allowance.
5. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
6. Schedule of Values Revisions: Revise the schedule of values when Change Orders result in a change in the Contract Sum. Include at least one separate line item for each Change Order.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments.

B. Payment Application Times: The date for each progress payment shall be established by the State. The period covered by each Application for Payment is one month.

1. Submit draft copy of Application for Payment three days prior to due date for review by State Construction Supervisor/Inspector.
2. State Construction Supervisor/Inspector will review the draft with the Contractor to verify requested payment percentages.
3. Submit Application for Payment upon approval by the State Construction Supervisor/Inspector.

C. Application for Payment Forms: Submit forms for approval with initial submittal of schedule of values.

D. Application Preparation: Complete every entry on form. State will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders issued before last day of construction period covered by application.

E. Partial payment for "mobilization" shall be made in percentages as follows (less retainage):

Contract Amount Completed	Payment for Mobilization
5 %	50% of amount bid for mobilization, or 5% of original Contract amount, whichever is lesser.
10%	75% of amount bid for mobilization, or 7.5% of original Contract amount, whichever is lesser.
20%	95% of amount bid for mobilization, or 9.5% of original Contract amount, whichever is lesser.
50%	100% of amount bid for mobilization, or 10% of original Contract amount, whichever is lesser.

1. Upon completion of all Work on the Project, payment of any amount bid for mobilization in excess of 10% of the original Contract amount will be paid.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored subject to or under the control of the State, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to State, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.

3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit Application for Payment signed by the Contractor and State Construction Supervisor/Inspector to the State.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. Schedule of values.
2. Contractor's construction schedule (preliminary if not final).
3. Key Personnel Names List.

I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements in accordance with Section 01 77 00 "Closeout Procedures."
2. Certification of completion of final punch list items.
3. Warranty certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Evidence that claims have been settled.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Requests for Information (RFIs).
3. Digital project management procedures.
4. Web-based Project management software package.
5. Project meetings.

1.2 INFORMATIONAL SUBMITTALS

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals, and their duties and responsibilities, list telephone numbers, and e-mail addresses. Provide names, e-mail addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project. Keep list current at all times.

1.3 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Subletting and Subcontracting Responsibilities: Refer to General Conditions of the Contract for Construction, Article 4.
2. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
3. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
4. Coordinate the Work with related work being done by the State and other contractors operating in the area. This coordination shall include reasonable adjustments of schedule in order to allow other contractors or State to do their work. Make provisions for accommodating items installed by the State or under separate contracts.
5. Make adequate provisions to accommodate items scheduled for later installation.
6. Carefully examine Drawings relating to entire work with actual conditions so that Work will be accommodated in spaces provided. General arrangement and location of elements of various systems is shown on the Drawings or specified. Final locations, levels, etc., shall be governed by actual material size used, by building conditions encountered, and by work of all trades. Space conflicts and interferences shall be resolved before work is installed.

B. Site Examination: Visit the site prior to commencement of the Work and get familiar with existing conditions. Be prepared to carry out the Work within existing limitations.

1. Inspect and take responsibility for previously prepared or installed work of other contractors before applying subsequent materials or finishes. If work is in unsatisfactory condition, notify the State. Do not proceed until defective work has been corrected.

C. Work Layout

1. Property lines, location ties, and elevations of components of the Project to be built under this Contract are shown on the Drawings. Grade elevations shown for various parts of the Work are taken from a benchmark shown on the Drawings, or if not shown, will be designated by the State. In case of conflict therein, notify the State in writing before starting work.
2. Layout the Work and furnish surveys required for alignment and elevations of the Work. Furnish necessary lines, levels, locations, measurements and markers for all the Work and be responsible for their accuracy.
3. On building structures, layout on forms, walls, floors, and columns, the exact location of partitions as guide to all trades.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.4 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. State will return without response those RFIs submitted to State by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. State’s Representative name.
3. State’s Project number.
4. Date.
5. Name of Contractor.
6. RFI number, numbered sequentially.
7. RFI subject.

8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Form bound in Project Manual or software-generated form with substantially the same content as indicated above, acceptable to State.

1. Attachments shall be electronic files in PDF format.

D. State’s Action: State will review each RFI, determine action required, and respond.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of State’s actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. State’s action may include a request for additional information, in which case State’s time for response will date from time of receipt by State of additional information.
3. State’s action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Document 00 72 00 “General Conditions of the Contract for Construction”.

1.5 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. State’s Data Files Not Available: State will not provide State’s CAD drawing digital data files for Contractor's use during construction.

B. Web-Based Project Management Software Package: Use State’s web-based Project management software package for purposes of hosting and managing Project communication and documentation until Acceptance of the Work.

1. Web-based project management software includes, at a minimum, the following features:

    a. Compilation of Project data, including Contractor, subcontractors, State, State's consultants, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    c. Document workflow planning, allowing customization of workflow between project entities.

d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, Requests for Information, Submittals, Additional Detailed Instructions, and Change Orders.
e. Track status of each Project communication in real time, and log time and date when responses are provided.
f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
g. Processing and tracking of payment applications.
h. Processing and tracking of contract modifications.
i. Creating and distributing meeting minutes.
j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

1.6 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify State of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, within three days of the meeting.

B. Preconstruction Conference: State will schedule and conduct a preconstruction conference before starting construction, at a time convenient to State, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of State Architect or Engineer, and their consultants, State Construction Supervisor/Inspector; Contractor and its superintendent; major subcontractors; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including but not limited to the following:

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long lead items.
e. Lines of communications.
f. Use of web-based Project software.
g. Procedures for processing field decisions and Change Orders.
h. Procedures for RFIs.
i. Procedures for Quality Assurance / Quality Control (testing and inspecting).
j. Procedures for processing Applications for Payment.
k. Distribution of the Contract Documents.
l. Submittal procedures.
m. Sustainable design requirements including commissioning.

n. Preparation of Record Documents.
o. Use of the premises.
p. Allowable entrance.
q. Work restrictions.
r. Working hours.
s. State’s occupancy requirements.
t. Installation of temporary facilities and controls.
u. Storm Water Pollution Control.
v. Procedures for disruptions and shutdowns.
w. Construction waste management and recycling.
x. Parking availability.
y. Office, work, and storage areas.
z. Equipment deliveries and priorities.
aa. Safety.
bb. Security.
cc. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Sustainable Design Requirements Coordination Conference: State will schedule and conduct a sustainable design coordination conference before starting construction, at a time convenient to State Architect or Engineer, and Contractor.

1. Attendees: Authorized representatives of State, State's Commissioning Authority, Architect or Engineer, and their consultants; Contractor and its superintendent and sustainable design coordinator; major subcontractors; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect meeting sustainable design requirements, including the following:

a. Sustainable design Project checklist.
b. General requirements for sustainable design-related procurement and documentation.
c. Commissioning requirements.
d. Project closeout requirements and sustainable design certification procedures.
e. Role of sustainable design coordinator.
f. Construction waste management.
g. Construction operations and sustainable design requirements and restrictions.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise State of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Project Closeout Conference: State will schedule and conduct a project closeout conference no later than 30 days prior to the scheduled date of Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of State, State’s Commissioning Authority, Architect or Engineer, and their consultants; Contractor and its superintendent; major subcontractors; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of Record Documents.
b. Procedures required prior to inspection for Completion and for final inspection for acceptance.
c. Procedures for completing and archiving web-based Project software site data files.
d. Requirements for preparing operations and maintenance data.
e. Submittal of written warranties.
f. Requirements for completing sustainable design and commissioning documentation.
g. Requirements for delivery of material samples, attic stock, and spare parts.
h. Requirements for demonstration and training.

i. Preparation of Contractor's punch list.
j. Procedures for processing Applications for Payment at Completion and for final payment.
k. Submittal procedures.
l. State's Occupancy requirements.
m. Installation of State's furniture, fixtures, and equipment.
n. Removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

F. Progress Meetings: State will conduct progress meetings at weekly intervals.

1. Attendees: In addition to representatives of State, State's Commissioning Authority and Architect or Engineer, each contractor, subcontractor, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting.

1) Review schedule for next period.

b. Review present and future needs, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Safety.
4) Status of submittals.
5) Status of sustainable design documentation and commissioning.
6) Deliveries.
7) Off-site fabrication.
8) Access.
9) Site use.
10) Temporary facilities and controls.
11) Storm Water Pollution Control.
12) Progress cleaning.
13) Quality Assurance / Quality Control (testing and inspection).
14) Status of correction of deficient items.
15) Field observations.
16) Status of RFIs.
17) Status of Changes in the Work.
18) Payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Issue revised Contractor's construction schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 25

WEB-BASED PROJECT MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for the use of State's web-based project management software system for purposes of hosting and managing Project communication and documentation until Acceptance of the Work.

B. Use of this web-based project management system will not change any contractual responsibilities of the construction team members.

1.2 DEFINITIONS

A. System: A real time web-based software that shares data, translates data, organizes data, facilitates communication, archives actions, and offers status prompts to identified Users.

B. Users: Authorized participants of this Project furnished with a unique password and authorized to access the system to view/input/export data. State, Construction Manager (as applicable), Architect or Engineer, and the Contractors are all Users. Other Users may be added as necessary.

C. Contacts: Entities identified to automatically receive specific transmissions or entities selected to receive specific information sent by the system through to an e-mail address.

D. Signees: Those individuals identified, by the Contractors, authorized to sign change orders and payment applications via electronic signature. This electronic signature is as contractually binding as an original signature on paper.

1.3 SOFTWARE AND HARDWARE REQUIREMENTS

A. Each User shall provide and maintain a computer with high-speed internet access and an email address.

B. License(s) to Use System: State will provide licenses to use the system for this Project.

1.4 USE OF SYSTEM

A. Use of the system is mandatory for the documentation of the transmittal of all non-oral information, even if the actual transmission of the information is by another means.

1. The State will **NOT** accept faxed, emailed, and/or handwritten documentation of Requests for Information, Sketches, Drawings, and/or Submittals.

B. Use of the system will be mandatory by the Contractor to send, retrieve, and respond to data.

C. The State will provide each Project team member with an invitation to web-based project management system, and the supporting documentation of each Project team member's responsibility and how to operate within web-based project management system.

1. The State will administer User accounts for this Project.

D. Official Records:

1. Documentation and records uploaded and maintained in web-based project management system will be the "Official Records" for the Project and the sole property of the State.

1.5 SUBMITTALS

A. Submit to the State the contact information, including email address, of the Contractor's key personnel that will administer the system on behalf of the Contractor.

1.6 QUALITY ASSURANCE

A. A four-hour initial training session in the use of software for this Project will be offered by the State at a location convenient to the Project site. Instructional guides will be provided for the most common tasks.

1. Attendees shall have sufficient computer skills and previous experience with web-based project management software systems.

B. Web-based support is available at Aconex Support Central site (help.aconex.com).

C. Acceptance via automated system notifications or audit logs extends only to the face value of the submitted documentation and does not constitute validation of the Contractor's submitted information.

D. Contractor shall be solely responsible for:

1. Training its staff on how to use the Aconex beyond the training provided by the State at no additional costs to the contract.
2. Validity of their information placed in Aconex.
3. Scanning of documents as necessary for the electronic submittal and attachment of necessary information related to Contractor's supporting documentation.

1.7 SYSTEM DESCRIPTION

A. The web-based project management system is Aconex (www.aconex.com) and is updated monthly.

1. Access into the various applications within Aconex will be role based.
2. The following Aconex applications shall be made available to the Project team:

a. Tasks.
b. Documents.
c. Workflows.
d. Mail.
e. Cost.

B. Web-based project management system includes, at a minimum, the following features:

1. Compilation of Project data, including Contractor, subcontractors, State, State's consultants, and other entities involved in Project. Include names of individuals and contact information.
2. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
3. Document workflow planning, allowing customization of workflow between Project entities.
4. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, Requests for Information, Submittals, Additional Detailed Instructions, and Change Orders.
5. Track status of each Project communication in real time, and log time and date when responses are provided.
6. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
7. Processing and tracking of payment applications.
8. Processing and tracking of contract modifications.
9. Creating and distributing meeting minutes.
10. Document management including revision control.
11. Management of construction progress photographs.
12. Mobile device compatibility, including smartphones and tablets.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 RESPONSIBILITIES

A. All documents submitted shall be in PDF file format unless otherwise requested.

B. The following documents shall be managed inside the system:

1. Correspondence, using Mail module.
2. RFIs
3. Submittals

    a. Placeholders
    b. Request for Substitutions

4. Financials

    a. Contract
    b. Payment Applications
    c. Change Events and Change Orders

5. Schedules including but not limited to:

    a. Baseline
    b. Monthly Progress
    c. Recovery
    d. Short Interval

6. Addenda
7. Specifications
8. Drawings, including ADI.
9. Reference Documents
10. Daily Reports
11. SWPPP
12. Inspection Reports (including Special Inspections)
13. Punchlists
14. Meeting Minutes
15. Regulatory Agency's Permits
16. Photographs
17. Closeout Documentation

3.2 QUALITY CONTROL

A. Contractor is responsible for its own connectivity to the Internet. The State will not be liable for any delays associated from the usage of Aconex including, but not limited to slow response time, down time periods, connectivity problems, or loss of information. Under no circumstances shall the usage of the Aconex be grounds for a time extension or cost adjustment to the contract.

B. The document control system shall be available for Contractor use at all times unless system maintenance (i.e., backups, upgrades, etc.) is being performed. System maintenance will generally be limited to non-core business hours. In the event a Contractor's authorized user cannot access the control system, the Contractor shall notify the State. In the event the control system becomes unavailable during normal business hours for an extended period, the Contractor may issue correspondence requiring immediate attention by the State in hard copy format. The hard copy correspondence must be entered into Aconex immediately upon becoming available again. Inability by the Contractor to gain access to the Aconex for any reason shall not be grounds for claim.

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Construction Schedule.
3. Short Interval Schedule.
4. Recovery Schedule.
5. Construction schedule updating reports.
6. Daily construction reports.
7. Unusual event reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The amount of time between earliest start date and late start date, or between earliest finish date and latest finish date of Schedule activities.

G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.
3. Three paper copies of sufficient size to display entire period or schedule, as required.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
3. Total Float Report: List of activities sorted in ascending order of total float.
4. Projected Monthly Payment Requests Report: List of Contractor’s monthly planned billings from the Notice to Proceed until Completion of the Work.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Short Interval Schedule: Submit at weekly intervals.

H. Daily Construction Reports: Submit at weekly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

1.4 QUALITY ASSURANCE

A. Scheduling Conference: State may conduct conference at Project site to review methods and procedures related to the Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.

3. Discuss constraints, including, but not limited to, phasing work, stages, area separations, interim milestones and beneficial occupancy.
4. Review delivery dates for State-furnished products.
5. Review submittal requirements and procedures.
6. Review time required for review of submittals and resubmittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for Project closeout and State startup procedures, including commissioning activities.
9. Review list of construction activities to be included in schedule.
10. Review procedures for updating schedule.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use Microsoft Project or Primavera for current Windows operating system.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 21 days.
2. Indicate start and completion dates for the following as applicable:

    a. Securing of approvals and permits required for performance of the Work.
    b. Temporary facilities.
    c. Construction of mock-ups, prototypes and samples.
    d. State interfaces and furnishing of items, if any.
    e. Regulatory agency approvals.
    f. Punch list.

3. Procurement Activities: Include procurement process activities for the long lead-time items and major items as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
4. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Commissioning Time: Include no fewer than 15 days for commissioning.
7. Punch List and Completion: Include not more than 30 days for completion of punch list items and Completion. No activities other than Startup, Testing and/or Commissioning shall be scheduled during this period.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Work by State: Include a separate activity for each portion of the Work performed by State.
2. Owner-Furnished Products: Include a separate activity for each product.

3. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Uninterruptible services.
    c. Beneficial occupancy before Completion.
    d. Use-of-premises restrictions.
    e. Provisions for future construction.
    f. Seasonal variations.
    g. Environmental control.

4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Beneficial Occupancy, and Completion, and any milestones indicated in Document 00 73 00 “Supplementary Conditions”.

F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Completion percentage for each activity.

G. Distribution of Approved Copies:

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made post in the same locations.

1.6 SHORT INTERVAL SCHEDULE

A. Short Interval Scheduling (SIS) shall be used throughout onsite construction activity. Interval shall be a 3-week projection and shall include week submitted and two weeks thereafter. It shall contain sufficient detail to evaluate daily milestones and manpower/equipment loading and shall identify/tie into monthly updated Schedule.

1.7 RECOVERY SCHEDULE

A. When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days,

crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

B. Upon acceptance by the State, incorporate Recovery Schedule into Contractor's Construction Schedule.

1.8 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within 10 days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.9 CPM SCHEDULE REQUIREMENTS

A. Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's Construction Schedule using a cost-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.

2. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities.
2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

4. Cost-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities.

    a. Each activity cost shall reflect an appropriate value subject to approval by State.
    b. Total cost assigned to activities shall equal the total Contract Sum.

D. Contract Modifications:

1. For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
2. The State shall have no obligation to consider time extension request unless requirements of Contract Documents are complied with; the State shall not be responsible or liable to Contractor for constructive acceleration due to failure of the State to grant time extensions under the Contract Documents, should Contractor fail to comply with submission requirements and justification requirements of this Contract for time extension requests. Contractor's failure to perform in accordance with Schedule shall not be excused because Contractor has submitted time extension requests, until and unless such requests are approved by the State.

E. Schedule Reports: Prepare network diagram(s) from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Dollar value of activity (coordinated with the schedule of values).
10. Cash flow report calculated by early start, late start and indicating actual progress.

F. Optional Schedule Reports: In addition to the above reports, the State may request, from month-to-month, any of the following reports:

1. Total float from least to most.
2. Activities by early start.
3. Activities by late start.
4. Activities grouped by subcontractors or selected trades.
5. Activities with scheduled early start dates in a given time frame (i.e. 30- or 60-day outlook).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

1.10 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. Approximate count of personnel at Project site.
3. Equipment at Project site.

4. Material deliveries.
5. High and low temperatures and general weather conditions, including presence of rain or snow.
6. Testing and inspection.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Services connected and disconnected.
15. Equipment or system tests and startups.

B. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise State in advance when these events are known or predictable.

1. Submit unusual event reports directly to State within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

1.11 PAYMENTS WITHHELD

A. Progress Payments may be withheld in whole or in part should Contractor fail to comply with requirements of this Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Final Completion construction photographs.
5. Preconstruction video recordings.
6. Periodic construction video recordings.
7. Construction webcam.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within seven days of taking photographs.

1. Submit photos on CD-ROM or thumb-drive and by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in file metadata tag:

    a. Name and number of Project.
    b. Date photograph was taken.
    c. Description of location, vantage point, and direction.
    d. Unique sequential identifier keyed to accompanying key plan.

C. Video Recordings: Submit video recordings within seven days of recording.

1. Submit video recordings by uploading to web-based Project management software site. Include copy of key plan indicating each video's location and direction.
2. Identification: With each submittal, provide the following information on web-based Project management software site:

    a. Name and number of Project.
    b. Date video recording was recorded.
    c. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    d. Unique sequential identifier keyed to accompanying key plan.

D. Special Publicity Photographs: Submit two photographs, taken by professional photographer, professionally mounted and framed suitable for entrance lobby or office display.

1. Frame size: 30” x 48”.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer for not less than three years.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode. Provide supplemental lighting in low light levels or backlit conditions.

C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

D. Metadata: Record accurate date and time and GPS location data from camera.

E. File Names: Name media files with date, Project number, Project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. Photographer:

B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, and in the presence of the State’s Representative, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by State.

1. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
2. Take 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

E. Periodic Construction Photographs: Take 20 photographs weekly. Following suggestions by State, select vantage points to show status of construction and progress since last photographs were taken.

F. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.

1. Frequency: Take photographs weekly, on the same day each week.
2. Vantage Points: Following suggestions by State and Contractor, photographer shall select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time, to create a time-lapse sequence as follows:

    a. Commencement of the Work, through completion of subgrade construction.
    b. Above-grade structural framing.
    c. Exterior building enclosure.
    d. Interior Work, through date of Completion.

G. Final Completion Construction Photographs: Take 100 photographs after date of Completion for submission as Project Record Documents. State will inform photographer of desired vantage points.

H. Special Publicity Photographs: Take photographs at the conclusion of construction activities. Photographs shall depict the achievement and accomplishment of the Project. State will inform photographer of desired vantage points.

1. 14 days' notice will be given, where feasible.

1.6 CONSTRUCTION VIDEO RECORDINGS

A. Preconstruction Video Recording: Before starting excavation, and in the presence of the State’s Representative, record video recording of Project site and surrounding properties from different vantage points, as directed by State.
1. Show existing conditions adjacent to Project site before starting the Work.
2. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of excavation.
3. Show protection efforts by Contractor.

B. Periodic Construction Video Recordings: Record video recording monthly. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes(s).

C. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.

1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every five minutes, from same vantage point each time, to create a time-lapse sequence of 30 minutes in length as follows:

    a. Commencement of the Work, through completion of subgrade construction.
    b. Above-grade structural framing.
    c. Exterior building enclosure.

2. Timer: Provide timer to automatically start and stop video recorder, so recording occurs only during construction work hours.
3. Vantage Points: Following suggestions by State and Contractor, photographer shall select vantage points.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. Submittals: Written and graphic information and physical samples that require State's responsive action. Submittals are those submittals indicated in individual Specification Sections. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by State and additional time for handling and reviewing submittals required by those corrections.

1. Schedule submissions during the first 90 days after a date established for the Notice to Proceed and at least 21 days before dates reviewed submittals will be needed and within the time periods specified below.
   a. Items needed in initial stages of Work or requiring long lead-time for ordering: 30 days.
   b. Deferred Approval submittals, for review and approval by Regulatory Agencies such as but not limited to Office of the State Fire Marshal, Office of Statewide Health Planning and Development, and Division of the State Architect, have long review periods. Contact these agencies at the onset of the start of construction to determine the length of time for review, back-checks and approval, and appropriately include this time in Submittal and Construction Schedule to avoid delays: 90 days.
   c. Major electrical, mechanical and equipment items other than those covered by Deferred Approval submittals: 60 days.

2. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
3. Initial Submittal Schedule: Submit within 10 days of date established for the Notice to Proceed. Include submittals required during the first 90 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
4. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

5. Format: Arrange the following information in a tabular format:

a. Scheduled date for first submittal.
b. Specification Section number and title.
c. Description of the Work covered.
d. Scheduled date for State's final release or approval.
e. Scheduled dates for purchasing.
f. Scheduled dates for installation.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of firm or entity that prepared submittal.
5. Unique submittal number, including revision identifier.
6. Submittal purpose and description.
7. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
8. Drawing number and detail references, as appropriate.
9. Indication of full or partial submittal.
10. Location(s) where product is to be installed, as appropriate.
11. Other necessary identification.
12. Remarks.
13. Signature of transmitter.

B. Options: Identify options requiring selection by State.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by State on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. State reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on State's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 21 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. State will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 21 days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from State's action stamp.

E. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from State's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

C. Samples: Submit physical samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Where size of Samples is not specified, Samples should be of sufficient size and quantity to clearly illustrate functional characteristics of product or material, with integrally related parts and attachment devices.

3. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.
4. Web-Based Project Management Software: Prepare submittals to accompany Samples in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Paper Transmittal: Include paper transmittal to accompany Samples, including complete submittal information indicated.
6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

E. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

F. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

G. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.

g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to State.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

2. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as original Drawings.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to State.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. State will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 STATE’S REVIEW

A. Submittals: State will review each submittal, indicate corrections or revisions required, and return.

1. Submittals by Web-Based Project Management Software: State will indicate, on Project management software website, the appropriate action.

a. Actions taken by indication on Project management software website have the following meanings:

1) No Exception Taken: Where the submittal is marked "No Exception Taken," the Work covered by the submittal may proceed, provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
2) Exception, See Comments: Where the submittal is marked "Exception, See Comments," the Work covered by the submittal may proceed, provided it

complies both with State's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.

3) Revise and Resubmit: Where the submittal is marked "Revise and Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to State's notations and corrections.
4) Rejected: Where the submittal is marked "Rejected," do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.

B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from State.

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

D. State will return without review submittals received from sources other than Contractor.

E. Submittals not required by the Contract Documents will be returned by State without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 29.08

BUY CLEAN CALIFORNIA REPORTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general requirements and procedures for compliance with Buy Clean California Act per California Public Contract Code, Sections 3500-3505.

B. Contractor is required to submit current facility-specific environmental product declaration for each eligible material proposed to be used on the Project.

1.02 DEFINITIONS

A. Environmental Product Declaration (EPD): Type III environmental impact label, as defined by the International Organization for Standardization (ISO) standard 14025, or similarly robust life cycle assessment methods that have uniform standards in data collection consistent with ISO standard 14025, industry acceptance, and integrity.

B. Eligible Materials: Any of the following:

1. Carbon steel rebar.
2. Flat glass.
3. Mineral wool board insulation.
4. Structural steel.

1.03 REFERENCES

A. California Department of General Services Buy Clean California Act Website: https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act.

1.04 SUBMITTALS

A. General: Buy Clean California submittals are required to be submitted along with other required submittal items for eligible materials as described in the Specifications.

B. Facility-specific Environmental Product Declaration: For each eligible material proposed to be used on the Project.

1. Facility-specific EPDs must comply with ISO 14025 and applicable Product Category Rules (PCR) located on the California Department of General Services Buy Clean California Act website.

2. Global Warming Potential (GWP) of each eligible material or product as evidenced by its environmental product declaration shall not exceed the maximum acceptable global warming potential values established by the California Department of General Services.

Do not install the applicable material or product until the submittal is authorized. California Department of General Services publishes the maximum acceptable global warming potential for each category of material or product on its website.

a. Maximum acceptable GWP limits for eligible materials are located on the California Department of General Services Buy Clean California Act website: https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by State, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

B. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

D. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."

G. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

H. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by State.

1.3 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to State.

B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the State regarding the conflict. Use the requirement(s) that is/are more stringent and/or of higher quality and/or higher quantity.

1.5 SUBMITTALS

A. Reports: Prepare and submit certified written reports, products test reports, and documents as required and/or specified.

B. Permits, Licenses, and Certificates: For State’s record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.6 REPORTS AND DOCUMENTS

A. Manufacturer's Technical Representative's or Factory-Authorized Service Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

1.7 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of California or jurisdiction where Project is located, and who has minimum of five years of experience in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Mockups / Field Samples: Before installing portions of the Work requiring mockups / field samples, build mockups / field samples for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups / field samples of size indicated.
2. Build mockups / field samples in location indicated or, if not indicated, as directed by State.
3. Notify State seven days in advance of dates and times when mockups / field samples will be constructed.

4. Employ supervisory personnel who will oversee mockup / field sample construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain State's acceptance of mockups / field samples before starting corresponding Work, fabrication, or construction.

    a. Allow 21 days for initial review and each re-review of each mockup / field sample.

7. Promptly correct unsatisfactory conditions noted by State's preliminary review, to the satisfaction of the State, before completion of final mockup / field sample.
8. Acceptance of mockups / field samples by the State does not constitute approval of deviations from the Contract Documents contained in mockups / field samples unless State specifically accepts such deviations in writing.
9. Maintain mockups / field samples during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups / field samples when directed unless otherwise indicated.

1.8 QUALITY CONTROL

A. State Responsibilities: Where quality-control services are indicated as State's responsibility, State will engage a qualified testing agency to perform these services.

    1. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

    2. Tests and inspections shall be performed by State's testing laboratory in conformance with California Code of Regulations, Title 24 as noted in individual specifications sections.

B. Contractor Responsibilities: Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

    1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
    2. Engage a qualified testing agency to perform quality-control services.

        a. Contractor shall not employ same entity engaged by State, unless agreed to in writing by State.
        b. Testing, Adjusting, and Balancing of Systems: These services shall be provided by approved testing organization in conformance with requirements for services specified in individual sections pertaining to each system.

    3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
    4. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
    5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspection equipment at Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

G. The State shall have the right to reject materials and workmanship which are defective or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the State. If Contractor does not correct such rejected work within a reasonable time, fixed by a written notice, the State may correct same and charge the expenses to Contractor.

H. Should it be considered necessary or advisable by the State at any time before Acceptance of the Work to make examination of work already completed by removing or tearing out same, Contractor shall, on request, promptly furnish necessary facilities, labor and materials. If such work is found to be defective in any respect due to fault of Contractor or subcontractor, Contractor shall defray all expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet requirements of the Contract, additional cost of labor and material necessarily involved in the examination and replacement will be allowed to the Contractor.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: State will engage a qualified testing agency and/or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of State.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Notify State's Inspector 48 hours in advance of operations to allow for laboratory assignment of personnel and scheduling of tests. When tests or inspections cannot be performed after such notice, reimburse the State for laboratory personnel and travel expenses incurred due to Contractor's negligence.

B. When additional testing services are needed for Contractor's convenience, employ and pay for services of separate, equally qualified independent testing laboratory; or make arrangements with State's laboratory and pay for additional samples and tests required for Contractor's convenience.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, State, testing agencies, and authorities having jurisdiction.

B. Sewer, Drainage, Water, Gas, Telecommunication and Electric Power Service: Pay connection and service use charges for usage by all entities for construction operations.

1.3 SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel. Site Utilization Plan to be reviewed and approved by SFM prior to mobilization.

B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

C. Erosion and Sedimentation Control Plan: Show compliance with requirements of State Water Resources Control Board General Permit for Discharges of Storm Water Associated with Construction Activity or authorities having jurisdiction, whichever is more stringent.

D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

E. Dust-, Odor- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste-handling procedures.
5. Other dust-control measures.
6. Other odor-control measures.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

1. Construct and maintain temporary electrical facilities in accordance with California Electrical Code, California Public Utilities Commission “Rules for Overhead Line Construction” (General Order No. 95), and requirements of utility company providing service. Materials, devices, and equipment used for these facilities shall be in good and safe condition but need not be new.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before State’s acceptance, regardless of previously assigned responsibilities.

B. Construction Equipment: Erect, equip, operate, and maintain construction equipment in strict accordance with applicable statutes, laws, ordinances, rules, and regulations of authorities having jurisdiction.

1. Provide and maintain scaffolding, staging, runways, and similar equipment, as needed.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Field Offices for the State use: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

1. Trailer shall display California Commercial Coach Insignia as evidence of meeting or exceeding minimum Construction and Fire Safety requirements of Title 25, California Code of Regulations (CCR), Chapter 3, Sub Chapter 2, Article 3.
2. Wind and snow load design requirements shall meet most stringent criteria for project location during Contract period.
3. Install trailer as directed by State and in accordance with above referenced 25 CCR 3.2.3. Jack up trailer and level both ways; mount on concrete piers (with load off wheels). Furnish and install required tie down accessories per Section 4368 of referenced 25 CCR 3.2.3.
4. Provide two exterior doors, with steps and entry platform at each exterior door as required. If required, one door should have an accessible ramp.

5. Windows, doors and vents shall be provided with insect screens; maintain in good condition during Contract.
6. Trailer office and furnishings shall remain property of Contractor, remove from site upon completion of Contract.

B. Field Office: Of sufficient size, minimum 12 x 42 feet to accommodate needs of State personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents:
   a. Desk: 2 ea., 34” x 60”, locking, double-pedestal, three drawers on one pedestal, and one drawer and one file drawer on other pedestal; laminated plastic top. One swivel chair per desk, steel, with arms, adjustable with casters.
   b. File cabinet: 2 ea., four drawers, steel, locking, legal size.
   c. Plan table: 1 ea., 42” x 72”, adjustable, wood or steel with drawers. One drafting stool per table, steel, adjustable with casters.
   d. Plan racks: 1 ea.
   e. Bookcases: 1 ea., 36” x 72”, six shelves, wood or steel.
   f. Coat rack: 1 ea.
2. Partition office to provide private office(s), conference room, and separate room to contain plan tables.
3. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
4. Drinking water dispenser or bottled water service.
5. Private toilet with water closet and handwash station, to be serviced, cleaned and stocked weekly or more frequent, if necessary. Provide accessible toilet if required.
6. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
   a. Provide unit mounted on end of trailer: of sufficient function, capacity and ductwork for equal distribution of air conditioning to all rooms. Roof mounted units are not acceptable.
7. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Field Office for Contractor use: Contractor may provide at their expense field office facilities for Contractor’s use as desired.

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless State authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If State authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in

system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. See other Sections for disposition of salvaged materials that are designated as State's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, State, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to State's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to State. At Beneficial Occupancy, restore these facilities to condition existing before initial use.
1. Pay for all water used during time of this Contract. Arrange with water company for transfer of water payment responsibility.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of State's existing or new toilet facilities is not permitted.

F. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for storage of materials, curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Follow manufacturer's recommendations and industry practice standards for proper protection of stored and installed materials. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

G. Temporary Heating and Cooling: Permanent heating system shall not be used for temporary heat until it has undergone operational testing and is approved by the State. No demand shall be made by Contractor for use of permanent heating system for temporary heat, except with consent of State and by agreement in writing for use mutually acceptable to State and Contractor.

1. Operation and Maintenance: Provide operator, maintain permanent heating system, and continue to do so during entire time temporary heat is required, and until entire Work of this Contract is accepted by State. Maintenance shall include replacement of filters and other dispensable items.

a. Refer to technical specifications for requirements relating to replacement of filters and other items used for temporary heating.

2. Payment for Use: Cost of fuel, operators, and maintenance for permanent heating system shall be borne by Contractor until acceptance of building by State.

H. Gas Service: Provide gas service and distribution system of sufficient size, and capacity characteristics required for construction operations.

I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

J. Lighting: Provide temporary lighting that provides adequate illumination for construction operations, observations, inspections, and traffic conditions or as designated by the State.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all State's construction personnel. Install one land-based telephone line(s) for each field office.

1. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.

L. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by State.

1. Minimum Internet Connection Requirements:

a. Download Speed: 25 Mbps.
b. Upload Speed: 3 Mbps.

M. Printer: Wireless "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions. Printer to be maintained and operable by contractor with paper and toner.

N. Computer Docking Station: Provide one docking station per field office adequate for use by State to access Project electronic documents and maintain electronic communications. Docking station model shall be compatible with the State issued laptop or tablet computer. Equip docking station with not less than the following:

1. Display: 24-inch LCD monitor, two per docking station.
2. Full-size keyboard and mouse.
3. Network Connectivity: Gigabit.
4. Printer: Wireless "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.

O. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.

a. Spaces used by Contractor and subcontractors for materials storage and/or staging within building, shall be protected and restored before completion of Contract to prior existing or better than prior existing condition.

2. Maintain support facilities until State schedules final inspection. Remove before Completion.

P. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

Q. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

R. Parking: Personnel involved in construction operations shall comply with parking and traffic regulations for use of streets, as enforced by authorities having jurisdiction, except for other arrangements as may be agreed to between Contractor and authorities having jurisdiction.
1. Provide temporary parking areas for construction personnel.
2. Use designated areas of State’s existing parking areas for construction personnel.

S. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

T. Project Signs: Not required.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.

a. Construct sign in sturdy fashion with sign on one face, and wood framing as detailed.

1) Set posts plumb and true in concrete footings.

b. Upon contract completion, remove sign and restore area to original condition.

U. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

V. Other Signs or Advertising: Not permitted, except that Contractor's name may be placed on Contractor's field office.

W. Lifts and Hoists: Provide and maintain hoists and construction elevators, including elevators for hoisting workmen; complete with operators, power and signals, as required per Safety Orders of State of California Division of Industrial Safety.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Security: Secure building and grounds at Project site from vandalism or theft, during entire time of Contract.

C. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 10 00 "Summary."

D. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Section 01 57 23 "Temporary Storm Water Pollution Control" and Section 31 25 00 "Storm Water Pollution Prevention Plan".

E. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to State.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

3.5 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work per manufacturer's recommended practices.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during construction and remain wet for 48 hours are considered defective and require replacing.

b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to State.
c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

B. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Completion.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. State reserves right to take possession of Project identification signs.
2. At Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temporary stormwater pollution controls.
2. Preparation, implementation and monitoring of the General Construction Storm Water Permit (General Permit) and the Storm Water Pollution Prevention Plan for the purpose of preventing the discharge of pollutants and sediments from the Project site into receiving waters.

1.2 REGULATORY REQUIREMENTS

A. Comply with the State Water Resources Control Board, Regional Water Quality Control Board (RWQCB), county, city, municipality, and other local agency requirements regarding storm water discharges and management. The State does not obtain local permits.

B. Electronically file and provide all Permit Registration Documents (PRD) including, but not limited to Notice of Intent (NOI), Site Map, SWPPP, Risk Assessment, Annual Fees, ATS Design Document (if required), Water Balance Calculations (if required) and Certification; and pay fees to the State Water Board.

1. Fact Sheets about the permit can be found at http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo_2009_0009_complete.pdf.

2. Pay annual renewal fees until Completion (as defined by the General Conditions) of the project at which time the Notice of Termination (NOT) must have been previously approved by the appropriate RWQCB.

C. Employ, for the entire Construction Contract, the services of a Qualified SWPPP Developer (QSD) who is authorized to develop and revise the SWPPP, and a Qualified SWPPP practitioner (QSP) who is assigned responsibility for non-storm water and storm water visual observations, sampling and analysis and responsible to ensure full compliance with the permit and implementation of all the elements of the SWPPP.

D. Any engineering work involved in the development of the SWPPP shall be accomplished by a Civil Engineer, licensed in the State of California.

1.3 STORMWATER POLLUTION PREVENTION PLAN

A. The Stormwater Pollution Prevention Plan (SWPPP) has not been prepared for the site. Prepare the SWPPP in its entirety in accordance with all the requirements of the General Construction Storm Water Permit (SWRCB Order 2010-0014-DWQ). Prepare this Plan by showing the Best Management Practices (BMP) for the prevention and control of pollutants and erosion on the

site upon Notice to Proceed (NTP). Contractor is responsible to implement the SWPPP and make revisions to the Plan as necessary until the RWQCB's approval of the NOT.

1. Information on the Permit can be found on the internet at http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

2. The project is Risk Level is: 2

B. Do not commence grading until the SWPPP has been prepared and reviewed by the State, the PRD has been filed with the RWQCB, and the RWQCB has issued a Water Discharger Identification (WDID) number.

C. Erosion and sediment controls must be in place prior to the commencement of grading and any storm event.

1.4 MEETINGS

A. Meetings: Conduct conference at Project site.

1. Review requirements of the SWPPP, including permitting process, worker training, and inspection and maintenance requirements.

1.5 SUBMITTALS

A. Stormwater Pollution Prevention Plan (SWPPP): Submit completed SWPPP within 14 days after the Notice to Proceed date. The State will review the SWPPP within 14 days. If revisions are required, make corrections and resubmit within 7 days.

B. Project Registration Documents (PRD): Submit electronic copy in Adobe PDF document format after filing it with RWQCB.

C. Closeout Documents: Notice of Termination filed and approved by the appropriate RWQCB.

D. Qualifications Data: Licensing/certifications of the QSD and QSP.

E. Schedule of Values shall include separate line items for the SWPPP development, SWPPP reporting, and maintenance for the SWPPP Work.

F. Monthly SWPPP reports and related documents including Rain Event Action Plans (REAP's). These reports shall be included with the Contractor's Payment Requests.

1.6 QUALITY ASSURANCE

A. QSP and QSD: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.

1. QSD shall complete and finalize the SWPPP form.
2. QSD and QSP shall be responsible for inspections and maintaining of all requirements of the SWPPP.

B. Installers: Trained as indicated in the SWPPP.

1.7 LIABILITIES AND PENALTIES

A. Review of the SWPPP, prepared by the Contractor, shall not relieve the Contractor from liabilities arising from non-compliance with storm water pollution regulations. State review of the SWPPP, prepared in its entirety by the Contractor, shall not relieve the Contractor from liabilities arising from non-compliance with storm water pollution regulations.

B. Contractor shall be held responsible for paying all penalties for violations of permit conditions. The State shall recover from the Contractor all costs of any fines against the State, due to non-compliance by the Contractor.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

A. Provide temporary stormwater pollution controls as required by the SWPPP.

PART 3 - EXECUTION

3.1 IMPLEMENTATION

A. Comply with the requirements of the General Construction Storm Water Permit (SWRCB Order 2010-0014-DWQ) and the SWPPP. QSD shall update the SWPPP and have the SWPPP including maps, reports, weather records and training records available at the construction site at all times.

1. A “Water Pollution Control” exhibit no smaller than 24 inches x 36 inches shall always be mounted in a full view in the construction trailer.
2. Subsequent to the State’s verification of the Contractor’s QSD’s and QSP’s certifications and licenses, the State will authorize access for the QSD and QSP like to the project’s Stormwater Multiple Application and Report Tracking System (SMARTS) account as “data submitters”. As data submitters, the contractor’s QSD & QSP will upload all required documents including, but not limited to, all the NOI documents, rain event data, exceedance reports and annual reports within the Construction General Permit time frames.

B. Implement best management practices for control of all pollutants including sediment, concrete and cement plaster waste, paint, fertilizers, soil amendments and other construction related pollutants.

C. Implement an effective combination of erosion and sediment controls by stabilizing all disturbed soil, paying attention to exposed slopes. Back up erosion prevention measures with sediment control measures. Ensure all control measures are adequate, in place, and in operable condition.

D. QSP shall conduct site inspections, and no duties shall be delegated to non-certified personnel, in accordance with the General Construction Storm Water Permit and the SWPPP before, during extended storm events, and after each storm event to identify areas that may contribute to erosion and sediment problems or any other pollutant discharges. If additional control measures are needed, implement them immediately. Document all inspection findings and actions taken in detailed, site specific inspection reports. These reports must be maintained on site for review.
1. For Risk Level 1 projects, monitor in accordance with the requirements in Attachment C of the General Construction Storm Water Permit.

2. For Risk Level 2 projects, monitor in accordance with the requirements in Attachment D of the General Construction Storm Water Permit.
3. For Risk Level 3 projects, monitor in accordance with the requirements in Attachment E of the General Construction Storm Water Permit.
4. QSP shall upload all sampling data into SMARTS in accordance with the appropriate Attachment, based on Risk Level.

E. Maintain and repair all erosion prevention and sediment control measures throughout the season and until Completion (as defined by the General Conditions) of the project. Keep replacement supplies on the site.

F. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

G. Train all site personnel in erosion prevention and sediment control techniques, and the responsibilities under the General Construction Storm Water Permit at the beginning of the project and on a monthly basis.

H. Immediately report to the RWQCB office and the State, of any instances of sediment or other pollutant discharges from the site.

I. Obtain QSP services and pay for such services and for any sampling, testing, and analysis of storm water as required for compliance with the General Permit and the SWPPP.

J. Make the SWPPP available to the RWQCB staff, State staff, and any delegated local agency staff, and correct any requirements imposed as a result of their inspections within 72 hours, or prior to a rain event, whichever is sooner.

3.2 CERTIFICATION AND REPORTS

A. On the first of the month, as determined by the requirements of the General Permit, the SWPPP and the State Water Resources Board, each year during the construction period, submit an annual certification report (for the previous compliance year) as outlined in the General Permit, to the State Water Resources Control Board and the State, indicating that the construction activities are in compliance with the General Permit and the SWPPP.

1. Respond to any comments within 72 hours after receipt. The annual report shall be prepared by the QSD. This reporting shall continue until a Notice of Termination is approved by the Regional Water Quality Control Board.

B. Prior to Completion of the project submit records of all inspections, compliance certifications and noncompliance reports to the State in dated, tabbed, indexed binders and electronically.

C. Prior to Completion of the project, the QSD shall file a Final Annual Report and a Notice of Termination with the State Water Resources Control Board via the SMARTS.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and substitutions.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a substitution request, if applicable.

D. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."

E. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.

5. Store loose granular materials on solid surfaces in well-drained area; prevent mixing with foreign matter.
6. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
7. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
8. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the State or endorsed by manufacturer to State.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for State and issued in the name of the State or endorsed by manufacturer to State.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Components required to be supplied in quantity within individual Specification Sections shall be the same and shall be interchangeable.
3. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
4. State reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
5. Where products are accompanied by the term "as selected," State will make selection.
6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

7. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," comply with requirements in Section 01 25 00 “Substitution Procedures" to obtain approval for use of an unnamed product.

    a. Submit additional documentation required by State in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the State, whose determination is final.
    b. Where the words "or equal" are used following trade names, patented products, or proprietary products or methods, they shall be deemed to read "or equal in quality, design, utility and suitability"; as solely determined by the State. Where such trade names, products, or methods are without the use of the words "or equal", they shall be deemed to be followed by the words "or equal in quality, design, utility and suitability" as solely determined by the State.

B. Product Selection Procedures:

1. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

    a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of an unnamed product is considered a substitution.

2. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

    a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of products of an unnamed manufacturer is considered a substitution.

3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.

    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions.

C. Visual Selection Specification: Where Specifications include the phrase "as selected by State from manufacturer's full range" or a similar phrase, select a product that complies with requirements. State will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

D. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.

1. Select products for which sustainable design documentation submittals are available from manufacturer.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 64 00

OWNER-FURNISHED PRODUCTS

PART 1 - OWNER FURNISHED OWNER INSTALLED (OFOI)

1.1 SUMMARY

A. Modular Systems Furniture (MSF):

1. State will provide and install new and/or used MSF and other equipment as indicated in the Equipment Plan and Schedule in the drawings.
2. Contractor shall cooperate with State's installers to facilitate the execution of the MSF and other equipment installers' required services.
3. Contractor shall have specific components of MSF installation to perform.
4. Contractor shall install owner furnished safe, clock, photo backdrop and TV monitor and support brackets as indicated in drawings.

1.2 PRODUCTS (Not Applicable)

1.3 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall include MSF installation in Contractor's baseline and progress construction schedules.

1. The State's installation duration for MSF is typically15 calendar days.
2. Installation of MSF shall not take place until construction of tenant improvements are complete within the areas of delivery and installation.

B. Contractor shall attend State-arranged pre-installation meeting(s) for MSF at the project site.

1. Contractor's electrical and tele/data sub-contractors must attend pre-installation meeting(s).

C. After-hours Access: Contractor shall provide after-hours access to MSF installers

D. Contractor shall provide suitable, clean staging area(s) adjacent to installation area for MSF product prior to, and during, installation.

E. Contractor shall perform all hard-wiring of State's MSF electrical, data and voice requirements to include but not limited to the whips to Point-of-Connection. This includes base feed locations and MSF power poles as applicable. Whips and power poles for MSF will be supplied by the State. The complete installation of the MSF electrical, data and voice may be done in phases as the requirements of the MSF installation requires.

1. Contractor shall trim base electrical whips to length.
2. Contractor shall trim power poles to fit per MSF installer's instructions.
3. Contractor shall provide and install seismic bracing of MSF power poles.
4. Contractor shall cut ceiling tile for MSF power poles and install MSF ceiling trim for power poles. Trim provided by MSF installers.

F. Contractor shall install and terminate project tele/data cabling and outlets in MSF workstations in panel bases.

1. Cabling, outlets, and terminations shall all be provided by Contractor and are not considered a part of the State's MSF equipment.
2. Tele/data termination outlets must fit in State's standard MSF bases. Size of base standard punch-outs shall be confirmed by Contractor prior to submittal of tele/data termination outlets.

PART 2 – OWNER FURNISHED CONTRACTOR INSTALLED (OFCI)

2.1 SUMMARY

A. Roof joists

1. State will provide roof joists.

B. Concrete Masonry Units (CMU)

1. State will provide masonry materials, as specified.

C. Mechanical Equipment

1. State will provide mechanical equipment, as specified.

2.2 PRODUCTS

A. Roof joists

1. State will provide roof joists. Contractor to provide all components necessary for a complete installation, as per plans and specifications.

B. Concrete Masonry Units (CMU)

1. State will provide the following masonry materials, per 04 22 00. Contractor to provide all mortar, grout, reinforcing bars, spacers, flashing, anchor bolts, expansion anchors, adhesive anchors, screw anchors, cleaning, sealers, and any other items required for a complete installation, as per plans and specifications:

Quantity	Material
855	8816 DOE BB NAT (MT)
500	8816 OE STD NAT (MT)
90	8816 STD NAT (MT)
55	888 HALF SASH NAT (MT)
15	888 UBM NAT (MT)
500	8816 PIL ALT C NAT (MT)
515	8816 GF OE BB S515B
290	8816 GF OE STD S515B
35	888 GF UBM S515B
140	8816 GF OE CRNR S515B
230	8816 G2F OE BB S515B
70	8816 G2F OE STD S515B

10	8816 G2F OE STD SASH S515B
10	888 G2F HALF SASH S515B
30	888 G2F UBM S515B
40	2816 GF+TOP S515B
25	8816 G2F1E CRNR S515B
40	2816 GF+TOP S703R
3000	8816 GF OE BB S703R
785	8816 GF OE STD S703R
320	8816 GF OE STD S703R SASH
285	888 GF HALF SASH S703R
150	888 GF UBM S703R
150	8816 GF OE CRNR S703R
160	8816 GF+1E PIL ALT S703R
80	8816 GF+2E PIL AT S703R
3500	8816 DOE BB S703R
970	8816 OE STD S703R
460	8816 OE STD SASH S703R
180	8816 STD S703R
440	888 HALF SASH S70R
400	888 UBM S703R
370	8816 PIL ALT C S703R
60	8416 OE BB S703R
1470	**TOTAL UNITS**

C. Mechanical Equipment

1. State to provide the following mechanical equipment, contractor to provide the balance of equipment necessary for a complete installation, as per plans and specifications:

Quantity	Equipment	Model Number
1	Mitsubishi Loosnay	TLGHF1200RVX02A
1	Lossnay ERV Remote Controller	TZ-62DR-EA
1	Trane – Mitsubishi VRF Outoor Unit	TURYP0723AN40AN
2	Indoor Unit Accessory	TLP-41EAEU
1	Reducer	CMY-R302S-G1
1	VRF Controls – Centralized Controller	TE-200A
1	Trane – Mitsubishi VRF Wall Mounted Indoor Unit	TPKFYP006LM140A
13	Indoor Unit Accessory – Grille	TLP-18FAU
16	Ball Valve 3/8”	BV38BBSI
16	Ball Valve 5/8”	BV58BBSI
1	VRF Controls – MNET Converter	PAC-SJ96MA-E
1	F600 / F1200 FILTER	PZ-100RFP-E
1	Accessory 16 Branch Main BC	TCMBM1016JA11N4
1	Mitsubishi Ductless Split Outdoor Unit	TRUZA0121KA70NA
13	Mitsubishi VRF Indoor Unit Ceiling – Cassette	TPLFYP005FM140A
1	Wall Mounted Indoor Unit	TPKA0A0121LA00A
2	Mitsubishi VRF Indoor Unit Ceiling - Cassette	TPLFYP012EM140B
17	T-Stats	TAR-40MAAU
2	Condensate Pump	X87-721

1	VRF Controls	LICENSE SOFTWARE-BACNET-MASTER
1	Air Handling Unit & Curb – Captive Aire	CASTU3-I.400-24-15T
1	Exhaust Cook Fan	SQN-D (VF)

2.3 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall include all labor, tools, and equipment to install OFCI materials.

B. Contractor shall include all transportation of OFCI materials to the job site.

1. Joists are currently located on site and will need to be relocated for site work to take place.
2. CMU will be located at nearby Caltrans Yard, less than a quarter mile from jobsite.
3. Mechanical Equipment will be located at 725 S. Lexington Street, Delano, CA 93215, less than one mile from the jobsite.

C. Contractor responsible to protect OFCI materials from damage and loss and store in secure locations, when necessary.

D. Contractor shall seek to extend manufacturer's warranties on OFCI materials and equipment, where possible.

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Coordination of State's portion of the Work.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection and repair of installed construction.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

C. Layout Conference: Conduct conference at Project site.

1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform State of scheduled meeting.
2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.3 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural and Other Construction Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify State of locations and details of cutting and await directions from State before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection. Do not cut and patch other construction elements or components in a manner that could change their load-carrying

capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

2. Patching shall achieve security, strength, and weather protection, and shall preserve continuity of existing fire ratings.

3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in State's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner. Patching shall successfully duplicate undisturbed adjacent finishes, colors, textures, and profiles. Where there is a dispute as to whether duplication is successful or has been achieved to a reasonable degree, the State's judgment shall be final.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to State for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of all underground utilities, and other construction affecting the Work.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to State in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify State promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

3.4 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by State. Maintain conditions required for product performance until Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by State.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by State. Fit exposed connections together to form hairline joints.

I. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.5 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

3.6 COORDINATION OF STATE'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for State's construction personnel and State's separate contractors.

B. Coordination: Coordinate construction and operations of the Work with work performed by State's construction personnel and State's separate contractors.

1. Construction Schedule: Inform State of Contractor's preferred construction schedule for State's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify State if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include State's construction personnel and State's separate contractors at preinstallation conferences covering portions of the Work that are to receive State's work. Attend preinstallation conferences conducted by State's construction personnel if portions of the Work depend on State's construction.

3.7 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 91 13 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.9 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Completion.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the construction waste management and disposal.

B. Waste Management Objective for the Project:

1. Project shall minimize the generation of construction and demolition waste at the site.
2. Waste disposal in landfills shall be minimized.

1.2 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to State that may be uncovered during demolition remain the property of State.

1. Carefully salvage in a manner to prevent damage and promptly return to State.

1.4 SUBMITTALS

A. Construction Waste Estimate: Within 14 calendar days after Start Date of the Work, or prior to any waste removal, whichever occurs sooner, submit construction waste estimate, using the Form 01 74 19.01 “Construction Waste Estimate”. Include the following information:

1. Estimate of total job site waste to be generated, including material types and quantities.
2. Estimate of percentages of waste categories to landfill, to be reused, and to be recycled.

B. Waste Management Report: Upon completion of Work, including final cleanup, provide a final waste management report containing the information required in Form 01 74 19.02 “Waste Management Report”. Include the following information:

1. Total quantity of each waste material generated; and the date(s) removed from the project site.
2. Percentages of waste categories to landfill, to be reused, and to be recycled.
3. Identity of the landfill / receiving facility, handling costs, transport costs, tipping fees paid at the landfill, and total landfill costs. Attach copies of manifests, weight tickets, receipts, and invoices.
4. For each material reused or recycled from the Project, include the total costs of handling and transportation, and income. Attach manifests, weight tickets, receipts, and/or invoices.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

1. California Department of Resources Recycling and Recovery (CalRecycle); Telephone (916) 341-6300; https://www.calrecycle.ca.gov/condemo.
2. Local Integrated Waste Management Programs and Re-Use Programs in the Project area.
3. California Department of Toxic Substances Control (DTSC).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

B. Diversion from Landfill: Waste categories appropriate for diversion from landfill shall include, but not be limited to, the following:

1. Land clearing debris
2. Soil
3. Wood: Clean dimensional wood, palette wood
4. Sheet Wood: Plywood, OSB and particle board
5. Concrete
6. Bricks
7. Concrete Masonry Units (CMU)
8. Asphalt Concrete
9. Paper

a. Bond
b. Newsprint
c. Cardboard and paper packaging materials

10. Cement Fiber Products: Shingles, panels, and siding
11. Metals

a. Ferrous
b. Non-ferrous

12. Paint
13. Rigid Foam
14. Glass
15. Plastics
16. Carpet and pad
17. Beverage containers
18. Insulation
19. Gypsum Board
20. Porcelain Plumbing Fixtures
21. Fluorescent Light Tubes (per Department of Toxic Substances Control regulations).

PART 3 - EXECUTION

3.1 IMPLEMENTATION

A. General: Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator or designate on-site party to be responsible for implementing, monitoring, and reporting status of waste management work.

1. Distribute copies of the Construction Waste Estimate and Waste Management Report forms to the Job Site Foreman and each Subcontractor.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

D. Meetings: Conduct Waste Management meetings with subcontractors who generate construction waste. Present current status of the Waste Management Report at regular job-site meetings.

3.2 DEMOLITION AND CONSTRUCTION WASTE MANAGEMENT

A. Materials Handling Procedures: Provide means by which waste materials will be protected from contamination and means to be employed in reuse or recycling of waste material consistent with requirements for acceptance by receiving facilities.

B. Separation Facilities: Lay out and label a specific area to facilitate separation of materials for reuse and recycling. Recycling and waste bin areas shall be kept neat and clean and clearly marked to avoid contamination of materials.

C. Hazardous Wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations, and in accordance with specifications for such work as may be included in this Project.

D. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at appropriate stages of the Project.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

3.4 ATTACHMENTS

A. Form 01 74 19.01: Construction Waste Estimate.

B. Form 01 74 19.02: Waste Management Report.

END OF SECTION

CONSTRUCTION WASTE ESTIMATE

Date: _____

Waste Material (Edit to Suit)	Unit	Estimated Quantity Generated	Percent to Landfill	Percent Reused	Percent Recycled
Land Clearing Debris	CY				
Soil	CY				
Wood	CY				
Sheet Wood	CY				
Concrete	CY				
Bricks	CY				
Concrete Masonry Units	CY				
Asphalt Concrete	CY				
Paper	CY				
Cement Fiber Products	CY				
Metal (ferrous)	TON				
Metals (non-ferrous)	LBS				
Paint	GAL				
Rigid Foam	CF				
Glass	CF				
Plastics	CF				
Carpet and Pad	SY				
Beverage Containers	LBS				
Insulation	CF				
Gypsum Board	CF				
Porcelain Plumbing Fixtures	EA				
Fluorescent Light Tubes	EA				

WASTE MANAGEMENT REPORT
QUANTITIES

Waste Material (Edit to Suit)	Unit	Date Removed	Total Quantity Generated	Percent to Landfill	Percent Reused	Percent Recycled
Land Clearing Debris	CY					
Soil	CY					
Wood	CY					
Sheet Wood	CY					
Concrete	CY					
Bricks	CY					
Concrete Masonry Units	CY					
Asphalt Concrete	CY					
Paper	CY					
Cement Fiber Products	CY					
Metal (ferrous)	TON					
Metals (non-ferrous)	LBS					
Paint	GAL					
Rigid Foam	CF					
Glass	CF					
Plastics	CF					
Carpet and Pad	SY					
Beverage Containers	LBS					
Insulation	CF					
Gypsum Board	CF					
Porcelain Plumbing Fixtures	EA					
Fluorescent Light Tubes	EA					

WASTE MANAGEMENT REPORT
COST / INCOME

Waste Material (Edit to Suit)	Unit	Receiving Facility	Landfill Cost			Reused		Recycled	
			Handling	Transport	Fee	Cost	Income	Cost	Income
Land Clearing Debris	CY								
Soil	CY								
Wood	CY								
Sheet Wood	CY								
Concrete	CY								
Bricks	CY								
Concrete Masonry Units	CY								
Asphalt Concrete	CY								
Paper	CY								
Cement Fiber Products	CY								
Metal (ferrous)	TON								
Metals (non-ferrous)	LBS								
Paint	GAL								
Rigid Foam	CF								
Glass	CF								
Plastics	CF								
Carpet and Pad	SY								
Beverage Containers	LBS								
Insulation	CF								
Gypsum Board	CF								
Porcelain Plumbing Fixtures	EA								
Fluorescent Light Tubes	EA								
		TOTALS:							

SECTION 01 74 20

RECYCLED CONTENT CERTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the recycled content certification.

B. Recycled content reporting for the Project.

1. Document and report the percentage of recycled content in materials, products, equipment and furnishings installed and provided for this Project.
2. State Agency Buy Recycled Campaign (SABRC) is a joint effort between the Department of General Services and the California's Department of Resources Recycling and Recovery (CalRecycle) to implement the State law. Public Contract Code, Sections 12200-12320 require State agencies to purchase recycled content products instead of non-recycled content products in eleven (11) product categories, to ensure that a minimum percentage of purchases in those categories have recycled content, and report these purchases annually to CalRecycle. The certification and reporting is utilized to comply with those requirements.
3. All products that can be classified as being in one of the eleven (11) categories must be included in the reporting, whether the product is a recycled content product or non-recycled content product. Only products that can be classified in one of the categories shall be reported.

1.2 DEFINITIONS

A. Product Categories: Recycled content categories identified for purchasing and reporting of products.

1. Paper products.
2. Printing and writing papers.
3. Mulch, compost, and co-compost products.
4. Glass products.
5. Lubricating oils.
6. Plastic products.
7. Paint.
8. Antifreeze.
9. Tires.
10. Tire-derived products.
11. Metal.

B. Recycled Content Product (RCP): All materials, goods, and supplies that are from one of the eleven (11) Product Categories that contains the minimum percentages of secondary and postconsumer materials stipulated in the Form 01 74 20.01 "Recycled Content Certification Worksheet" footnotes.

C. Non-Recycled Content Product (non-RCP): All materials, goods, and supplies that are from one of the eleven (11) Product Categories having no recycled content or less than the minimum

percentages of secondary and postconsumer materials stipulated in the Form 01 74 20.01 “Recycled Content Certification Worksheet” footnotes.

1.3 REFERENCES

A. State Agency Buy Recycled Campaign: https://www.calrecycle.ca.gov/buyrecycled/stateagency.

1. Access this website for information on the Buy Recycled Campaign.

1.4 SUBMITTALS

A. Form 01 74 20.01 “Recycled Content Certification Worksheet”: Submit with each product submittal from one of the eleven (11) Product Categories, containing the following information:

1. Product Description, with applicable specification section of product.
2. Quantity of product.
3. Estimated material dollar value including any taxes and delivery cost.
4. Designate the Product Category for each product listed.
5. Designate whether product is a Recycled Content Product.
6. Estimate of percentage of material content.
7. Attach a copy of the manufacturer’s or vendor’s data sheet showing recycled content percentages if product is reported as a Recycled Content Product.

B. Form 01 74 20.02 “State Agency Buy Recycled Campaign Procurement Summary”: Submit with each product submittal from one of the eleven (11) Product Categories, containing the following information:

1. Product Category.
2. All reportable purchases, quantity and dollar value including any taxes and delivery cost.
3. Recycled Content Product purchases, quantity and dollar value including any taxes and delivery cost.
4. Percent of Recycled Content Product purchases, quantity and dollar value including any taxes and delivery cost.

1.5 CLASSIFICATION OF PRODUCTS

A. Recycled content products and non-recycled content products that are made from multiple material types should be reported in the product category of the material type representing most of the product.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.1 IMPLEMENTATION

A. Recycled Content Manager: Designate an individual responsible for instructing suppliers and subcontractors, and overseeing and documenting results of Recycled Content Certification for the Project. Recycled Content Manager shall document results of submitted Form 01 74 20.01

"Recycled Content Certification Worksheets" on the Form 01 74 20.02 "State Agency Buy Recycled Campaign Procurement Summary", in total for each product category. Only reportable products from one of the eleven (11) categories should be recorded.

B. Distribution: Recycled Content Manager shall provide copies of the Form 01 74 20.02 "State Agency Buy Recycled Campaign Procurement Summary" at intervals agreed to by the State's Representative for monitoring of the program. At the conclusion of the construction and prior to final payment, Manager shall provide a copy of the final Form 01 74 20.02 "State Agency Buy Recycled Campaign Procurement Summary" under provisions of Section 01 77 00 "Closeout Procedures".

3.2 ATTACHMENTS

A. Form 01 74 20.01: Recycled Content Certification Worksheet (Example).

1. An example of a completed form is attached for Contractor's reference. An electronic version of this form for Contractor's use will be provided by the State at the Project start meeting.

B. Form 01 74 20.02: State Agency Buy Recycled Campaign Procurement Summary (Example).

1. An example of a completed form is attached for Contractor's reference. An electronic version of this form for Contractor's use will be provided by the State at the Project start meeting.

END OF SECTION

FORM 01 74 20.01 RECYCLED CONTENT CERTIFICATION WORKSHEET (EXAMPLE)

This form must be completed by contractor. The contractor must submit worksheet with each product submittal to the State agency, with a row completed for each product supplied to the State. Attach additional sheets if necessary. Information must be included, even if the product does not contain recycled-content material but it is within one of the 11 categories. Refer to footnotes following this form.

PROJECT NAME: Visitor's Non-Secure Entrance, Statewide Youth Correctional Agency **PROJECT NUMBER:** 000000000001234

CONTRACTOR'S / VENDOR'S NAME: XYZ Contractors **DATE:** December 1, 2021

ADDRESS: 4300 Pleasant Valley Dr, Lincoln Logs, CA 95000 **PROJECT DIRECTOR:** (AS NAMED)

PHONE: (123) 456-7890 **FAX:** (012) 345-6789

Product Description / Specification Section	Quantity	Estimated Dollars	Product Category[1]	RCP Y/N?	Virgin Content (Percent)[2]	Postconsumer Material (Percent)[3]	Secondary Material (Percent)[4]	Total Percent[5]
High Impact Resistant Gypsum Board, 09260	N/A	$2,500	Paper	Y	50	10	40	100%
Cellulose Building Insulation, 07213	N/A	$10,000	Paper	Y	20	10	70	100%
Underslab Vapor Barrier, 03300	N/A	$1,500	Plastic	Y	20	20	60	100%
Electrical Cover Plates, 16010	N/A	$2,500	Plastic	N	90	0	10	100%
Interior and Exterior Paint, 09900	300gal	$8,000	Paint	N	100	0	0	100%
Recessed Entrance Mats, 10420	N/A	$1,800	Tire Derived	Y	40	20	40	100%
Ceramic Tile, 09310	N/A	$5,000	Glass	Y	35	10	55	100%
Exterior and Interior Windows, 08800	N/A	$30,000	Glass	N	70	10	20	100%
Metal Studs, 09206	N/A	$6,000	Metal	Y	65	15	10	100%

Public Contract Code sections 10233, 10308.5, and 10354 require all vendors and contractors to certify in writing, under penalty of perjury, the minimum, if not the exact, percentage of postconsumer and secondary material in the products, materials, goods, or supplies provided or used.

Public Contract Code section 12205 (a) requires all State agencies to require all contractors to certify in writing, under penalty of perjury, the minimum, if not the exact percentage, of postconsumer and secondary material in the products, materials, goods, or supplies provided or used.

Printed name of person completing form Title Signature of person completing form

Footnotes

You must submit copies of this form and/or other documentation for each product that is reportable.

1. Product category refers to one of the product categories into which the reportable product purchase falls. For products made from multiple materials, choose the category that comprises most of the product, either by a weight or volume criteria. The product categories and corresponding content requirements are defined as follows:

    1. Paper products
    2. Printing and writing papers
    3. Mulch, compost and co-compost
    4. Glass products
    5. Lubricating oils
    6. Plastic products
    7. Paint
    8. Antifreeze
    9. Tires
    10. Tire-derived products
    11. Metal

    Recycled-content printing and writing papers (PWP) include copy paper and xerographic papers of all colors, and higher-grade papers such as watermarked and cotton fiber papers. High-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, ruled tablets, calendars, posters, manila file folders, index cards, white wove envelopes, and other uncoated printing and writing paper such as writing and office paper, book paper, cotton-fiber paper **(containing 25–75 percent cotton fiber)**, and cover stock are all included in the PWP category.

    Recycled metal product means flat rolled metal products with **at least 25 percent** of the total weight consisting of secondary and postconsumer material, with **not less than 10 percent** postconsumer material. Products made with flat rolled metal meeting these content percentages may include automobiles, cans, appliances, and office furniture and supplies.

    Recycled-content product (RCP) for paper products, plastic products, glass products, tires, tire-derived products, compost and co-compost, lubricating oil, paints, solvents, is defined in PCC section 12200 (SB 1915, 1994) as containing **at least 50 percent** of the total weight of which consists of secondary and postconsumer material with **not less than 10 percent** of its total weight consisting of postconsumer material. This definition applies to all product categories that do not have specific statutory definitions.

2. Virgin material content is that portion of the product made from non-recycled material, that is, the material is neither secondary nor postconsumer material.

3. Postconsumer material is defined as “a finished material which would have been disposed of as a solid waste, having completed its life cycle as a consumer item, and does not include manufacturing wastes.” This is material such as newspaper that you read and was recycled and then made into recycled-content newsprint or some other recycled product. Postconsumer material is generally any product that was bought by the consumer, used, and then recycled into another product.

4. Secondary material is defined as “fragments of finished products or finished products of a manufacturing process, which has converted a resource into a commodity of real economic value, and includes postconsumer material, but does not include excess virgin resources of the manufacturing process.” This is material such as newsprint that is trimmed from a roll in the paper plant that is returned to the beginning of the process to make recycled-content newsprint. The material (product) did not get to the consumer before being recycled.
    For example, if a printing and writing paper contained 20 percent postconsumer material, you would indicate 20 percent in the postconsumer column and 80 percent in the virgin column. If the product had 40 percent secondary material and 20 percent postconsumer material, you would indicate 40 percent in the secondary column, 20 percent in the postconsumer column, and 40 percent in the virgin column. To meet the 50/10 content requirement of another product category, the product would contain 50 percent recycled content (40 percent secondary and 10 percent postconsumer material) and 50 percent virgin material.

5. The sum of the virgin column, the postconsumer column, and the secondary column must equal 100 percent.

Note: Products that are made from multiple material types should be reported in the product category of the material type representing most of the product. The amount of material used in the product can be measured by weight or volume. If, for instance, a chair is made from steel, aluminum, and plastic and most of the material, either by weight or volume, is plastic, report it as a plastic product. If, however, most of the product, either by weight or volume, is metal, report the purchase as a metal product.

FORM 01 74 20.01 RECYCLED CONTENT CERTIFICATION WORKSHEET

This form must be completed by contractor. The contractor must submit worksheet with each product submittal to the State agency, with a row completed for each product supplied to the State. Attach additional sheets if necessary. Information must be included, even if the product does not contain recycled-content material but it is within one of the 11 categories. Refer to footnotes following this form.

PROJECT NAME: _____ **PROJECT NUMBER:** _____

CONTRACTOR'S / VENDOR'S NAME: _____ **DATE:** _____

ADDRESS: _____ **PROJECT DIRECTOR:** _____

PHONE: _____ **FAX:** _____

Product Description / Specification Section	Quantity	Estimated Dollars	Product Category[1]	RCP Y/N?	Virgin Content (Percent)[2]	Postconsumer Material (Percent)[3]	Secondary Material (Percent)[4]	Total Percent[5]
								100%
								100%
								100%
								100%
								100%
								100%
								100%
								100%

Public Contract Code sections 10233, 10308.5, and 10354 require all vendors and contractors to certify in writing, under penalty of perjury, the minimum, if not the exact, percentage of postconsumer and secondary material in the products, materials, goods, or supplies provided or used.

Public Contract Code section 12205 (a) requires all State agencies to require all contractors to certify in writing, under penalty of perjury, the minimum, if not the exact percentage, of postconsumer and secondary material in the products, materials, goods, or supplies provided or used.

Printed name of person completing form | Title | Signature of person completing form

Footnotes

You must submit copies of this form and/or other documentation for each product that is reportable.

1. Product category refers to one of the product categories into which the reportable product purchase falls. For products made from multiple materials, choose the category that comprises most of the product, either by a weight or volume criteria. The product categories and corresponding content requirements are defined as follows:

    1. Paper products
    2. Printing and writing papers
    3. Mulch, compost and co-compost
    4. Glass products
    5. Lubricating oils
    6. Plastic products
    7. Paint
    8. Antifreeze
    9. Tires
    10. Tire-derived products
    11. Metal

Recycled-content printing and writing papers (PWP) include copy paper and xerographic papers of all colors, and higher-grade papers such as watermarked and cotton fiber papers. High-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, ruled tablets, calendars, posters, manila file folders, index cards, white wove envelopes, and other uncoated printing and writing paper such as writing and office paper, book paper, cotton-fiber paper **(containing 25–75 percent cotton fiber)**, and cover stock are all included in the PWP category.

Recycled metal product means flat rolled metal products with **at least 25 percent** of the total weight consisting of secondary and postconsumer material, with **not less than 10 percent** postconsumer material. Products made with flat rolled metal meeting these content percentages may include automobiles, cans, appliances, and office furniture and supplies.

Recycled-content product (RCP) for paper products, plastic products, glass products, tires, tire-derived products, compost and co-compost, lubricating oil, paints, solvents, is defined in PCC section 12200 (SB 1915, 1994) as containing **at least 50 percent** of the total weight of which consists of secondary and postconsumer material with **not less than 10 percent** of its total weight consisting of postconsumer material. This definition applies to all product categories that do not have specific statutory definitions.

2. Virgin material content is that portion of the product made from non-recycled material, that is, the material is neither secondary nor postconsumer material.

3. Postconsumer material is defined as “a finished material which would have been disposed of as a solid waste, having completed its life cycle as a consumer item, and does not include manufacturing wastes.” This is material such as newspaper that you read and was recycled and then made into recycled-content newsprint or some other recycled product. Postconsumer material is generally any product that was bought by the consumer, used, and then recycled into another product.

4. Secondary material is defined as “fragments of finished products or finished products of a manufacturing process, which has converted a resource into a commodity of real economic value, and includes postconsumer material, but does not include excess virgin resources of the manufacturing process.” This is material such as newsprint that is trimmed from a roll in the paper plant that is returned to the beginning of the process to make recycled-content newsprint. The material (product) did not get to the consumer before being recycled.
   For example, if a printing and writing paper contained 20 percent postconsumer material, you would indicate 20 percent in the postconsumer column and 80 percent in the virgin column. If the product had 40 percent secondary material and 20 percent postconsumer material, you would indicate 40 percent in the secondary column, 20 percent in the postconsumer column, and 40 percent in the virgin column. To meet the 50/10 content requirement of another product category, the product would contain 50 percent recycled content (40 percent secondary and 10 percent postconsumer material) and 50 percent virgin material.

5. The sum of the virgin column, the postconsumer column, and the secondary column must equal 100 percent.

Note: Products that are made from multiple material types should be reported in the product category of the material type representing most of the product. The amount of material used in the product can be measured by weight or volume. If, for instance, a chair is made from steel, aluminum, and plastic and most of the material, either by weight or volume, is plastic, report it as a plastic product. If, however, most of the product, either by weight or volume, is metal, report the purchase as a metal product.

FORM 01 74 20.02 STATE AGENCY BUY RECYCLED CAMPAIGN PROCUREMENT SUMMARY (EXAMPLE)

Attach copies of the recycled-content certification form(s) and/or other documentation for each product that contains any amount of recycled material. Refer to footnotes following this form.

PROJECT NAME: Visitor's Non-Secure Entrance, Statewide Youth Correctional Agency **PROJECT NUMBER:** 000000000001234

CONTRACTOR'S / VENDOR'S NAME: XYZ Contractors **DATE:** December 1, 2021

ADDRESS: 4300 Pleasant Valley Dr, Lincoln Logs, CA 95000 **PROJECT DIRECTOR:** (AS NAMED)

PHONE: (123) 456-7890 **FAX:** (012) 345-6789

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Product Category[1]	**All Reportable Purchases (QUANTITY)[2]**	**All Reportable Purchases (DOLLARS)[3]**	**RCP Purchases (QUANTITY)[4]**	**RCP Purchases (DOLLARS)[5]**	**Percent of RCP (QUANTITY)[6]**	**Percent of RCP (DOLLARS)[7]**
Paper products		$ 18,000.00		$ 12,500.00		70%
Printing and writing paper		$ 0.00		$0.00		0%
Mulch, compost and co-compost	0(cu yd)	$ 0.00	0(cu yd)	$ 0.00	0%	0%
Glass products		$ 35,000.00		$ 5,000		14%
Lubricating oils	0(gal)	$ 0.00	0(gal)	$ 0.00	0%	0%
Plastic products		$ 4,000.00		$ 1,500.00		38%
Paint	300(gal)	$ 8,000.00	300(gal)	$ 0.00	0%	0%
Antifreeze	0(gal)	$ 0.00	0(gal)	$ 0.00	0%	0%
Tires	0	$ 0.00	0	$ 0.00	0%	0%
Tire-derived products		$ 2,000.00		$ 2,000.00		100%
Metal		$ 11,000.00		$ 6,000.00		54%
		Total[8]: $ 78,000		**Total[9]: $ 27,000**		**Total[10]: 34.6%**

Footnotes

Attach copies of the recycled-content certification forms and/or other documentation for each product.

Note: All purchases within these product categories, regardless of the source of the product or the type of contract used to purchase them, should be included in your report. Include **all** product purchases — RCPs and non-RCPs.

1. Include **all** purchases (RCPs and non-RCPs) within the 11 product categories. RCPs outside of the 11 product categories **cannot** be counted toward attaining the procurement goals and are not reportable.
2. Indicate the quantity (units) of **all** purchases (RCPs and non-RCPs) in each product category during the course of the project. Quantities do not need to be reported for the product categories with shading.
3. Indicate the total dollars spent on **all** purchases (RCPs and non-RCPs) in each product category purchased during the course of the project.
4. Indicate the total quantity (units) of RCPs purchased during the course of the project. Quantities do not need to be reported for the product categories with shading.
5. Indicate the total dollars spent on RCPs during the course of the project for each category.
6. Indicate the percentage of RCPs purchased. The percent recycled is calculated by dividing the figure in column 4 by the figure in column 2 and multiplying by 100. Percentages do not need to be calculated for the product categories with shading.
7. Indicate the percentage of total dollars spent on RCPs in each category. The percent recycled is calculated by dividing the figure in column 5 by the figure in column 3 and multiplying by 100.
8. The total of column 3 should be equivalent to the total estimated dollars spent on **all** products (RCPs and non-RCPs) during the course of the project.
9. The total of column 5 should be equivalent to the estimated total dollars spent on reportable RCPs during the course of the project.
10. Column 7 is calculated by dividing the figure in column 5 by the figure in column 3 and multiplying by 100.

FORM 01 74 20.02 STATE AGENCY BUY RECYCLED CAMPAIGN PROCUREMENT SUMMARY

Attach copies of the recycled-content certification form(s) and/or other documentation for each product that contains any amount of recycled material. Refer to footnotes following this form.

PROJECT NAME: _____ **PROJECT NUMBER:** _____

CONTRACTOR'S / VENDOR'S NAME: _____ **DATE:** _____

ADDRESS: _____ **PROJECT DIRECTOR:** _____

PHONE: _____ **FAX:** _____

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Product Category[1]	**All Reportable Purchases (QUANTITY)[2]**	**All Reportable Purchases (DOLLARS)[3]**	**RCP Purchases (QUANTITY)[4]**	**RCP Purchases (DOLLARS)[5]**	**Percent of RCP (QUANTITY)[6]**	**Percent of RCP (DOLLARS)[7]**
Paper products		$		$		70
Printing and writing paper		$		$		%
Mulch, compost and co-compost	(cu yd)	$	(cu yd)	$	%	%
Glass products		$		$		%
Lubricating oils	(gal)	$	(gal)	$	%	%
Plastic products		$		$		%
Paint	(gal)	$	(gal)	$	%	%
Antifreeze	(gal)	$	(gal)	$	%	%
Tires		$		$	%	%
Tire-derived products		$		$		%
Metal		$		$		%
		Total[8]: $		**Total[9]: $**		**Total[10]: %**

Footnotes

Attach copies of the recycled-content certification forms and/or other documentation for each product.

Note: All purchases within these product categories, regardless of the source of the product or the type of contract used to purchase them, should be included in your report. Include **all** product purchases — RCPs and non-RCPs.

1. Include **all** purchases (RCPs and non-RCPs) within the 11 product categories. RCPs outside of the 11 product categories **cannot** be counted toward attaining the procurement goals and are not reportable.
2. Indicate the quantity (units) of **all** purchases (RCPs and non-RCPs) in each product category during the course of the project. Quantities do not need to be reported for the product categories with shading.
3. Indicate the total dollars spent on **all** purchases (RCPs and non-RCPs) in each product category purchased during the course of the project.
4. Indicate the total quantity (units) of RCPs purchased during the course of the project. Quantities do not need to be reported for the product categories with shading.
5. Indicate the total dollars spent on RCPs during the course of the project for each category.
6. Indicate the percentage of RCPs purchased. The percent recycled is calculated by dividing the figure in column 4 by the figure in column 2 and multiplying by 100. Percentages do not need to be calculated for the product categories with shading.
7. Indicate the percentage of total dollars spent on RCPs in each category. The percent recycled is calculated by dividing the figure in column 5 by the figure in column 3 and multiplying by 100.
8. The total of column 3 should be equivalent to the total estimated dollars spent on **all** products (RCPs and non-RCPs) during the course of the project.
9. The total of column 5 should be equivalent to the estimated total dollars spent on reportable RCPs during the course of the project.
10. Column 7 is calculated by dividing the figure in column 5 by the figure in column 3 and multiplying by 100.

SECTION 01 75 00

STARTING AND ADJUSTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Procedures for starting, testing, adjusting, and balancing of the following systems:

a. As identified in Section 23 05 93 “Testing, Adjusting, and Balancing for HVAC”

1.2 SUBMITTALS

A. Sequencing Schedule:
1. Preliminary schedule listing times and dates for start-up of each item of equipment, in sequence: Submit two weeks prior to proposed dates. Accepted Schedule shall be the sequencing schedule.

B. Reports: Submit manufacturer authorized representative's reports within one week after start-up, listing start-up dates.

C. Qualification Statements: For manufacturer's authorized representative.

1.3 QUALITY ASSURANCE

A. When specified in individual specification Sections, Contractor shall require manufacturer to provide authorized representative to be present at site to:

1. Inspect, check, and approve equipment or system installation prior to start-up.
2. Supervise placing equipment or system in operation.
3. Provide written report that equipment or system has been properly installed and is functioning correctly.

1.4 PROJECT CONDITIONS

A. Ensure building is enclosed and weathertight.

B. Ensure excess packing and shipping bolts are removed.

C. Ensure interdependent systems have been checked and are operational.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that Project conditions comply with specified and manufacturer’s requirements.

B. Verify that status of work meets requirements for start-up of equipment and systems.

3.2 STARTING SYSTEMS

A. Coordinate sequence of start-up for various items of equipment.

B. Notify the State Inspector 7 days prior to start-up of each item of equipment.

C. Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during entire start-up process.

D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions, which may cause damage.

E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

F. Verify that wiring and support components for equipment are complete and tested.

G. Execute start-up under supervision of Contractor's personnel and/or manufacturer’s representative when so specified in accordance with manufacturer’s instructions.

H. Place equipment for operation in proper sequence, in accordance with approved sequencing schedule.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Beneficial Occupancy procedures.
2. Completion procedures.
3. Warranties.
4. Record Drawings.
5. Operation manuals.
6. Maintenance manuals.
7. Operation and maintenance documentation directory manuals.
8. Final cleaning.

1.2 DEFINITIONS

A. Punch-list (List of Incomplete Items): Contractor-prepared list of items to be completed or corrected, prepared for the State’s use prior to State’s inspection, to determine if the Work is complete.

1.3 SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's Punch-list: Initial submittal at Beneficial Occupancy.

C. Certified Punch-list: Final submittal at Completion.

D. Certificate of Insurance: For continuing coverage.

E. Guaranties, Warranties and Bonds: Submittal prior to Final Inspection.

F. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.

G. Record Drawings Reports: Submit written report monthly at the time of Application for Payment submittal indicating items incorporated into Project Record Drawings concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

H. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Format: Submit operation and maintenance manuals in the following format:
    a. Submit on digital media acceptable to State. Enable reviewer comments on draft submittals.

I. Certification of Small Business / Disabled Veteran Business Enterprise Participation:

1. Preliminary Report upon Completion.
2. Final Report upon receipt of Final Payment.

J. Waste Management Report: Submittal prior to Final Inspection. Provide as specified in individual Specification Section.

K. Recycled-Content Certification Worksheet: Submittal prior to Final Inspection. Provide as specified in individual Specification Section.

L. State Agency Buy Recycled Campaign Procurement Summary: Submittal prior to Final Inspection. Provide as specified in individual Specification Section.

M. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.4 COMPLETION PROCEDURES

A. Punch-list: Prepare and submit a list of items to be completed and corrected a minimum of 30 calendar days prior to the end of the Contract Time.

B. Submittals Prior to Completion: Before requesting final inspection for determining the date of Completion of the Work, complete the following.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting State unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Waste Management Report and Recycled-Content Certification Worksheet.
3. Submit Project Record Drawings, and similar final record information.
4. Submit each operation and maintenance manual in final form prior to requesting inspection for Completion and at least 30 days before commencing demonstration and training.
5. Submit closeout submittals specified in individual Sections, including warranties, certifications, training and similar documents.
6. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by State. Label with manufacturer's name and model number. Obtain State’s signature for receipt of submittals.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section.

7. Submit testing, adjusting, and balancing records.
8. Submit sustainable design submittals not previously submitted.
9. Submit Completion photographic documentation.

C. Procedures Prior to Completion: Complete the following a minimum of 14 days prior to requesting inspection for determining date of Completion of the Work. List items below that are incomplete at time of request.

1. Make final changeover of permanent locks and deliver keys to State. Advise State's personnel of changeover in security provisions.
2. Complete startup and testing of systems and equipment.
3. Perform preventive maintenance on equipment used prior to Completion.
4. Instruct State's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
5. Advise State of changeover in utility services.
6. Participate with State in conducting inspection and walkthrough with authorities having jurisdiction.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements.
9. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Final Inspection: Submit a written request for final inspection to determine Completion a minimum of 14 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, State will either proceed with inspection or notify Contractor of unfulfilled requirements. After inspection, State will notify Contractor of items, either on Contractor's list or additional items identified by State, that must be completed or corrected before Acceptance of the Work.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

E. Submittals After Final Inspection:

1. Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."
2. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
3. Certified Punch-list: Submit certified copy of punch list, endorsed and dated by Architect or Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

F. Completion of the Work date and Acceptance of the Work will be determined as specified in Document 00 72 00 “General Conditions of the Contract for Construction”, Article 8.6.

1.5 PUNCH-LIST ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information on each page:

a. Project name and number.
b. Date.
c. Page number.

4. Submit list of incomplete items in the following format:

a. MS Excel Electronic File: State will return annotated file.

1.6 SUBMITTAL OF CERTIFICATION OF SMALL BUSINESS / DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION

A. If final payment has been made to Small Business and DVBE subcontractors, upon Completion of the Work, Contractor shall submit the two-page certification, Forms 01 77 00.01 and 01 77 00.02 "Contractor's Certification of DVBE/SB Participation".

B. If retention has been withheld, and final payment to Small Business and DVBE subcontractors will not be made until the Contractor has received Final Payment from the State, Contractor shall:

1. Upon completion of the Work submit the two-page certification, Forms 01 77 00.01 and 01 77 00.02 "Contractor's Certification of DVBE/SB Participation"; and mark the box entitled "PRELIMINARY REPORT" on Form 01 77 00.02.
2. Within 30 days of receipt of Final Payment submit an updated two-page certification, Forms 01 77 00.01 and 01 77.00.02 "Contractor's Certification of DVBE/SB Participation" and mark the box entitled "FINAL REPORT" on Form 01 77 00.02. The FINAL REPORT shall be mailed to: DGS, Real Estate Services Division, Project Management & Development Branch; Attn: Ryan Beck, , 707 Third Street 4th Floor, West Sacramento, CA 95605 or sent as a scanned Adobe PDF or similar e-mail attachment to: ryan.beck@dgs.ca.gov.

C. When completing the Certification, the Contractor should include information and perform percentage calculations on all DVBE's performing Work or supplying materials even if the firms were not listed at bid time. If DVBE utilization was different than that approved in original agreement, provide comments. The Contractor should include all Small Business even if the firms were not listed at bid time when completing percentage calculations. The second page of the Certification may be copied as needed in order to list all firms.

D. Pursuant to Military and Veterans Code §999.7, the awarding department shall withhold, on a contract entered into on or after January 1, 2021, ten thousand dollars ($10,000) from the final payment, or the full final payment if less than ten thousand dollars ($10,000), until a prime contractor complies with the certification requirements of subdivision (d) of Section Military and Veterans Code §999.5. A prime contractor that fails to comply with the certification requirement shall, after notice, be allowed to cure the defect. Notwithstanding any other law, if, after at least 15 calendar days but not more than 30 calendar days from the date of notice, the prime contractor refuses to comply with the certification requirements, the awarding department shall permanently deduct ten thousand dollars ($10,000) from the final payment, or the full payment if less than ten thousand dollars ($10,000).

1.7 SUBMITTAL OF PROJECT WARRANTIES

A. Standard Guarantee: Refer to Document 00 72 00 "General Conditions of the Contract for Construction", Article 3.5. Submittal is not required for standard one year guarantee for Work on this project.

B. Time of Submittal: Submit written warranties on request of State for designated portions of the Work where warranties are indicated to commence on dates other than date of Completion, or when delay in submittal of warranties might limit State's rights under warranty.

1. For equipment put into use with State's permission during construction, submit warranties within 10 days after first operation.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Provide duplicate, notarized copies of warranties. Execute Contractor's submittals and assemble documents executed by subcontractors, suppliers, and manufacturers.

E. Warranties:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name and number, and name of Contractor.

F. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

G. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.8 RECORD DRAWINGS

A. General: The State will provide one set of paper copies of the Contract Drawings to be used as record prints.

B. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Information entered on record prints shall be neat, legible, and emphasized by drawing "revision clouds" around changed items.
d. Symbols and designations used in preparing record prints shall match those used in Contract Drawings.
e. Record data as soon as possible after obtaining it.
f. Record and check the markup before enclosing concealed installations.
g. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Special measurements.
    k. Changes made by Change Order
    l. Changes made by Request for Information (RFI)
    m. Changes made following Additional Detailed Instructions.
    n. Details not on the original Contract Drawings.
    o. Field records for variable and concealed conditions.
    p. Record information on the Work that is shown only schematically.
    q. Miscellaneous records required by other Specification Sections.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Change Order, Request for Information and Additional Detailed Instructions numbers, and similar identification, where applicable.

1.9 MAINTENANCE OF RECORD DRAWINGS

A. Maintenance of Record Drawings: Store Record Drawings in the field office apart from the Contract Documents used for construction. Do not use Project Record Drawings for construction purposes. Maintain Record Drawings in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Drawings for State reference during normal working hours.

B. Monthly Applications for Payments will not be processed without review and approval of Project Record Drawings by the State.

C. Final Inspection will not be scheduled until Project Record Drawings are submitted to the State.

1.10 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into

individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

3. All material shall be neatly typewritten; handwritten instructions are not acceptable.
4. Extraneous Data: Where contents of manuals include manufacturers' catalog pages, clearly indicate precise items included in this installation and delete, or otherwise clearly indicate, manufacturer's data with which this installation is not concerned.

1.11 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Date of submittal.
4. Name and contact information for Contractor.
5. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system.

1. Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by State’s operating personnel for types of emergencies indicated.

a. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1) Fire.
2) Flood.
3) Gas leak.
4) Water leak.
5) Power failure.
6) Water outage.
7) System, subsystem, or equipment failure.
8) Chemical release or spill.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.

1.12 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.13 OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by State’s operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.14 MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by State’s operating personnel.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

D. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

E. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

F. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Types of cleaning agents to be used and methods of cleaning.
7. List of cleaning agents and methods of cleaning detrimental to product.
8. Schedule for routine cleaning and maintenance.
9. Demonstration and training video recording, if available.

G. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

H. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

I. Warranties: Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Completion for entire Project or for a designated portion of Project:

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove spills, stains, and other foreign deposits.
c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
h. Vacuum and mop hard surfaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils as required by Sustainable Design Requirements.

p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
q. Clean strainers.
r. Remove snow and ice to provide safe access to building.

C. Deficient cleaning operations, as determined by the State, shall be immediately corrected as directed.

D. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

E. Construction Waste Disposal: Comply with waste-disposal requirements.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 01 73 00 "Execution" before requesting inspection for determination of Completion.

3.3 ATTACHMENTS

A. Certification of Small Business / Disabled Veteran Business Enterprise Participation: 2 pages.

1. Form 01 77 00.01: Contractor’s Certification of SB/DVBE Participation (the first page).
2. Form 01 77 00.02: Contractor’s Certification of SB/DVBE Participation (the second page).

END OF SECTION

State of California
Department of General Services - Procurement Division
Prime Contractor's Certification - DVBE Subcontractor Report
STD 817, Formerly DGS PD 810P

STATE DEPARTMENT AND CONTRACT INFORMATION

State Department Information		Contract Information		Prime Contractor Information:		FOR STATE USE ONLY	
State Department Name:		Contract #:		Name:		Date Received:	
State Department Address:		FI$Cal Supplier ID#:		Address:			
Contract Manager Name:		Contract Execution Date:		Phone #:			
Contract Manager Phone #:		Date Work Completed:		Email:			
Contract Manager Email Address:		Contract Award Amount:		Date Last Payment Received:			
				Contract Received Amount:			

SECTION 3 — List all Disabled Veteran Business Enterprise firms involved with this contract.

	(A) DVBE Subcontractor(s) Name	(B) DVBE Subcontractor(s) Address	(C) DVBE Certification ID Number	(D) Total Contract Commitment Percentage to DVBE	(E) Total Contract Commitment Amount to DVBE	(F) Total Payment Amount to DVBE	(G) Difference in Amount Paid to DVBE (F - E)	(H) Percentage Paid to DVBE (F/Contract Received Amount)
Number of DVBE Subcontractors			Grand Total		$ 0.00	$ 0.00	$ 0.00	0.00%
1.				0.00%			0.00	0.00%
2.				0.00%			0.00	0.00%
3.				0.00%			0.00	0.00%
4.				0.00%			0.00	0.00%
5.				0.00%			0.00	0.00%
6.				0.00%			0.00	0.00%
7.				0.00%			0.00	0.00%
8.				0.00%			0.00	0.00%
9.				0.00%			0.00	0.00%
10.				0.00%			0.00	0.00%
11.				0.00%			0.00	0.00%
12.				0.00%			0.00	0.00%
13.				0.00%			0.00	0.00%
	(I) Comments/Explanations							

Use next page for additional lines

I certify under penalty of perjury under the laws of the State of California that all information submitted is true and correct.

Prime Contractor	Print Name:		Date:	
	Title:			
	Signature:			

Return upon completion of contract.

State of California
Department of General Services - Procurement Division
Prime Contractor's Certification - DVBE Subcontractor Report
STD 817, Formerly DGS PD 810P

STATE DEPARTMENT AND CONTRACT INFORMATION

State Department Information		Contract Information		Prime Contractor Information		FOR STATE USE ONLY	
State Department Name:		Contract #:		Name:		Date Received:	
State Department Address:		FI$Cal Supplier ID#:		Address :			
Contract Manager Name:		Contract Execution Date:		Phone #:			
Contract Manager Phone #:		Date Work Completed:		Email:			
Contract Manager Email Address:		Contract Award Amount:		Date Last Payment Received:			
				Contract Received Amount:			

List all Disabled Veteran Business Enterprise firms involved with this contract.

	(A) DVBE Subcontractor(s) Name	(B) DVBE Subcontractor(s) Address	(C) DVBE Certification ID Number	(D) Total Contract Commitment Percentage to DVBE	(E) Total Contract Commitment Amount to DVBE	(F) Total Payment Amount to DVBE	(G) Difference in Amount Paid to DVBE (F - E)	(H) Percentage Paid to DVBE (F/Contract Received Amount)
Number of DVBE Subcontractors			**Total**		$ 0.00	$ 0.00	$ 0.00	0.00%
14.				0.00%			0.00	0.00%
15.				0.00%			0.00	0.00%
16.				0.00%			0.00	0.00%
17.				0.00%			0.00	0.00%
18.				0.00%			0.00	0.00%
19.				0.00%			0.00	0.00%
20.				0.00%			0.00	0.00%
21.				0.00%			0.00	0.00%
22.				0.00%			0.00	0.00%
23.				0.00%			0.00	0.00%
24.				0.00%			0.00	0.00%
25.				0.00%			0.00	0.00%
26.				0.00%			0.00	0.00%
27.				0.00%			0.00	0.00%
28.				0.00%			0.00	0.00%
29.				0.00%			0.00	0.00%
30.				0.00%			0.00	0.00%
31.				0.00%			0.00	0.00%
32.				0.00%			0.00	0.00%
33.				0.00%			0.00	0.00%
34.				0.00%			0.00	0.00%
35.				0.00%			0.00	0.00%
36.				0.00%			0.00	0.00%

Attach copies of this page for additional lines

I certify under penalty of perjury under the laws of the State of California that all information submitted is true and correct.

Americans with Disabilities (ADA) Notice: Persons with disabilities requiring reasonable modifications should contact the OSDS Report Coordinator at OSDSReports@dgs.ca.gov

Form Completion Instructions

GENERAL INFORMATION: Military and Veteran Code (MVC) 999.5(d), 999.7 and Government Code (GC) 14841, and California Code of Regulations (CCR) 1896.78(e) requires all Prime Contractors that committed to have a Disabled Veteran Business Enterprise (DVBE) perform an element of work for a contract to report DVBE subcontractor participation information and certify to the state that all DVBE subcontracting payments were made. Departments are required to withhold $10,000 from the final payment, or the full payment if less than $10,000, on contracts until the Prime Contractor complies with the certification requirements by submitting this form.

If prime contractors do not comply with the requirements after given notice to cure by the state departments, the withheld amount will be permanently deducted.

All contracted work must be completed before submission of invoice(s) and this certification form.

Prime Contractors are required to maintain records supporting the information submitted on this form and that all payments to DVBE subcontractor(s) were made. Upon request, proof of payment must be provided (MVC 999.5(d)).

INCLUDE

- **ONLY ONE contract per Report**
- **All DVBEs that performed an element of work for this contract regardless of tier**

State Department Information:

State Department Name: Enter the State Department name

State Department Address: Enter the State Department address

Contract Manager Name: Enter the Contract Manager name

Contract Manager Phone Number: Enter the Contract Manager phone #

Contract Manager Email Address: Enter the Contract Manager email address

Contract Information

Contract Number: Enter the Contract Number

Contractor's FI$Cal Supplier ID Number: Enter your FI$Cal supplier ID number

Contract Execution Date: Enter the date contract was signed

Date Work Completed: Enter the date the work was completed on the contract

Contract Award Amount: Enter the total dollar amount awarded for this contract including all financial amendments

State of California
Department of General Services Procurement Division
Prime Contractor's Certification - DVBE Subcontracting
Report STD 817, Formerly DGS PD 810P
(Rev. 10/2021)

Form Completion Instructions

Prime Contractor Information:

Prime Contractor Name: Enter your name as shown on the contract

Prime Contractor Address: Enter your address

Phone Number: Enter your number (with area code)

Email Address: Enter your email address

Date Last Payment Received: Enter the date the last payment for work performed was received

Contract Received Amount: Enter the dollar amount of the last payment received

For State Use Only

Date STD 817 Received: Enter date the Contract Manager received the STD 817 from the Prime Contractor

TABLE INSTRUCTIONS

A) DVBE Subcontractor(s) Name: Enter the name of all DVBEs that are listed to perform an element of work or supplies for this contract and any formal approved substitution(s). (Use additional lines if the name does not fit on a single line) Use page two for additional lines.

B) DVBE Subcontractor(s) Address: Enter the address of each DVBE (Use page 2 for additional lines if address does not fit on a single line)

C) DVBE Certification ID Number: Enter each DVBE's certification number

D) Total Contract Commitment Percentage to DVBE: Enter the total percentage of contracted dollars to each DVBE at the time of award

E) Total Contract Commitment Amount to DVBE: Enter the entire amount contracted to each DVBE at the time of award

F) Total Payment Amount to DVBE: Enter the total amount paid to all DVBEs that performed an element of work or were suppliers for this contract

Form Completion Instructions

Note: Complete and accurate certifications are due upon completion of contract.

G) **Difference in Amount Paid to DVBE**: The form will compute the difference of DVBE dollars contracted compared to dollars paid

H) **Percentage Paid to DVBE:** The form will compute the percentage paid to DVBEs using the Contract Received Amount entered under State and Contract Information

Instructions I

I) **Comments/Explanations:** Enter any relevant comments and explanations for any differences between the DVBE amounts or percentages committed and paid. Reference the line number if comments and explanations are used.

SIGNATURE BLOCK

Prime Contractor's Signature: Enter your printed name, title, sign with an electronic signature or a wet signature, and date

CONTRACTOR'S CERTIFICATION OF SB PARTICIPATION

TO:	Real Estate Services Division (Construction Services Area Office Address)	Date: Project Number: Contract Number:

FROM:

PROJECT TITLE:

THIS IS TO CERTIFY THAT I, _____
(Print Name)

AS AN AUTHORIZED OFFICIAL OF _____
(Firm or Corporation)

WORKING IN THE CAPACITY OF _____
(Title)

AND HAVE BEEN PROPERLY AUTHORIZED BY SAID FIRM OR CORPORATION TO SIGN THE FOLLOWING STATEMENT PERTAINING TO SUBJECT CONTRACT.

Pursuant to Section 14841 of the Government Code,

I, the undersigned, hereby certify that to the best of my knowledge, the Small Business participation information listed on the attached report for the above contract is complete and correct.

SIGNED: DATE:

State of California · Department of General Services

☐ **PRELIMINARY REPORT**

CONTRACTOR'S CERTIFICATION OF SB PARTICIPATION

☐ **FINAL REPORT**

CONTRACT NUMBER	PROJECT NUMBER	CONTRACT COMPLETION DATE	CONTRACT ACCEPTANCE DATE

PRIME CONTRACTOR	ORIGINAL CONTRACT AMOUNT	FINAL CONTRACT AMOUNT

DESCRIPTION OF WORK PERFORMED AND MATERIALS PROVIDED	SB BUSINESS NAME AND ADDRESS	SB CERT. NO.	SB CONTRACT PAYMENTS			
			PAYMENT AMOUNT	DATE WORK COMPLETED	DATE OF FINAL PAYMENT	COMMENTS
		TOTAL $				

ORIGINAL SMALL BUSINESS COMMITMENT: _____%

ACTUAL SMALL BUSINESS ACHIEVED: _____%

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing State's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, products and equipment.
2. Demonstration and training video recordings.

1.2 SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Submit a minimum of 6 weeks prior to requesting inspection for determining date of Completion of the Work.
2. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, within seven days of end training, submit list of participants and length of instruction time.

C. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name of Contractor.
c. Date of video recording.

2. At completion of training, submit complete training manual(s) for State's use prepared in same PDF file format required for operation and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

1.4 COORDINATION

A. Coordinate instruction schedule with State's operations. Adjust schedule as required to minimize disrupting State's operations and to ensure availability of State's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and accepted by State.

1.5 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.

c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.6 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 77 00 "Closeout Procedures."

B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

A. Engage qualified instructors to instruct State’s personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. State will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction for all seasons of operations.

1. Schedule training with State with at least 14 days' advance notice.
2. All demonstration and training shall be completed prior to requesting final inspection.

C. Time Allocated for Instructions: Amount of time required for instruction on each item of equipment and system shall be as specified in individual Sections, and not less than one hour.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

1. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.8 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode.

1. Submit video recordings on thumb drive and by uploading to web-based Project software site.
2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

a. Produce segments to present a single significant piece of equipment per segment.
b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 81 13.14

SUSTAINABLE DESIGN REQUIREMENTS - LEED v4 BD+C: NEW CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements and procedures for compliance with USGBC's LEED prerequisites and credits needed for Project to obtain LEED Silver certification based on USGBC's "LEED Version 4 for Building Design and Construction" (hereafter, LEED v4 BD+C).

1. Specific requirements for LEED are also included in other Sections.
2. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
3. A copy of LEED Project checklist is provided for information only as part of Reference Documents.

    a. Some LEED prerequisites and credits needed to obtain indicated LEED certification depend on State’s design and other aspects of Project that are not part of the Work of the Contract.

1.2 DEFINITIONS

A. BUG Rating: Classification system for luminaires defined in terms of backlight (B), uplight (U), and glare (G).

B. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001. Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

C. Cradle-to-Gate Assessment: Analysis of a product's partial life-cycle from extraction (cradle) to gate (factory completion prior to distribution).

D. LEED: USGBC's "LEED Version 4 for Building Design and Construction." Definitions that are part of this document apply to this Section.

E. Life-Cycle Assessment: Evaluation of environmental impacts of a product from cradle to gate, defined by ISO 14040 and ISO 14044.

F. Life-Cycle Inventory: Database that defines environmental input and output for each step in a material or assembly's life cycle.

G. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Reutilization of materials (such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it) is excluded.

H. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

I. Solar Reflectance Index (SRI): The measure of a constructed surface's ability to stay cool in the sun by reflecting solar radiation and emitting thermal radiation. SRI values range from zero (solid black surface) to 100 (solid white surface). SRI value of a material is calculated according to ASTM E1980 and based on the aged tested values of solar reflectance and thermal emittance.

J. Vertical Illuminance: Illuminance levels calculated at a point on a vertical service or plane.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Review LEED requirements and action plans for compliance with requirements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from State about USGBC's LEED prerequisites and credits that are Contractor's responsibility, that depend on product selection or product qualities, or that depend on Contractor's procedures, until USGBC has made its determination on Project's LEED certification application.

1.5 SUBMITTALS

A. General: Submit sustainable design submittals required by other Sections.

B. Sustainable Design Documentation Submittals:

1. Documentation for luminaires indicating BUG ratings, lumens emitted, and vertical illuminance values.
2. Documentation for compliant paving materials indicating the SRI, SR, and permeability.
3. Documentation for compliant roofing materials indicating the SRI.
4. Product Data and certification for WaterSense-labeled water fixtures.
5. Product Data for plumbing fixtures indicating flush or flow rate.
6. Documentation complying with Section 01 91 13 "General Commissioning Requirements," Section 21 08 00 "Commissioning of Fire Suppression,"
7. Environmental Product Declarations (EPDs).
8. Documentation for products that comply with LEED requirements for multi-attribute optimization.

a. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
b. Include documentation for any applicable third-party certifications.

9. Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
10. Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:

    a. Product Data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
    b. Product Data and certification for bio-based materials, indicating that they comply with requirements. Include statement of costs.
    c. Product Data and chain-of-custody certificates for products containing certified wood. Include invoices.
    d. Receipts for salvaged and refurbished materials used for Project, indicating sources and costs.
    e. Product Data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
    f. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.

11. Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
12. Documentation for products that comply with LEED requirements for material ingredient optimization.
13. Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.

    a. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.

14. Documentation complying with Section 01 74 19 "Construction Waste Management and Disposal."
15. Product Data for adhesives and sealants used inside weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials.
16. Product Data for paints and coatings used inside weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials.
17. Laboratory test reports for flooring, indicating compliance with requirements for low-emitting materials.
18. Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials.
19. Laboratory test reports for ceilings, walls, and thermal insulation, indicating compliance with requirements for low-emitting materials.
20. Construction Indoor-Air-Quality (IAQ) Management:

    a. Construction IAQ management plan.
    b. Product Data for temporary filtration media.
    c. Product Data for filtration media used during occupancy.

d. Construction Documentation: Six photographs at three different times during construction period, along with brief description of SMACNA approach employed, documenting implementation of IAQ management measures, including protection of ducts and on-site stored or installed absorptive materials.

21. IAQ Assessment:

a. Signed statement describing the building air flush-out procedures, including dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
b. Product Data for filtration media used during flush-out and occupancy.
c. Report from testing and inspecting agency indicating results of IAQ testing and documentation that show compliance with IAQ testing procedures and requirements.

C. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:

1. Plumbing.
2. Mechanical.
3. Electrical.
4. Specialty items such as elevators and equipment.

D. Sustainable Design Action Plans: Provide preliminary submittals within 30 days of date established for the Notice to Proceed, indicating how the following requirements will be met:

1. List of proposed products with EPDs.
2. List of proposed products complying with requirements for multi-attribute optimization.
3. List of proposed products complying with requirements for raw material and source extraction reporting.
4. List of proposed products complying with requirements for leadership extraction practices.
5. List of proposed products complying with requirements for material ingredient reporting.
6. List of proposed products complying with requirements for material ingredient optimization.
7. List of proposed products complying with requirements for product manufacturer supply chain optimization.
8. Waste management plan complying with Section 01 74 19 "Construction Waste Management and Disposal."
9. Construction IAQ management plan.

E. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable design action plans.

1.6 QUALITY ASSURANCE

A. LEED Coordinator: Contractor shall engage an experienced LEED Accredited Professional to coordinate LEED requirements that can serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide products and procedures necessary to obtain LEED credits indicated as Contractor's responsibility. Although other Sections may specify some requirements that contribute to these LEED credits, Contractor shall provide additional materials and procedures necessary to obtain LEED credits.

B. At least 20 different products from at least five different manufacturers shall have EPDs that comply with LEED requirements. Industrywide (generic) EPDs shall be valued as one-half of a product.

C. At least 50 percent, by cost, of permanently installed products for Project shall comply with LEED requirements for multi-attribute optimization.

D. At least 20 different products from at least five different manufacturers shall have publicly released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.

E. At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.

F. At least 25 percent, by cost, of permanently installed products for Project shall comply with LEED requirements for material ingredient optimization.

G. At least 25 percent, by cost, of permanently installed products for Project shall comply with LEED requirements for product manufacturer supply chain optimization.

H. Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices.

1. Structure and enclosure materials shall not be more than 30 percent, by cost, of materials used to comply with this requirement.

I. Extended Producer Responsibility Program: Not less than 25 percent of building materials, by cost, shall be manufactured by a participant in an extended producer responsibility program.

J. Recycled Content: Building materials shall have recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content for Project constitutes a minimum of 25 percent of cost of materials used for Project.

1. Cost of postconsumer recycled content plus one-half of preconsumer recycled content of an item shall be determined by dividing weight of postconsumer recycled content plus one-half of preconsumer recycled content in the item by total weight of the item and multiplying by cost of the item.
2. Do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.

2.2 LOW-EMITTING MATERIALS

A. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Clear Wood Finishes, Varnishes: 275 g/L.
9. Clear Wood Finishes, Lacquers: 275 g/L.
10. Floor Coatings: 50 g/L.
11. Shellacs, Clear: 730 g/L.
12. Shellacs, Pigmented: 550 g/L.
13. Stains: 100 g/L.

B. Paints and Coatings: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Wood Glues: 30 g/L.
2. Metal-to-Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Contact Adhesives: 80 g/L.
16. Structural Glazing Adhesives: 100 g/L.
17. Wood Flooring Adhesives: 100 g/L.
18. Structural Wood Member Adhesives: 140 g/L.
19. Single-Ply Roof Membrane Adhesives: 250 g/L.
20. Special-Purpose Contact Adhesives (That Are Used to Bond Melamine-Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
21. Top and Trim Adhesives: 250 g/L.
22. Plastic Cement Welding Compounds: 250 g/L.

23. ABS Welding Compounds: 325 g/L.
24. CPVC Welding Compounds: 490 g/L.
25. PVC Welding Compounds: 510 g/L.
26. Adhesive Primer for Plastic: 550 g/L.
27. Sheet-Applied Rubber Lining Adhesives: 850 g/L.
28. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
29. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
30. Special-Purpose Aerosol Adhesives (All Types): 70 percent by weight.
31. Other Adhesives: 250 g/L.
32. Architectural Sealants: 250 g/L.
33. Nonmembrane Roof Sealants: 300 g/L.
34. Single-Ply Roof Membrane Sealants: 450 g/L.
35. Other Sealants: 420 g/L.
36. Sealant Primers for Nonporous Substrates: 250 g/L.
37. Sealant Primers for Porous Substrates: 775 g/L.
38. Modified Bituminous Sealant Primers: 500 g/L.
39. Other Sealant Primers: 750 g/L.

D. Adhesives and Sealants: For field applications that are inside the weatherproofing system, 90 percent of adhesives and sealants shall comply with requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Flooring: Shall comply with requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Composite Wood, Agrifiber Products, and Adhesives: Shall be made using ultra-low-emitting formaldehyde resins as defined in California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

G. Ceilings, Walls, and Thermal Insulation: Shall comply with requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

A. Smoking is not permitted within the building or within 25 ft. of entrances, operable windows, or outdoor-air intakes.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY (IAQ) MANAGEMENT

A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."

1. If State authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 01 50 00 "Temporary Facilities and Controls," install MERV 8 filter media at each return-air inlet for the air-handling system used during construction.
2. Replace air filters immediately prior to occupancy with new filters specified in Section 01 81019 "Construction Indoor Air quality Managment."

3.4 INDOOR-AIR-QUALITY (IAQ) ASSESSMENT

A. Flush-Out:

1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14,000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.

2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu. ft./sq. ft. of outside air has been delivered to the space.

B. Air-Quality Testing: Engage testing agency to perform the following:

1. Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in USGBC's "LEED Reference Guide for Building Design and Construction v4."
2. Demonstrate that contaminant maximum concentrations listed below are not exceeded:

    a. Formaldehyde: 27 ppb.
    b. Particulates (PM10): 50 mcg/cu. m.
    c. Ozone: 0.075 ppm, according to ASTM D5149.
    d. Total Volatile Organic Compounds (TVOC): 500 mcg/cu. m.
    e. 4-Phenylcyclohexene (4-PH): 6.5 mcg/cu. m.
    f. Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
    g. Target Chemicals in California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," Table 4-1 (except formaldehyde).

3. For each sampling point where maximum concentration limits are exceeded, take corrective action until requirements have been met.
4. Air-sample testing shall be conducted as follows:

    a. All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside airflow rate for the occupied mode throughout the duration of the air testing.

b. Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
c. Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 5000 sq. ft.. For large open spaces, one sampling point per 50,000 sq. ft. may be used.
d. Air samples shall be collected between 3 and 6 ft. from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning activities.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of commissioning process test equipment, instrumentation, and tools.
5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
6. Commissioning tests and commissioning test demonstration.
7. Adjusting, verifying, and documenting identified systems and assemblies.

1.2 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

B. Commissioning Authority: An entity engaged by State to evaluate Commissioning-Process Work.

C. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation of commissioning requirements.

D. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with State's Project Requirements.

E. Construction-Phase Commissioning-Process Completion: The stage of completion and acceptance of commissioning process when resolution of deficient conditions and issues discovered during commissioning process and retesting until acceptable results are obtained has been accomplished. State will establish in writing the date construction-phase commissioning-process completion is achieved.

1. Commissioning process is complete when the Work specified of this Section and related Sections has been completed and accepted, including, but not limited to, the following:

a. Completion of tests and acceptance of test results.
b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
c. Comply with requirements in Section 01 79 00 "Demonstration and Training."
d. Completion and acceptance of submittals and reports.

F. State's Witness: Commissioning Authority, State's Project Manager, or Architect- or Engineer-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.

G. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

H. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

I. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.

1.3 COMPENSATION

A. If State, and/or State's Representatives perform additional services or incur additional expenses due to actions of Contractor listed below, State will deduct charges for such additional services and expenses from the Contract Sum.

1. Failure to meet acceptance criteria for test.

B. For a deficiency identified, not related to any pre-functional checklist or start-up fault, the following shall apply:

1. For the first retesting of the equipment the State will not deduct charges from the Contractor for the actual cost the State has incurred in retesting. Additional retesting cost beyond the first retest shall be charged to the Contractor and deducted from the Contract Sum.
2. Retesting required because a specific pre-functional checklist or start-up test item, reported to have been successfully completed, but determined during functional performance testing to be faulty, shall be charged to the Contractor and deducted from the Contract Sum.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s):

1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning process.
2. Appointed team members shall have the authority to act on behalf of the entity they represent.

B. Members Appointed by State:

1. Commissioning Authority, plus consultants that Commissioning Authority may deem appropriate for a particular portion of the commissioning process.
2. State's representative(s) that the State may deem appropriate for a particular portion of the commissioning process.

1.5 SUBMITTALS

A. Comply with requirements in Section 01 33 00 "Submittal Procedures" for submittal procedure general requirements for commissioning process.

B. Commissioning Plan Information:

1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors performing and participating in the various commissioning requirements.
2. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning schedule:

1. Schedule of commissioning activities integrated with the Construction Schedule. Comply with requirements in Section 01 32 00 "Construction Progress Documentation" for the Construction Schedule general requirements for commissioning process.
2. Two-week look-ahead schedules.

D. Commissioning Coordinator Qualification Data: For entity coordinating Contractor's commissioning activities to demonstrate their capabilities and experience.

1. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of three previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

E. List test instrumentation, equipment, and monitoring devices.

F. Test Reports:

1. Pre-Startup Report: Prior to startup of equipment or a system, submit signed, completed construction checklists.
2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
3. Commissioning Issue Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit printout of log of alarms that occurred since the last log was printed.

G. Construction Checklists:

1. Material checks.
2. Installation checks.
3. Startup procedures, where required.

H. Commissioning Report:

1. At Construction-Phase Commissioning Completion, include the following:

a. Pre-startup reports.
b. Approved test procedures.
c. Test data forms, completed and signed.
d. Progress reports.
e. Commissioning issue report log.

f. Commissioning issue reports showing resolution of issues.
g. Correspondence or other documents related to resolution of issues.
h. Other reports required by commissioning process.
i. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction-Phase Commissioning Completion.
j. Report shall include commissioning work of Contractor.

I. Request for Certificate of Construction-Phase Commissioning Process Completion.

J. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Commissioning Coordinator Qualifications:

1. Documented experience commissioning systems of similar complexity to those contained in these documents on at least three projects of similar scope and complexity.
2. Certification of commissioning-process expertise.

B. Commissioning process shall meet the requirements of LEED EA Prerequisite: Fundamental Commissioning and Verification.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Test equipment and instrumentation required to perform the commissioning process shall remain the property of Contractor unless otherwise indicated.

B. Test equipment and instrumentation required to perform commissioning process shall comply with the following criteria:

1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
2. Calibrated and certified.
3. Maintain test equipment and instrumentation.
4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

2.2 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate, or perform work on its equipment.

1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.

2. Proprietary test equipment, instrumentation, and tools shall become the property of State at Completion.

2.3 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:

1. Record report on USB thumb drive.
2. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:

1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include the following:

a. Test specification.
b. Pre-startup reports.
c. Approved test procedures.
d. Test data forms, completed and signed.
e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 PREPARATION

A. Review preliminary construction checklists and preliminary test procedures and data forms.

3.2 CONSTRUCTION CHECKLISTS

A. Construction checklists cannot modify or conflict with the Contract Documents.

B. Create construction checklists based on actual systems and equipment to be included in Project.

C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment if applicable.

1. Service connection requirements, including configuration, size, location, and other pertinent characteristics.
2. Included optional features.
3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness, and lack of damage.
4. Installation Checks:

a. Location according to Drawings and approved Shop Drawings.
b. Configuration.
c. Compliance with manufacturers' written installation instructions.
d. Attachment to structure.
e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
f. Utility connections are of the correct characteristics, as applicable.
g. Correct labeling and identification.
h. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.

D. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, at minimum.

E. Performance Tests:

1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.
2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.
3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.
5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.

6. Identify checklists by number and title.
7. Provide a target schedule for completion of checklists.
8. Written approval of proposed checklists, including approved schedule of completion of each checklist.

3.3 GENERAL EXECUTION REQUIREMENTS

A. Schedule and coordinate commissioning process with the Construction Schedule.

B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.

C. Perform test demonstrations for State’s witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.

1. On determination of the sample size, the samples shall be selected randomly by State’s witness at the time of the test demonstration.
2. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.

D. Report test data and commissioning issue resolutions.

E. Schedule personnel to participate in and perform Commissioning-Process Work.

F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.
2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.
3. Furnish and apply oils, greases, refrigerants, fuels and other lubricants and materials required to place equipment in condition ready for operation

3.4 COMMISSIONING COORDINATOR RESPONSIBILITIES

A. Management and Coordination: Manage, schedule, and coordinate commissioning process, including, but not limited to, the following:

1. Coordinate with subcontractors on their commissioning responsibilities and activities.
2. Obtain, assemble, and submit commissioning documentation.
3. Conduct periodic on-site commissioning meetings. Comply with requirements in Section 01 31 00 "Project Management and Coordination."
4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the Construction Schedule. Update Construction Schedule at specified intervals.
5. Review and comment on preliminary test procedures and data forms.
6. Report inconsistencies and issues in system operations.
7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
8. Direct and coordinate test demonstrations.
9. Coordinate witnessing of test demonstrations by State’s witness.
10. Coordinate and manage training. Be present during training sessions to direct video recording, present training, and direct the training presentations of others. Comply with requirements in Section 01 79 00 "Demonstration and Training."
11. Prepare and submit specified commissioning reports.
12. Track commissioning issues until resolution and retesting is successfully completed.
13. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide State’s representative access to these records on request.
14. Assemble and submit commissioning report.

3.5 COMMISSIONING TESTING

A. Quality Control: Construction checklists, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.

B. State’s witness will be present to witness commissioning work requiring the signature of the State’s witness, including, but not limited to, test demonstrations. State will coordinate attendance by State’s witness with Contractor's published Commissioning Schedule. State’s witness will provide no labor or materials in the commissioning work. The only function of State’s witness will be to observe and comment on the progress and results of commissioning process.

C. Construction Checklists:

1. Complete construction checklists as Work is completed.
2. Distribute construction checklists to installing contractors before they start work.
3. Installers:

a. Verify installation using approved construction checklists as Work proceeds.

b. Complete and sign construction checklists for work performed during the preceding day.

4. Provide Commissioning Authority access to construction checklists.

D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.

E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre-startup report for each system.

F. Test Procedures and Test Data Forms:

1. Test procedures shall define the step-by-step procedures to be used to execute tests and test demonstrations.
2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
3. Completed test data forms are the official records of the test results.
4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
5. Review preliminary test procedures and test data forms, and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:

   a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
   b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.

6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."
7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.

G. Performance of Tests:

1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
2. Perform and complete each step of the approved test procedures in the order listed.
3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.
4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Performance of Test Demonstration:

1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be 100 percent unless otherwise indicated in the individual test specification.
2. Notify State's witness at least three days in advance of each test demonstration.
3. Perform and complete each step of the approved test procedures in the order listed.
4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
5. Provide full access to State's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of State's witness at the time of the test to authenticate the reported results.
6. Test demonstration data forms not signed by Contractor and State's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.

    a. Exception for Failure of State's Witness to Attend: Failure of State's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If State's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for State's witness, and shall note the absence of State's witness at the scheduled time and place.

7. False load test requirements are specified in related sections.

    a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady-state operation and modulation at the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without State's written approval.

I. Commissioning Compliance Issues:

1. Test results that are not within the range of acceptable results are commissioning compliance issues.
2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.
3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse State for billed costs for the participation in the repeated demonstration.
4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:

    a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.
    b. Submit commissioning compliance issue report form within 48 hours of the test.
    c. Determine the cause of the failure.
    d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.

5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.

    a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report.) If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.
    b. Complete and submit the commissioning compliance issue report immediately when the condition is observed.
    c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
    d. Resolve commissioning compliance issues promptly. Complete and re-submit the commissioning compliance issue report when issues are resolved.

6. Diagnose and correct failed test demonstrations as follows:

    a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
    b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
    c. Record the results of each step of the diagnostic procedure.
    d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
    e. Determine and record corrective measures.
    f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.

7. Retest:

    a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of State’s witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate State for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.
    b. For each repeated test demonstration, submit a new test data form, marked "Retest."

8. Do not correct commissioning compliance issues during test demonstrations.

    a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than 15 minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

9. Failure due to Manufacturer defect:

    a. If 10% or three, whichever is greater, of identical pieces, size alone does not constitute a difference, of equipment fail to perform to the Contract Documents, not allowing it to meet its submitted performance specifications, due to manufacturing

defect, either mechanically or substantively, all identical units may be considered unacceptable. Comply with the following:

1) Within one week of notification, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings.
2) Within 14 calendar days of the original notification, the Contractor or manufacturer shall provide a signed and dated written explanation of the problem, cause of failures, other pertinent information and proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3) The State shall determine whether a repair is acceptable, or the replacement of all identical units is required.
4) Two samples of the proposed solution shall be installed, tested, and operated for a minimum of 7 calendar days, upon which the State will decide whether to accept the solution.
5) Upon acceptance, replace or repair all identical items, at its expense and extend the warranty accordingly. The replacement or repair work shall proceed without delay.

3.6 COMMISSIONING MEETINGS

A. Schedule and conduct commissioning meetings. Comply with requirements in Section 01 31 00 "Project Management and Coordination."

3.7 SEQUENCING

A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:

1. Construction Checklists:

   a. Material checks.
   b. Installation checks.
   c. Startup, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.
   d. Performance Tests:

      1) Static tests, as appropriate.
      2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.
      3) Equipment and assembly performance tests.
      4) System performance tests.
      5) Intersystem performance tests.

2. Commissioning tests.

B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.

C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify State if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.

D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

3.8 SCHEDULING

A. Commence commissioning process as early in the construction period as possible.

B. Commissioning Schedule: Integrate commissioning activities into Construction Schedule. See Section 01 32 00 "Construction Progress Documentation."

1. Include detailed commissioning activities in monthly updated Construction Schedule and short-interval schedule submittals.
2. Schedule the start date and duration for the following commissioning activities:

    a. Submittals.
    b. Preliminary operation and maintenance manual submittals.
    c. Installation checks.
    d. Startup, where required.
    e. Performance tests.
    f. Performance test demonstrations.
    g. Commissioning tests.
    h. Commissioning test demonstrations.

3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
4. Determine milestones and prerequisites for commissioning process. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short-interval schedule submittals.

C. Three-Week Look-Ahead Commissioning Schedule:

1. Three weeks prior to the beginning of tests, submit a detailed three-week look-ahead schedule. Thereafter, submit updated three-week look-ahead schedules weekly for the duration of commissioning process.
2. Three-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
3. Use three-week look-ahead schedules to notify and coordinate participation of State’s witnesses.

D. State’s Witness Coordination:

1. Coordinate State’s witness participation.
2. Notify State of commissioning schedule changes at least two workdays in advance for activities requiring the participation of State’s witness.

3.9 COMMISSIONING REPORTS

A. Test Reports:

1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:

    a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
    b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
    c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
    d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
    e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.

2. Test data reports include the following:

    a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
    b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
    c. Signatures of individuals performing and witnessing tests.
    d. Data trend logs accumulated overnight from the previous day of testing.

3. Commissioning Compliance Issue Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:

    a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
    b. Action distribution list.
    c. Report date.
    d. Test number and description.
    e. Equipment identification and location.
    f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
    g. Diagnostic procedure or plan to determine the cause (include in initial submittal)
    h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
    i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
    j. When issues have been resolved, update and resubmit the commissioning issue report forms. Identify resolution taken and the dates and initials of the persons making the entries.
    k. Schedule for retesting.

4. Progress reports include information for tests conducted since the preceding report and the following:

    a. Completed data forms.
    b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
    c. Activities scheduled but not conducted per schedule.
    d. Commissioning compliance issue report log.
    e. Schedule changes for remaining Commissioning-Process Work, if any.

5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.

    a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.
    b. Attach to the data form printed trend log data collected during the test or test demonstration.
    c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by the test procedure invalidates the test results.

6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."

    a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

3.10 CERTIFICATE OF CONSTRUCTION-PHASE COMMISSIONING PROCESS COMPLETION

A. When Contractor considers that construction-phase commissioning process, or a portion thereof which State agrees to accept separately, is complete, Contractor shall prepare and submit to State a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to compete commissioning process.

B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction-phase commissioning process or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction-Phase Commissioning Process Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction-Phase Commissioning Process Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction-phase commissioning process completion.

C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning process. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for State’s and Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.

D. When construction-phase commissioning process or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction-Phase Commissioning Process Completion that shall establish the date of completion of construction-phase commissioning process. Certificate of Construction-Phase Commissioning Process Completion shall be submitted prior to requesting inspection for determining date of Completion.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMWORK AND ACCESORIES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. Requirements of Division 1 apply to all work of this section.

1.02 SCOPE

A. Design, furnish and install forms for concrete as indicated on drawings and specified here. Remove forms and shores at specified time. Clean up.

1.03 RELATED WORK (See also Table of Contents)

A. Reinforcing Steel: Section 03 21 00.

B. Cast-In-Place Concrete: Section 03 30 00.

C. Structural Steel: Section 05 12 00.

D. Metal Fabrications: Section 05 50 00.

E. Items relating solely to mechanical or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.

1.04 QUALITY ASSURANCE

A. General:

1. Conform to all requirements of ACI 347 and ACI 318 Section 6.1 and 6.2.

2. Concrete formwork shall be designed and constructed to safely support fluid concrete and superimposed construction loads without excessive deflection or concrete leakage. Provide bracing to maintain accurate alignment and to resist all anticipated lateral loads. Forms shall conform with drawings as to shape, line, and dimension. Design, engineering and construction of forms shall be Contractor's responsibility. Formwork for exposed concrete shall be constructed to tolerances indicated in ACI 303R.

3. Cooperate and coordinate with other trades who furnish and/or install piping, conduit, reglets, anchors, inserts, sleeves, hangers, etc., as their work requires; including provisions for recesses and chases.

B. Submittals: (Submit under provisions of Section 01 33 00)

1. Product Data. Provide manufacturers data and installation instructions for the following:

a. Tie rods and spreaders.

b. Formwork for exposed concrete.

c. Form coatings and release agents.

C. Standards and References: (Latest Edition unless otherwise noted)

1. 2019 California Building Code (CBC).

2. American Concrete Institute (ACI).

a. ACI 303R - “Guide to Cast-In-Place Architectural Concrete Practice”

b. ACI 318 – “Building Code Requirements for Structural Concrete”

c. ACI 347 - "Recommended Practice for Concrete Formwork”

3. Standard Grading and Dressing Rules #17, West Coast Lumber Inspection Bureau (For Douglas Fir Form Lumber).

4. U.S. Product Standard PS 1 (For Plywood Form Lumber).

PART 2 - PRODUCTS

2.01 MATERIALS

A. Form Material:

1. Smooth Concrete exposed to view: 5/8 inch minimum APA Plyform or steel.

2. Concrete concealed from view: 5/8 inch minimum APA Plyform, steel or clean and sound 1 x 8 Standard Grade Douglas Fir.

B. Fiber Forms: Tubular column forms spirally constructed of laminated plies of fiber. Plies shall be laminated using a non-water sensitive adhesive and surface wax impregnated for moisture protection. Forms shall give a smooth and seamless appearance to the cast concrete. Provide reveals, as shown on the drawings, as supplied by the form manufacturer. Forms shall be as manufactured by Sonoco Products, plastic lined; Burke Smoothtube by Burke Co.; or approved equal.

C. Form Clamps: Assembly to have cone washers, (1 inch break back) 3/8” inch center rod.

D. Form Ties:

1. Concrete exposed to view: Snap ties allowing full 1 inch break back.

2. Concrete concealed from view: Snap ties or wire.

3. Verify special spacing requirements with architectural drawings at exposed concrete.

E. Spreaders: Metal (no wood).

F. Form Coating: Non-grain and non-staining types of form coating that will not leave a residual matter on the face of the concrete or adversely affect proper bonding of any subsequent paint or other surface applications.

1. Form coating containing mineral oils or other non-drying materials will not be permitted for any concrete work.

G. Joint Tape: No. 471 plastic film tape 3 inches wide, as manufactured by the Industrial Tape Division of 3M Company.

H. Expansion Joint Filler (Preformed): ½ inch thick; Flexcell by Celotex Corporation, Elastic Fiber Expansion Joint by Phillip Carey Mfg. Co., or Sealtight Fiber Expansion Joint by W.R. Meadows, Inc.

I. Extruded Polystyrene Foam: ASTM C578 type IV. Dow Chemical Corp. "Styrofoam", UC Industries "Foamular", or approved equal.

PART 3 - EXECUTION

3.01 FORM CONSTRUCTION

A. Construct substantial forms to the shapes, lines, grades and elevations shown, sufficiently tight to prevent leakage of mortar, and tied, clamped and braced to prevent spreading, shifting or settling. Plywood joints shall be square and tight; plywood shall be arranged in such manner as to minimize number of joints and to provide a smooth, attractive finished concrete surface.

B. Apply form coating to forms before reinforcing steel is in place.

C. Sleeves, anchors and bolts, including those for angle frames, supports, ties and other materials in connection with concrete construction, shall be secured in position before the concrete is placed.

D. Proper provisions shall be made for openings, blockouts, sleeves, offsets, sinkages, recesses and depressions required by other trades and suppliers prior to placing concrete.

1. The Contractor shall also see that sleeves have been installed and other provisions have been made for the installation of mechanical, electrical and other equipment.

2. Coordinate with all trades to insure proper placement of all items in forms and to provide proper blockouts wherever required.

E. Concrete work out of alignment, level or plumb will be cause for rejection of the whole work affected and, if so rejected, such work shall be removed and replaced, as directed by Architect, with no additional cost to the Owner.

F. Form Not Required: Concrete footings may be poured directly against cut earth where feasible and when the Architect’s approval has been obtained.

1. See structural drawings for requirements for placing concrete footings directly against earth without forms.

G. Use ¾ inch minimum wood chamfer strips typical at all exposed corners unless noted otherwise on drawings.

3.02 CLEANING OF FORMS

A. All dirt, chips, sawdust, rubbish, water, etc. shall be completely removed from form by water hosing and air pressure before any concrete is deposited therein. No wooden ties or blocking shall be left in concrete except where indicated for attachment of other work.

B. Thoroughly clean and patch all holes in formwork and re-coat as required before reusing. Forms not suited to obtain concrete surfaces and tolerances in conformity with Contract requirements will be rejected by Architect.

1. Reuse of forming materials shall be limited only as required to produce the finishes as specified, free from blemishes and other defects unless covered by other building materials in which case blemish free concrete is not required.

3.03 INSPECTION OF FORMS

A. Notify the Architect at least 48 hours in advance of the beginning of pouring operations and at the completion of formwork and location of all construction joints. An inspection of forms and joints will be made for approval of finished work and general layout only. The foregoing inspection shall in no way relieve the Contractor of responsibility of design and safety or formwork, bulkheads and shorings.

3.04 REMOVAL OF FORMS AND SHORING

A. Do not remove forms until concrete has attained sufficient strength to support its weight and any construction loading. Concrete must be allowed to cure long enough to avoid damage during form removal. Contractor or his representative in charge of concrete construction shall be present during removal of forms and shores, and shall be personally responsible for safety of this operation at all times and under all conditions.

B. As a minimum, formwork and shoring shall remain in place for the following periods:

1. Concrete on grade: 24 hours

2. Walls and Columns: 3 days

3. Formwork may be removed and reshores installed before the times indicated above, provided the concrete has cured sufficiently to avoid damage when formwork is removed. Shores must be immediately replaced with reshores in a sequence designed to avoid inducing stress in the concrete member.

3.05 ADJUSTING AND CLEANING

A. Upon completion of this Work, clean up and remove from Site all equipment and debris resulting from this work.

B. Surfaces to be painted shall be smooth and free of substances such as dirt, wax, excessive latence, grease or materials that would prevent proper bonding of finishes.

1. Removal of foregoing contaminants, and complete removal of parting and curing compounds affecting proper paint bond, shall be responsibility of this Section of Work. Sandblast cleaning shall not be employed without specific approval of Structural Engineer.

END OF SECTION

SECTION 03 21 00

REINFORCING STEEL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Requirements of Division 1 apply to all work of this Section.

1.02 SCOPE

A. Unless noted otherwise, furnish and install reinforcing for all concrete, including dowels, chairs, spacers, bolsters, etc., necessary for supporting and fastening reinforcement in place as shown on the Drawings and specified herein.

1.03 RELATED WORK (See also Table of Contents)

A. Concrete Formwork: Section 03 10 00.

B. Cast-In-Place Concrete: Section 03 30 00.

C. Concrete Unit Masonry: Section 04 22 00.

1.04 QUALITY ASSURANCE

A. General:

1. Acceptable Manufacturers: Regularly engaged in the manufacture of steel bar and welded wire fabric reinforcing.

2. Installer Qualifications: Installation shall be done only by an installation firm normally engaged in this business. All work shall be performed by qualified mechanics working under an experienced supervisor.

3. Welding Qualifications: Welding procedures, welding operators and welders shall be qualified in accordance with AWS D1.4 - "Structural Welding Code Reinforcing Steel".

a. Welders whose work fails to pass inspection shall be re-qualified before performing further welding.

4. Reinforcement Work shall conform to ACI 301 and ACI 318 Chapter 25, as minimum standards.

5. Allowable Tolerances:

a. Fabrication:

1) Sheared length: 1 inch.

2) Depth of truss bars: Plus or minus ½-inch.

3) Ties: Plus or minus ½-inch.

4) All other bends: Plus or minus 1 inch.

b. Placement:

1) Concrete cover to form surfaces: Plus or minus ¼-inch.

2) Minimum spacing between bars: Plus or minus ¼-inch.

3) Crosswise of members: Spaced evenly within 2 inches of stated separation.

4) Lengthwise of members: Plus or minus 2 inches.

c. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 2 bar diameters.

B. Standards and References: (Latest Edition unless otherwise noted):

1. 2019 California Building Code (CBC).

2. American Concrete Institute (ACI).

a. ACI 301 - "Specifications for Structural Concrete for Buildings".

b. ACI 315 - "Details and Detailing of Concrete Reinforcing".

c. ACI 318 – “Building Code Requirements for Structural Concrete”

3. American Society for Testing and Materials (ASTM).

a. ASTM A82 - "Cold Drawn Wire for Concrete Reinforcement".

b. ASTM A185 - "Welded Steel Wire Fabric for Concrete Reinforcement".

c. ASTM A615 - "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement".

d. ASTM A706 – “Low Alloy Steel Deformed Bars for Concrete Reinforcement”.

4. Concrete Reinforcing Steel Institute (CRSI) - "Manual of Standard Practice".

5. American Welding Standard (AWS).

a. AWS D1.4 - "Structural Welding Code – Reinforcing Steel".

C. Submittals: (Submit under provisions of Section 01 33 00)

1. Shop Drawings: Prepare in accordance ACI 315. Indicate bending diagrams,

assembly diagrams, splicing and laps of bars and shapes, dimensions and details of bar reinforcing and assemblies. Correctness of all reinforcing requirements and work is the responsibility of Contractor. Identify such shop drawings with reference thereon to sheet and detail numbers from Contract Drawings.

a. Do not use scaled dimensions from Contract Drawings in determining the lengths of reinforcing bars.

b. No reinforcing steel shall be fabricated without approved shop drawings.

c. Any deviations from the contract documents must be clearly indicated as a deviation on the shop drawings.

d. Areas of high congestion, including member joints and embed locations shall be fully detailed to verify clearances and assembly parameters and coordination with other trades.

2. Certified mill test reports of supplied reinforcing indicating chemical and physical analysis. Tensile and bend tests shall be performed by the mill in accordance with ASTM A615.

3. Product Data:

a. Manufacturer's specifications and installation instructions for splice devices.

b. Bar Supports.

4. Certificates of Compliance with specified standards:

a. Reinforcing bars.

b. Welded wire fabric.

c. Welding electrodes.

5. Samples: Only as requested by Architect.

D. Tests and Inspections:

1. A testing program is required prior to start of construction. Testing program to be done in compliance with the CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.

2. All reinforcing steel whose properties are not identifiable by mill test reports shall be tested in accordance with ASTM A615. One Series of tests for each missing report to be borne by the Contractor.

3. When inspections are indicated for reinforcement placement on the Structural drawings, a special inspector shall be employed to inspect reinforcing placement per

CBC Section 1704.

4. When tests are indicated for reinforcing steel on the structural drawings, the reinforcing steel used shall be tested in accordance with ASTM A615. One tensile and one bend test for each 2-1/2 tons of steel or fraction thereof, shall be made.

5. Inspect shop and field welding in accordance with AWS D1.4, including checking materials, equipment, procedure and welder qualification as well as the welds. Inspector will use non-destructive testing or any other aid to visual inspection that he deems necessary to assure himself of the adequacy of the weld.

6. Tests and inspection shall be performed by Owners testing agency except when needed to justify rejected work, in which case the cost of retests and reinspection shall be borne by the Contractor.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.

B. Handle and store materials to prevent contamination.

1. Store reinforcement in a manner that will prevent excessive rusting or coating with grease, oil, dirt, and other objectionable materials. Storage shall be in separate piles or racks so as to avoid confusion or loss of identification after bundles are broken.

C. Deliver and store welding electrodes in accordance with AWS D1.4.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcement Bars: ASTM A615, Grade 60 for all bars.

1. Bar reinforcement to be welded shall meet chemical requirements of ASTM A706.

2. Longitudinal reinforcement in column and beams of special moment-resisting frames shall meet the chemical requirements of ASTM A706.

B. Stirrups and Ties: ASTM A615, Grade 60 for all bars.

C. Steel Dowels: Same grade as bars to which dowels are connected.

D. Welded wire Fabric: ASTM A185.

E. Tie Wires: FS-QQ-W-461, annealed steel, black, 16 gauge minimum.

F. Welding Electrodes: AWS D1.4, low hydrogen, E70XX series.

G. Bar Supports:

1. Typical, unless noted otherwise; CRSI Class 2 wire supports.

   a. Do not use wood, brick or other objectionable materials.

   b. Do not use galvanized supports.

2. Supports placed against ground: Pre-cast concrete blocks not less than 4 inches square with embedded wire.

H. Mechanical Couplers: Comply with ACI 318 section 25.5.7.1

PART 3 - EXECUTION

3.01 FABRICATION

A. Shop fabricate reinforcement to meet requirements of Drawings.

B. Fabricate reinforcement in accordance with the requirements of ACI 315 where specific details are not shown or where Drawings and Specifications are not more demanding.

C. Steel reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the Drawings shall not be used. Heating of bars for bending will not be permitted.

D. Reinforcing shall not be field bent or straightened without structural engineer’s review.

E. Provide offsets in rebar (1:6 maximum) where required to maintain clearances.

3.02 CONDITION OF SURFACES

A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions have been corrected.

3.03 GENERAL

A. Concrete shown without reinforcing shall be reinforced as similar parts shown with reinforcing except where concrete is specifically noted to be unreinforced.

3.04 PLACEMENT

A. All reinforcement shall be accurately set in place, lapped, spliced, spaced rigidly and securely held in place and tied with specified wire at all splices and crossing points. All wire tie ends shall point away from the form. Carefully locate all dowel steel to align with wall and column steel.

1. Bars shall be in long lengths with laps and splices as shown. Offset laps in adjacent bars. Place steel with clearances and cover as shown. Bar laps shall be as indicated on the Drawings. Tie all laps and intersections with the specified wire.

2. Maintain clear space between parallel bars not less than 1-1/2 times nominal diameter, but in no case shall clear space be less than 1-1/2 times maximum size

concrete aggregate.

3. Reinforcing dowels for slabs shall be placed as detailed. Sleeves may be used if reviewed by the Structural Engineer before installation. Install dowel through all construction and expansion joints for all slabs on grade.

B. Bar Supports: Support and securely fasten bars with chairs, spacers and ties to prevent displacement by construction loads or placement of concrete beyond the tolerances specified. Conform to CRSI as a minimum standard.

C. Steel Adjustment:

1. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.

2. Do not move bars beyond allowable without concurrence of Structural Engineer.

3. Do not heat, bend, or cut bars without concurrence of Structural Engineer.

4. Reinforcement shall not be bent after being embedded in hardened concrete.

D. Splices:

1. Splice reinforcing as shown.

2. Lap Splices: Tie securely with wire to prevent displacement of splices during placement of concrete.

3. Splice Devices: Install in accordance with manufacturer's written instructions. Obtain Structural Engineer’s review before using.

4. Do not splice bars except at locations shown without concurrence of Structural Engineer.

a. Where splices in addition to those indicated are required, indicate location on shop drawings clearly and highlight "for Engineer’s approval".

E. Welding:

1. Welding is not permitted unless specifically detailed on Drawings or approved by Engineer.

2. Employ shielding metal-arc method and meet requirements of AWS D1.4.

3. Welding is not permitted on bars where the carbon equivalent is unknown or is determined to exceed 0.55.

4. Welding shall not be done within two bar diameters of any bent portion of a bar which has been bent cold.

5. Welding of crossing bars is not permitted.

F. Welded Wire Fabric: Install in long lengths, lapping 24 inches at end splices and one mesh at side splices. Offset laps in adjacent widths. Place fabric in approximately the middle of the slab thickness unless shown otherwise on the Drawings by dimension. Wire tie lap joints at 12-inch centers. Use concrete blocks to support mesh in proper position.

G. Reinforcement shall be free of mud, oil or other materials that may reduce bond at the time concrete is placed. Reinforcement with tightly adhered rust or mill scale will be accepted without cleaning provided that rusting has not reduced dimensions and weights below applicable standards. Remove loose rust.

H. Protection against rust:

1. Where there is danger of rust staining adjacent surfaces, wrap reinforcement with impervious tape or otherwise prevent rust staining.

2. Remove protective materials and clean reinforcement as required before proceeding with concrete placement.

I. Drawing Notes: Refer to notes on Drawings for additional reinforcement requirements.

J. Mechanical and Electrical Drawings: Refer to Mechanical and Electrical Drawings for formed concrete requiring reinforcing steel. All such steel shall be included under the work of this Section.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. Requirements of Division 1 apply to all Work of this Section.

1.02 SCOPE

A. Furnish, place and finish cast in place concrete and related work as indicated on the Drawings and specified here.

1. Install miscellaneous metal and other items furnished by other trades to be installed in concrete work.

2. Provide facilities for job curing of test cylinders and transporting to Testing Laboratory.

B. Provide grouting of steel base plates as indicated on the Drawings and specified here.

1.03 RELATED WORK (See also Table of Contents)

A. Concrete Formwork: Section 03 10 00.

B. Reinforcing Steel: Section 03 21 00.

C. Mortar and Grout: 04 05 00.

D. Structural Steel: Section 05 12 00.

E. Metal Decking: Section 05 30 00.

F. Metal Fabrications: Section 05 50 00.

1.04 QUALITY ASSURANCE

A. Standards and References: (Latest Edition unless otherwise noted)

1. 2019 California Building Code (CBC).

2. American Concrete Institute (ACI)

a. ACI 117 – “Standard Tolerances for Concrete Construction and Materials”

b. ACI 211.1 – “Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete”

c. ACI 211.2 – “Standard Practice for Selecting Proportions for Structural Lightweight Concrete”

d. ACI 301 – “Structural Concrete for Buildings”

e. ACI 302 – “Guide for Concrete Floor and Slab Construction”

f. ACI 305R – “Hot Weather Concreting”

g. ACI 306R – “Cold Weather Concreting”

h. ACI 318 – “Building Code Requirements for Structural Concrete”

i. ACI 360 – “Design of Slabs-On-Ground”

3. American Society for Testing and Materials (ASTM)

a. ASTM C31 – “Making and Curing Concrete Test Specimens in the Field”

b. ASTM C33 – “Concrete Aggregates”

c. ASTM C39 – “Compressive Strength of Cylindrical Concrete Specimens”

d. ASTM C42 – “Obtaining and Testing Drilled Cores and Sawed Beams of Concrete”

e. ASTM C94 – “Ready-Mixed Concrete”

f. ASTM C109 – “Test of Hydraulic Cement Concrete”

g. ASTM C143 – “Slump of Hydraulic Cement Concrete”

h. ASTM C150 – “Portland Cement”

i. ASTM C172 – “Sampling Freshly Mixed Concrete by the Volumetric Method”

j. ASTM C192 – “Making and Curing Concrete Test Specimens in the Laboratory”

k. ASTM C260 – “Air-Entraining Admixtures for Concrete”

l. ASTM C330 – “Lightweight Aggregates for Structural Concrete”

m. ASTM C494 – “Chemical Admixtures for Concrete”

n. ASTM C618 – “Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete”

o. ASTM C685 – “Volumetric Batching and Continuous Mixing”

p. ASTM C1157 – “Hydraulic-Cement”

B. Submittals: (Submit under provisions of Section 01 33 00)

1. Concrete mix designs. See “Mix Design” below. Include results of test data used to establish proportions.

2. Certificates of Compliance from Manufacturer

   a. Cement certificates

   b. Aggregates

   c. Admixtures.

3. Data regarding hardeners and sealers.

4. Grout samples for sacked surface textures and colors upon Architects request only.

5. Layout drawings for construction, control and expansion joints.

6. Transit-mix delivery slips:

   a. Keep record at the job site showing time and place of each pour of concrete, together with transit-mix delivery slips certifying contents of the pour.

   b. Make the record available to the Architect for his inspection upon request.

   c. Upon completion of this portion of the work, deliver the record and the delivery slips to the Architect.

7. See Section 03 21 00 for reinforcing steel submittals.

C. Tests and Inspections:

1. Provide special inspections and testing as described in the “Statement of Structural Special Inspections and Testing” within the structural drawings and as required by this section.

2. A testing program is required prior to start of construction. Testing program to be done in Compliance with the CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.

3. The following tests shall be made by a recognized testing laboratory selected by the Owner and approved by the governing agency. All tests shall be in accordance with the previously mentioned standards and ACI 318 Section 26.12. A complete record of all tests and inspections shall be kept per CBC Section 1903.1.

   a. Compressive Strength: Make and cure in accordance with ASTM C-31. Test in accordance with ASTM C-39 and ACI 318 Section 26.12.

1) A record shall be made of time and of locations of concrete from which samples were taken.
2) Four identical cylinders shall be taken from each pour of 150 cubic yards or 5000 square feet or part thereof, being placed each day per ACI 318 Section 26.12.2. One cylinder shall be tested at age 7 days, and two at age 28 days unless otherwise specified. Preserve remaining cylinder for future use.

b. Drying Shrinkage: (applies to lightweight concrete only unless noted otherwise)

1) A record shall be made of time cylinders and of locations of concrete from which samples were taken.

2) Three identical 4" x 4" x 11" specimens shall be made from same concrete as used in structure. Percent of shrinkage shall be reported at 21 days after 7 day moist curing period. Average results of 3 specimens shall be used as the accepted value. The value for laboratory cast specimens shall not exceed .075%. If field test specimens are used in lieu of laboratory specimens, a tolerance of +33% may be used.

3) Test specimens in accordance with ASTM C157.

c. Concrete consistency (slump) shall be tested in accordance with ASTM C143.

4. Provide full time inspection per CBC Section 1704.3 during the taking of test specimens and during the placing of all concrete and embedded steel.

5. See Section 03 21 00 for reinforcing steel tests and inspections.

6. Provide concrete batch plant inspections per ASTM C685.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Portland Cement: ASTM C 150, Type II or Type V. One brand of cement shall be used throughout to maintain uniform color for all exposed concrete.

B. Concrete Aggregate: Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of appropriate ASTM Standards and ACI 318.

1. Concrete Aggregates for Standard Weight Concrete: ASTM C 33. Aggregate shall be crushed granite or Perkins type.

2. Concrete Aggregates for Lightweight Concrete: ASTM C330 to produce concrete weighing no more than 115 pcf at 28 days. Aggregate shall be vacuum saturated expanded shale as produced through the rotary kiln method.

C. Water: Clean and free from injurious amounts of oil, acids, alkali, organic matter and other deleterious substances; suitable for domestic consumption.

D. Admixtures shall be subject to prior approval by the Architect, in accordance with ACI 318 Section 26.4.1.4. Calcium Chloride is not permitted.

1. Water Reducing

a. ASTM C494 Type A - for use in cool weather.

b. ASTM C494 Type D - for use in hot weather.

2. Air Entraining

a. Conform to ASTM C 260

3. Fly Ash

a. Conform to ASTM C 618

4. Mid-Range Water-Reducers

a. Master Builders “Polyheed” or approved equal.

5. Fly Ash Pozzolan

a. Conforming to ASTM A-618 Class F

E. Slab on Grade Vapor Retarder

1. Vapor Retarder must have the following qualities:

a. 15 mil thickness minimum

b. WVTR less than 0.008 as tested by ASTM E 96

c. ASTM E 1745 Class A (Plastics)

2. Vapor Retarder Products

a. Stego Wrap Vapor Retarder by STEGO Industries LLC.

b. Perminator by W.R. Meadows.

3. Vapor Retarder Tape

a. Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower

b. Minimum 6-mils thick

c. Minimum 3 3/4 inches wide

d. Manufactured from High Density Polyethylene

e. Pressure Sensitive Adhesive

F. Sand: Clean, dry, well graded.

G. Abrasive aggregate for non-slip finish: Fused aluminum oxide grits, graded 12/30. Use factory-graded rustproof and non-glazing material that is unaffected by freezing, moisture and cleaning materials.

1. Products offered by manufacturers to comply with the above requirements include: A-H Alox; Anti-Hydro Waterproofing Co., Toxgrip; Toch Div. - Carboline, or approved equal.

H. Expansion Joint Filler:

1. Joint fill shall be a preformed non-extruded resilient filler, saturated with bituminous materials and conforming to ASTM D 1751. Products shall be equivalent to Burke "Fiber Expansion Joint", W.R. Meadows "Fibrated Expansion Joint Filler", or approved equal.

I. Bonding Agent: Sonneborn "Sonobond"; the Euclid Chemical Company "Euco-Weld"; Larsen Products Corp., "Weld-Crete" or approved equivalent.

J. Concrete Sealer: Cure and Seal, as manufactured by the Euclid Chemical Company "Aqua-Cure VOX", Sonneborn "Kure-N-Seal WB", Burke "Spartan-Cote",W.R. Meadows "Intex" or approved equal conforming to ASTM C-309, Type I, Class B requirements, and conforming to State of California Air Resources Board VOC Regulations.

K. Concrete Hardener/Sealer: Clear, water soluble, sprayable in-organic silicate based hardener/sealer or acrylic co-polymer resin. Products shall be equal to Euclid Chemical Company "Eucosil", Burke "Spartan-Cote", Sonneborn "Sonosil", W.R. Meadows "Pena-Lith", or approved equal and must conform to State of California Air Resources Board VOC Regulations.

L. Concrete Cure: Water based curing compound conforming to ASTM C-309, Type 1, Class A and B, and AASHTO Specification M-148; Type 1, Class A and B requirements, and State of California Air Resources Board VOC Regulations. Product shall be equivalent to Euclid Chemical Company "Kurez VOX", Burke "No. 1127" or "Aqua-Resin Cure", W.R. Meadows "1100 Clear", or approved equal.

M. Non-Shrink Grout: See Section 2.02.A.3.

2.02 CONCRETE

A. Concrete Mixes:

1. Type A Concrete:
Strength: 3000 lbs. per square inch at 28 days.

Maximum Aggregate Size: 1-1/2 inch.
Cement Content: As required by mix design (ACI 318 Section 26.4.3).
5.0 sacks per yard minimum.
Maximum Water to Cement Ratio: 0.58
Admixture: Water Reducing.
Weight: 145 lbs. per cubic foot
Use for unexposed foundation concrete except as otherwise specified. At Contractor's option, Type B concrete may be substituted for this.

2. Type B Concrete:
Strength: 3500 lbs. per square inch at 28 days.
Maximum Aggregate Size: 1 inch.
Minimum Cement Content: As required by mix design. (ACI 318 Section 26.4.3).
5.5 sacks per yard minimum.
Maximum Water to Cement Ratio: 0.45
Admixture: Water reducing.
Weight: 145 lbs. per cubic foot
Use for building slab on grade

3. Grout shall be non-shrink, non-metallic, flowable Type "713" or "928" by BASF.

   a. Metallic grout equivalent to Master Builders "Embeco" may be used only where covered by earth, concrete, or masonry.

   b. Acceptance by Architect required before using.

B. Consistency of Concrete: Concrete slump, measured in accordance with ASTM C 143, shall fall within following limits.

1. For General concrete placement: 4 inch plus or minus 1 inch.

2. Mixes employing the specified mid-range water reducer shall provide a measured slump not to exceed 7 inch $\pm$1 inch after dosing, 2 inch $\pm$1 inch before dosing.

3. Concrete slump shall be taken at point of placement. Use water reducing admixtures as required to provide a workable consistency for pump mixers. Water shall not be added at the jobsite without written review by the structural engineer.

C. Mix Design:

1. Initial mix design shall be prepared for all concrete in accordance with ACI 318 Section 26.4.3. Mix proportions shall be determined in accordance with ACI 318 Section 26.4.3 or 26.4.4. In the event that additional mix designs are required due to depletion of aggregate sources, aggregate not conforming to Specifications or at request of Contractor, these mixes shall be prepared as above.

2. Contractor shall notify the Testing Laboratory and Architect of intent to use concrete pumps to place concrete so that mix designs can be modified accordingly.

3. Fly ash shall not exceed 25% of the total cementitious material.

4. Provide 6% air entrainment typical for exterior concrete exposed to freeze-thaw cycles.

5. Owner's testing laboratory shall review all mix design before submittal.

D. Mixing:

1. Equipment: All concrete shall be machine mixed. Provide adequate equipment and facilities for accurate measurement and control of materials.

2. Method of Mixing:

a. Transit Mixing: Comply with ASTM C 94. Ready mixed concrete shall be used throughout, except as specified below.

b. On-Site Mixing: Use only if method of storing material, mixing of material and type of mixing equipment is approved by Architect. Approval of site mixing does not relieve Contractor of any other requirements of Specifications.

c. Mixing shall be in accordance with ASTM C94 or ASTM C685.

3. Mixing Time: After mix water has been added, concrete shall be mixed not less than 1-1/2 minutes nor more than 1-1/2 hours. Concrete shall be rejected if not deposited within the time specified.

4. Admixtures:

a. Air entraining and chemical admixtures shall be charged into mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighed or measured by volume as recommended by manufacturer. Accuracy of measurement of any admixture shall be within plus or minus 3%.

b. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence, and provided further that admixtures used in that combination retain full efficiency and have no deleterious effect on concrete or on properties of each other.

c. All admixtures are to be approved by Structural Engineer prior to commencing this work.

5. Retempering:

a. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall be discarded, not retempered.

b. Indiscriminate addition of water to increase slump is prohibited.

c. When concrete arrives at project with slump below that suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded. Water shall be incorporated by additional mixing

equal to at least half of total mixing time required. Any addition of water above that permitted by limitation of water-cement ratio shall be accompanied by a quantity of cement sufficient to maintain proper water-cement ratio. Such additions shall only be used if approved by Architect. In any event, with or without addition of cement, not more than 2 gallons of water per cubic yard of concrete, over that specified in design mix, shall be added.

6. Cold Weather Batching: When average of the highest and lowest air temperature falls below 40 degrees F for more than three consecutive days, provide adequate equipment for heating concrete materials. No frozen materials or materials containing ice shall be used. When placed in forms, concrete placed in these temperatures shall have a minimum temperature based on dimensions of concrete sections placed per ACI 301.

7. Hot Weather Batching: Concrete deposited in hot weather shall have a placing temperature below 90 degrees F per ACI 301. If necessary, ingredients shall be cooled to accomplish this.

2.03 FLOOR LEVELING AND FILL MATERIALS

A. Epoxy Concrete Mortar: Floor leveling, non-shrink trowel applied epoxy concrete mortar; TPM 115 General Polymers Corp., A-H Emery Epoxy Topping #170 Anti-Hydro Corp., or approved equal, where areas to fill are less than 1/4 inch thick.

B. Concrete Mortar: Floor leveling, patching and repair, non-shrink trowel applied concrete mortar; Master Builders EMBECO 885, Euclid EUCO, or approved equal, where areas of fill are greater than 1/4 inch thick.

C. Cementitious Floor Leveling Material: Shall be self-leveling or trowelable with a minimum 28 day compressive strength of 3000 psi in accordance with ASTM C-109. Material shall be equal to Quickrete No. 1249, Ardex V-800/K-55, Mapei "Ultra/Flex" or approved equal.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Before any concrete is placed, the following items of work shall have been completed in the area of placing.

1. Forms shall have been erected, adequately braced, cleaned, sealed, lubricated if required, and bulkheaded where placing is to stop.

2. Any wood forms other than plywood shall be thoroughly water soaked before placing any concrete. The wetting of forms shall be started at least 12 hours before concreting.

3. Reinforcing steel shall have been placed, tied and supported.

4. Embedded work of all trades shall be in place in the forms and adequately tied and braced.

5. The entire place of deposit shall have been cleaned of wood chips, sawdust, dirt, debris, hardened concrete and other foreign matter. No wooden ties or blocking shall be left in the concrete except where indicated for attachment of other work.

6. Reinforcing steel, at the time the concrete is placed around it, shall be cleaned of scale, mill scale or other contaminants that will destroy or reduce bond.

7. Concrete surfaces to which fresh concrete is to be bonded shall be brush cleaned to remove all dust and foreign matter and to expose the aggregate, and then coated with the bonding adhesive herein specified.

8. Prior to placing concrete for any slabs on grade, the moisture content of the subgrade below the slabs shall be adjusted to at least optimum moisture.

9. No concrete shall be placed until formwork and reinforcement has been approved by Architect. Clean forms of all debris and remove standing water. Thoroughly clean reinforcement and all handling equipment for mixing and transporting concrete. Concrete shall not be placed against reinforcing steel that is hot to the touch. Notify Structural Engineer 48 hours in advance of concrete pour.

B. Conveying: Handle concrete from mixer to place of final deposit by methods which will prevent separation or loss of ingredients. Deposit concrete in forms as nearly as practicable at its final position in a manner which will insure that required quality is obtained. Chutes shall slope not less than 4 inches and not more than 6 inches per foot of horizontal run.

C. Depositing: Deposit concrete into forms in horizontal layers not exceeding 24 inches in thickness around building, proceeding along forms at a uniform rate and consolidating into previous pour. In no case shall concrete be poured into an accumulation of water ahead of pour, nor shall concrete be flowed along forms to its final place of deposit. Fresh concrete shall not be permitted to fall from a height greater than 6 feet without use of adjustable length pipes or, in narrow walls, of adjustable flexible hose sleeves. Concrete shall be scheduled so that placing is a continuous operation for the completion of each section between predetermined construction joints. If any concreting operation, once planned, cannot be carried on in a continuous operation, concreting shall stop at temporary bulkheads, located where resulting construction joints will least impair the strength of the structure. Location of construction joints shall be as shown on the drawings or as approved by Structural Engineer. The rate of rise in walls shall not be less than 2 feet per hour.

1. Consolidation: Concrete shall be thoroughly compacted and worked to all points with solid continuous contact to forms and reinforcement to eliminate air pockets and honeycombing. Power vibrators of approved type shall be used immediately following pour. Spading by hand, hammering of forms or other combination of methods will be allowed only where permitted by Structural Engineer. In no case shall vibrators be placed against reinforcing steel or used for extensive shifting of deposited fresh concrete. Provide and maintain standby vibrators, ready for immediate use.

2. Hot Weather Concreting: Unless otherwise directed by the Architect, perform all work in accordance with ACI 305 when air temperature rises above 75 degrees F and the following:

   a. Mixing Water: Keep water temperature as low as necessary to provide for the required concrete temperature at time of placing. Ice may be required to provide for the design temperature.

      Aggregate: Keep aggregate piles continuously moist by sprinkling with water.

      Temperature of Concrete: The temperature of the concrete mix at the time it is being placed in the forms shall not exceed 90 degrees F per ACI 301. The method employed to provide this temperature shall in no way alter or endanger the design mix or the design strength required.

      Dampen subgrade and formwork before placing concrete. Remove all excess water before placing concrete. Keep concrete continuously wet when air temperature exceeds 85 degrees F for a minimum of 48 hours after placing concrete. For slab on grade construction, see Section 3.01.E.
      Protection: Minimize evaporation from concrete in place by providing shade and windbreaks. Maintain such protection in place for 14 days minimum.

3. Cold Weather Concreting: Follow recommended ACI 306 procedures when average of the highest and lowest air temperature falls below 40 degrees F for more than three consecutive days, as approved by Architect. Concrete placed in these temperatures shall have a minimum temperature based on dimensions of concrete sections placed as shown in ACI 301. No chemicals or salts shall be used to prevent freezing and no accelerating agents shall be used without prior approval from Architect.

D. Construction Joints: Install only as indicated and noted on Drawings. Joints not indicated on Drawings shall be so located, when approved, as to least impair strength of structure, and shall conform to typical details. Construction joints shall have level tops, vertical sides. Horizontal construction joints shall be thoroughly cleaned and roughened by removing entire surface film and exposing clean aggregate solidly embedded in mortar matrix. Joints between concrete and masonry shall be considered construction joints. Vertical construction joints need not be roughened. See Drawings for doweling and required keys.

   1. Roughen construction joints by any of following methods:

      a. By sandblasting joint.

      b. By thoroughly washing joint, using a high pressure hose, after concrete has taken initial set. Washing shall be done not less than 2 hours nor more than 4 hours after concrete has been poured, depending upon setting time.

      c. By chipping and wire brushing.

   2. All decisions pertaining to adequacy of construction joint surfaces and to compliance with requirements pertaining to construction joints shall be reviewed with the Structural Engineer.

3. Just before starting new pour, horizontal and vertical joint surfaces shall be dampened (but not saturated).

4. Before placing regular concrete mix, horizontal construction joint surfaces shall be covered with a layer of mortar composed of cement and fine aggregate of same proportions as that used in prescribed mix, but omitting coarse aggregate.

5. For slabs, construction joints shall be in locations shown on plan. If not shown, locate at intervals not exceeding 150 feet in each direction. Refer to drawings for proper details for reinforcing at construction joints.

E. Concrete Slabs on Grade:

1. Exterior and interior concrete slabs on grade shall be poured as required under this Section. Base shall be accurately leveled and compacted prior to placing of concrete.

2. Typically, interior slabs on grade shall be poured over a minimum of four (4 inch) inches of compacted crushed rock, unless otherwise indicated, over a vapor retarder.

3. Protect slab on grade subbase from moisture prior to placing concrete. Avoid wetting rock layer to allow adequate concrete curing and avoid future vapor transmission. If the subbase has been wet excessively, verify that water has been eliminated prior to placement of concrete.

4. Vapor Retarder installation shall be in accordance with manufacturer's instructions and ASTM E 1643.

a. Unroll Vapor Retarder with the longest dimension parallel with the direction of the pour.

b. Lap Vapor Retarder over footings and seal to foundation walls.

c. Overlap joints 6 inches and seal with specified tape.

d. Seal all penetrations (including pipes) per manufacturer's instructions.

e. No penetration of the Vapor Retarder is allowed except for reinforcing steel and permanent utilities.

f. Repair damaged areas by cutting patches of Vapor Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

F. Control Jointing - Slabs on Grade:

1. Joints shall be in locations indicated on Drawings, or as directed by Architect.

2. Joints in interior slabs shall be made by one of following methods:

a. By use of construction joints laid out in checkerboard pattern; pour and allow alternate slabs to set; fill out balance of checkerboard pattern with second pour.

b. By use of dummy groove joints at least 1/4 depth of slab, and at least 1/8 inch wide. These joints may be sawcut as soon as wet concrete can support the weight of the equipment and operator. Delaying sawcutting past this point will make jointing ineffective.

3. Control jointing in exterior paving slabs shall be laid out in a checkerboard pattern; pour as described above, but with joint edges tooled to provide a uniform joint at least 3/8 inch in depth.

4. Slab reinforcing need not be terminated at control joints.

5. Construction and expansion joints shall be counted as control joints.

G. Expansion Joints:

1. Unless otherwise indicated, use 3/8 inch thick expansion joint filler. See Section 2.1.H

2. Joints in interior slabs on grade shall be only in locations indicated.

3. Joints in exterior slabs on grade shall be installed at each side of structures, at curb transitions opposite apron joints, at ends of curb returns, at back of curb when adjacent to sidewalk, and at uniformly spaced intervals not exceeding 20 feet.

4. Edges of concrete at joints shall be edger finished to approximately 3/8 inch radius.

5. Interrupt reinforcing at all expansion joints.

H. Score markings on exterior slabs on grade shall be located as indicated. Where not indicated, mark slabs into rectangles of not less than 12 square feet nor more than 20 square feet using a scoring tool which will leave edges of score markings rounded.

3.02 CURING AND PROTECTION

A. Curing: Exposed surfaces of all concrete used in structure shall be maintained in a moist condition for at least 7 days after placing. The following final curing processes shall normally be considered to accomplish this. Concrete shall be maintained at not less than 50 degrees F nor more than 100 degrees F for a period of 72 hours after being deposited.

1. Flatwork to be exposed, stained, or painted shall have curing process submitted and approved by the architect prior to construction.

2. Initial Curing Process - Flat Work:

a. Mist Spraying: As soon as troweling of concrete surfaces is completed, exposed concrete shall be sprayed continuously with a special atomizer spray nozzle, capable of producing a fine mist. Spraying shall be done without any dripping of water from nozzle. Amount of spraying shall be such as to maintain surface of

concrete moist without any water accumulating on surface. Maintain spraying for a minimum of 12 hours, or until such time as hereinafter described curing process is applied. Mist spraying will not normally be required when the ambient air temperature is below 90 degrees F.

3. Final Curing Process - Flatwork: Except as noted, use any of following:

   a. Water Curing: Concrete shall be kept wet by mechanical sprinklers or by any other approved method which will keep surfaces continuously wet.

   b. Saturated Burlap Curing: Finished surfaces shall be covered with a minimum of two layers of heavy burlap which shall be kept saturated during the curing period.

   c. Curing Compounds: Membrane curing compounds of chlorinated rubber or resin type conforming to ASTM C309 may be used only if specifically approved by Architect. Use of membrane curing compound will not be permitted on surfaces to be painted, or to receive ceramic tile, membrane water-proofing or hardeners and sealers. Membrane curing compound may be used in areas to receive resilient floor tile, provided it is wax-free, compatible with adhesive used and approved by adhesive manufacturer. Agitate curing compounds thoroughly by mechanical means continuously during use and spray or brush uniformly in accordance with manufacturer's recommendations. Apply immediately following final finishing operation. All curing compounds shall conform to State of California Air Resources Board VOC Regulations.

   d. Waterproof paper conforming to ASTM C 171, or opaque polyethylene film, may be used. Concrete shall be covered immediately following final finishing operation. Anchor paper or film securely and seal all edges in such a manner as to prevent moisture escaping from concrete.

4. Curing Process - Formed Surfaces: Forms heated by sun shall be kept moist during curing period. If forms are to be removed during curing period, curing as described for flatwork shall be commenced immediately.

B. Refer to Drawings for areas of concrete slab not to receive curing compounds or hardening compounds. Where concrete floors are to receive heavy duty coatings, waterproof coatings and the like, verify with coating installer the type of finish required for specified coating.

C. Protection: Contractor shall be responsible for protection of finished concrete against injury by rain, cold, vibration, animal tracks, marking by visitors, vandalism, etc.

D. Provide additional curing agents or compounds, not necessarily listed herein, but as recommended and or required for use with shake type hardeners or other special coatings and coverings by their manufacturers for a complete and proper installation.

3.03 FINISHES

A. Formed Surfaces:

1. Rough Form Finish: Surfaces shall be reasonably true to line and plane with no specified requirements for selected facing materials. Tie holes and defects shall be patched and fins exceeding 1/4 inch in height shall be rubbed down with wooden blocks. Fins and other rough spots at surfaces to receive membrane waterproofing shall be completely removed and the surfaces rubbed smooth. Otherwise, surfaces shall be left with the texture imparted by forms.

    a. Rough finish shall be used for the following areas:

        1) Below grade and unexposed surfaces.

2.. Smooth Plywood Form Finish: Finish shall be true to line and plane. Tie holes and defects shall have been patched and ground with surface fins removed. Arrangement of plywood sheets shall be orderly, symmetrical, as large as practical and free of torn grain or worn edges. Surface concrete shall be treated with 1 part muriatic acid, in three parts water solution, followed immediately by a thorough rinsing with clear water. Surfaces which are glazed, have efflorescence, or traces of form oil, curing compounds or parting compounds shall be cleaned or treated to match other formed surfaces, except as otherwise indicated or specified.
    a. Smooth Plywood Form Finish shall be used for the following areas:
        1) All surfaces above grade unless otherwise specified.
        2) At Contractor's option, may also be used in lieu of rough form finish.

3. Smooth Plastic Liner Finish: Surface shall be smooth, concrete free of honeycombing, air pockets larger than 1/8 inch in diameter, and fins.

    a. This finish shall be used only where indicated on the Drawings.

B. Flatwork:

1. Unless otherwise indicated or specified, flatwork shall have an integral monolithic finish.

2. Integral Monolithic Finish: Apply as soon as freshly poured concrete slabs will bear weight of workers. Pour slabs full thickness to finish floor elevations indicated. At proper time, tamp surface repeatedly with a wire mesh or grid tamper in a manner to force aggregate down below surface and to bring sufficient mortar to surface to provide for a smooth coating of cement mortar over entire surface. Allow surface mortar to partially set, then float with wooden floats and finish with one of following, as required.

    a. Broom Finish: Steel trowel surface to a smooth dense surface free of lines, tool marks, cat faces and other imperfections. After troweling, and before final set, give surface a broom finish, brushing in direction noted on Drawings, or as directed. Broom finish shall be used typically on exterior flatwork except as otherwise indicated or specified and shall be "medium" texture as approved by Architect.

b. Smooth Steel Trowel Finish: Apply 2 steel trowelings to obtain hard, smooth surface. All lips, irregularities, uneven levels, etc. shall be worked out before last troweling. All interior flatwork shall have a smooth steel trowel finish unless specified otherwise.

3. Tolerances:

a. For tolerances not indicated, refer to ACI 117.

b. Slabs on grade – at a minimum shall be sufficiently even to contact a 10' long straightedge with a tolerance of 1/8 inch.

c. Concrete over metal deck – Refer to Section 05 30 00 for minimum requirements.

d. Elevated slabs – Comply with Architectural requirements.

e. Finished surfaces of exterior integral finished flatwork shall not vary more than 1/4 inch from a 10' long straightedge, except at grade changes.

C. Sacked Surfaces: Exposed surfaces that are unacceptable in appearance to the Architect shall be sacked.

1. Prepare concrete surfaces in accordance with the referenced standards. Remove any form release materials by stoning by hand, power grinding or other method approved by the Architect.

2. Prepare concrete surfaces to receive sack finishing with a light sand blasting.

3. For best results, grout application and rubbing should be performed when areas to be treated are shaded and during cool, damp weather. When work is to be performed in hot and dry weather, a fog spray should be available for continuous use.

4. Prepare grout samples for matching of concrete surfaces for approval by the Architect. These shall be made in the following proportions of gray cement to white cement to sand: 1:1:2, 1:2:3, and 2:1:3, etc. until the correct matching color is obtained on the test areas. Sand should be fine enough to pass the Number 30 sieve. Mixes should be made to a good workable consistency in a clean container and the mix with the best color chosen, or modified if needed.

5. Provide sufficient qualities of sand and cement from the same source for the complete work at the job site.

6. Mixing and Application:

a. Mixing of grout on the job should be timed for it to be used up within 1 to 1-1/2 hours.

b. Let the grout stand 20 to 30 minutes after mixing, and then remixed before applying.

c. Soak the concrete surface thoroughly with water at least 15 minutes before applying grout and again just before application so that the surface is adequately wet during the operation.

d. Apply grout with plasterer's trowel or sponge rubber float in sweeping strokes from the bottom up. Brush or spray gun applications may be used when approved by the Architect.

e. Work in freshly applied grout vigorously with a sponge rubber float, then let sit until some of its plasticity is gone but not until it loses its damp appearance. At this point it shall be rubbed with clean, dry burlap to remove the excess grout, leaving no visible film on the surface but filling all air holes.

f. Keep the surface wet for a day after grouting and sack rubbing are completed.

7. Alternate methods of application and materials shall be subject to the approval of the Architect.

3.04 PATCHING

A. Formed Surfaces:

1. Promptly upon removal of contact forms and after concrete surfaces have been inspected, form ties shall be removed and all necessary patching and pointing shall be expertly done.

2. Honeycombed areas shall be removed down to sound concrete, coated with a bonding grout or approved compound and patched using a low shrinkage high bond mortar. Patched areas shall be cured by being kept damp for at least 5 days.

3. Tie holes shall be cleaned, dampened and filled solid with patching mortar or cement plugs of an approved variety.

B. Slabs on Grade: After entire slab is finished, shrinkage cracks that may appear shall be patched as follows:

1. Where slab is not exposed or where appearance is not important, cracks larger than 1/32 inch wide shall be filled with cement grout and struck off level with surface.

2. Where slab is exposed and appearance is important, unsightly cracks shall be repaired in a manner satisfactory in appearance to Architect. If this cannot be accomplished, concrete shall be considered defective.

3.05 DEFECTIVE CONCRETE

A. Defective concrete shall mean any of the following:

1. Concrete not meeting 100 percent of the specified 28 day compressive strength.

2. Concrete exhibiting rock pockets, voids, spalls, streaks, cracks, exposed reinforcing to extent that strength, durability, or appearance is adversely affected.

3. Concrete significantly out of place, line, or level.

4. Concrete not containing the required embedded items.

B. Upon determination that concrete strength is defective:

1. Should cylinder tests fall below minimum strength specified, concrete mix for remainder of work shall be adjusted to produce required strength. Core samples shall be taken and tested from cast-in-place concrete where cylinders and samples indicate inferior concrete with less than minimum specified strength.

a. Cores of hardened concrete shall be taken and tested in accordance with ASTM C 42 and C 39. Number and location of such cores shall be subject to the approval of Architect.

b. Cost of core sampling and testing will be paid for by the Contractor.

c. “85 percent” reduction in ACI 318 Section 26.12.4 will not justify low cylinder tests.

C. Upon determining that concrete surface is defective, Contractor may restore concrete to acceptable condition by cutting, chipping, pointing, patching, grinding, if this can be done without significantly altering strength of structure. Permission to patch defective areas will not be considered a waiver of the right to require removal if patching does not, in the opinion of the Architect, satisfactorily restore quality and appearance.

D. If core tests indicate that concrete is below the strength specified, or if patching does not restore concrete to specified quality and appearance, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the Owner.

E. No repair work shall begin until procedure has been reviewed by the Architect and Structural Engineer.

3.06 SURFACE HARDENER AND SEALER

A. Seal all interior exposed flatwork with clear sealer, except surfaces receiving ceramic tile, quarry tile, poured flooring or other special finishes specified, or as scheduled on the Drawings.

1. Apply sealer in 2 or 3 coats, in accordance with manufacturer's directions, using the maximum quantity recommended.

a. Concrete floors must be thoroughly cured for a minimum of 30 days and completely dry before treatment.

b. Surfaces to be treated must be clean, free of membrane curing compounds, dust, oil, grease and other foreign matter.

c. Upon completion, concrete surfaces shall be clean and without discoloration or traces of excess hardener left on the surface.

B. Apply sprayable hardener/sealer at locations as scheduled or as indicated on the Drawings. Apply in accordance with the manufacturer's favorably reviewed application instructions and recommendations.

3.07 GROUTING

A. Prepare and place grout materials at locations as indicated on the Drawings in accordance with the manufacturer's recommendations and installation instructions.

B. Pack grout materials solidly between bearing surfaces and bases or plates as indicated and to ensure no voids.

3.08 ADJUSTING AND CLEANING

A. Remove all debris, excess materials, tools and equipment resulting from or used in this operation at completion of this work.

END OF SECTION

SECTION 03 35 00

CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

A. Provide concrete floor sealer on housekeeping pads and per the finish schedule.

1.03 RELATED REQUIREMENTS

A. Cast-In-Place Concrete: Section 03 30 00

B. Alkalinity & Vapor Control: Section 03 39 50

1.04 SUMMARY

A. This section includes the following:
   1. Concrete Floor Sealers

1.05 ACTION SUBMITTALS

A. Mockup panel for concrete sealer.

1.06 INFORMATIONAL SUBMITTALS

A. Product Data

   1. Submit manufacturer's specifications for each product specified, including physical properties, performance properties, and testing reports. Each individual component of the system will be evaluated on the basis of these standards. For any of the tests not listed in the manufacturer's standard nationally published data, the manufacturer must supply the missing data from an independent test laboratory tested according to the referenced standard.

B. Installation Instructions

C. Maintenance Data

D. Record Drawings

E. Product Warranty

1.07 QUALITY ASSURANCE

A. Installer Qualifications

1. Installation shall be performed by a concrete floor sealer specialist with skilled mechanics having not less than three (3) years of satisfactory experience in the application of the type and complexity of system as specified in this section. The concrete floor sealer specialist shall be approved in writing by the manufacturer of the concrete floor sealer.

B. Manufacturer Qualifications

1. Materials to be obtained from a single manufacturer.

C. Performance

1. Non-toxic, non-combustible, and non-flammable. Shall not harm lungs or hands. Shall comply with all V.O.C. regulations in effect at the time of manufacture.

a. Technical Properties: Materials to be colorless, transparent, penetrating liquid containing no silicones and be highly resistant to oils, greases and acids.

2. Abrasion – Taber Abrasion Test: 30.7% increase in abrasion resistance.

3. Bonding – per ASTM D3359: 17% increase in epoxy adhesion. No change for polyurethane adhesion.

4. Curing – 94% or greater moisture loss from untreated samples during critical, initial 24 hour curing period.

5. Hardening – per ASTM C42: 40% increase in compressive strength at 7 days, 38% increase at 28 days over untreated samples. ASTM C805, Schmidt hammer: 13.3% increased impact resistance.

6. Permeability – The seepage rate using a 7 inch head of water on a 4.91 square inch area treated was 0.0083cc per hour.

7. Weathering – per ASTM G151: Ultraviolet light and water spray exposure had no adverse effect.

D. Furnish manufacturer’s standard warranty of the concrete floor sealer for a period of twenty (20) years following Acceptance of the work.

PART 2 - PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. “Ashford Formula” by Curecrete Chemical Company

2. “Seal Hard” by L & M Construction Chemicals

3. “Euco Diamond Hard” by The Euclid Chemical Company

4. Or approved equal.

PART 3 - EXECUTION

A. Installation

1. Mechanically clean the concrete to remove contaminants, form oils, bond breakers, and staining from the wet cure operation. All cleaning compounds shall be removed in their entirety and the concrete surface shall be neutralized.

2. First Application

a. As soon as possible after curing cover removal, spray product with a low pressure sprayer at a rate of 200-250 square feet per gallon.

b. Keep the entire surface wet for 30 to 40 minutes by re-spraying dry spots or moving material from wet areas to dry areas with nylon push brooms.

c. When the wet product becomes slippery underfoot, lightly sprinkle the surface with water to aid penetration and prevent surface drying.

d. As the product begins to dry into the surface and again becomes slippery underfoot, flush the surface with water and squeegee the surface dry, removing all excess product, water, alkali and other impurities from the surface.

e. Coordinate with manufacturer for application requirements at the access flooring areas.

3. Finish Application

a. Apply sealer with a low pressure sprayer or drop sealer with a floor scrubbing machine at 50 – 600 square feet per gallon.

b. Lambs wool or fine bristle broom the sealer evenly across the concrete surface or use a squeegee on the floor scrubbing machine to evenly spread a thin film.

END OF SECTION

SECTION 03 39 50

ALKALINITY AND VAPOR CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

A. This Section includes multiple-component alkalinity and vapor emission control system for use on concrete slab-on-grade floors. This system applies to new concrete floor slabs scheduled to receive carpet, resilient flooring, conductive vinyl and resinous flooring systems.

1.03 RELATED REQUIREMENTS

A. Cast-In-Place Concrete: Section 03 30 00

B. Concrete Floor Sealer: Section 03 35 00

1.04 SUMMARY

A. This section includes the following:

1. Alkalinity and Vapor Emission Control Systems

1.05 SUBMITTALS

A. Product warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer of the system shall supply written proof of at least 5 years successful experience in vapor emission control system installation.

B. Applicator Qualifications: Applicator shall have received training and be certified as approved by the manufacturer of the system. Applicator shall provide written verification of such approval upon request.

C. Performance Standard: The system shall function to bring down ASTM F710 test results to the limit of 5 lb / 1000 sf / 24 hours in general or 3 lb / 1000 sf / 24 hours where required by resinous flooring, and shall control high alkalinity problems.

D. Quantification testing: Testing shall be conducted with calcium chloride test kits using the following schedule: Minimum of 3 kits for up to 1000 sf; and an additional test kit for

each additional 1000 sf or portion thereof. Kits shall be placed in either a rectangular or cross-diagonal pattern. Procedure shall be in strict conformance with ASTM F710.

E. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace the entire failed flooring systems caused by alkalinity and vapor emission control system that fails in performance for ten years from date of Acceptance of the Work.

PART 2 - PRODUCTS

A. Product A for general use: A water based lithium formulation for curing concrete to control alkalinity and to reduce vapor emission to the limit of 5 lb / 1000 sf / 24 hours per ASTM F710.

1. VOC: Contains no volatile organic compounds.

B. Product B for use under resinous flooring: A 100% solids two-component primerless epoxy to penetrate into concrete to control alkalinity and to reduce vapor emission to the limit of 3 lb / 1000 sf / 24 hours per ASTM F710.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are suitable to receive the Work of the Section.

B. Do not begin application until unsuitable conditions have been corrected. Beginning application means acceptance of existing conditions.

3.02 PREPARATION

A. Remove or protect items not required to be coated.

B. Clean and prepare substrate surfaces in accordance with manufacturer’s instructions.

C. Remove dust, dirt, loose and foreign materials.

D. Fill hairline cracks, holes, and similar defects with filler compatible with finish treatment.

3.03 APPLICATION

A. Mix and apply sealer in accordance with manufacturer’s instruction, using brush, roller, or spray.

B. Apply at coverage rate recommended by manufacturer.

C. Edges abutting other materials and colors shall be sharp and clean without overlapping.

D. Finish surfaces shall be uniform in finish and color.

3.04 CLEANING

A. During progress of the Work, and upon completion, clean adjacent surfaces and materials of spills, splatters, and stains resulting from application. Remove using methods recommended by manufacturer and approved by State Representative, exercising care to prevent damage to finish surfaces and materials.

B. Touch up damaged surfaces before final acceptance.

END OF SECTION

SECTION 04 05 00

MORTAR AND GROUT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of Division 1 apply to all Work of this Section.

1.02 SCOPE

A. Provide all materials, labor and accessories as required and specified for complete mortar and grout installation in masonry walls.

1.03 RELATED WORK (See also Table of Contents):

A. Reinforcing Steel: Section 03 21 00.

B. Cast-In-Place Concrete: Section 03 30 00.

C. Concrete Unit Masonry: Section 04 22 00.

1.04 QUALITY ASSURANCE

A. Standards and References: (Latest Edition unless otherwise noted)

1. 2019 California Building Code (CBC)

2. TMS 402-13/ACI 530-13/ASCE 5-13 – Building Code Requirements for Masonry Construction

3. ASTM C144, Aggregate for Masonry Mortar.

4. ASTM C150, Portland Cement.

5. ASTM C207, Hydrated Lime for Masonry Purposes

6. ASTM C270, Standard Specification for Mortar for Unit Masonry

7. ASTM C404, Aggregates for Grout

8. ASTM C476, Standard Specification for Grout for Masonry

9. ASTM C1019, Method of Sampling and Testing Grout

B. Tests and Inspections:

1. A testing program is required prior to start of construction. Testing program to be done in Compliance with CBC requirements and in collaboration with Testing

Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.

2. All tests and inspections herein are to be performed by an independent testing laboratory approved by the building official.

3. Mortar and Grout Tests: If mortar and grout tests are indicated as required on the Structural drawings, at the beginning of Masonry Work, at least 1 test sample each of mortar and grout shall be taken on 3 successive working days, then once per week with at least one sample taken for each 5000 square feet of wall area, or fraction thereof.

   a. Test specimens shall be made in accordance with ASTM C1019 for grout and ASTM C780 for mortar.

   b. Test specimens shall be continuously stored in moist air until tested.

4. If masonry placement and grouting inspection is indicated as required on the Structural Drawings, a special inspector shall be employed per CBC Section 1704 during the placement of all units, placement of all reinforcing steel, during all grouting operations and during taking of all test specimens.

C. Submittals:

1. Mix design for mortar and grout shall be submitted for review.

2. Supplier's certificates indicating materials comply with the specifications below. They shall include but are not necessarily limited to:

   a. Aggregates

   b. Cement

   c. Admixtures

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C150, Type I or II, low alkali; natural gray.

B. Hydrated Lime: ASTM C207, Type S.

C. Quicklime: ASTM C5.

D. Lime Putty: Made from hydrated lime or quicklime.

1. If made from quicklime, other than processed pulverized quicklime, slake lime and then screen through a No. 16 mesh sieve. Before using, store and protect slaked and screened lime putty for not less than 10 days.

2. Processed pulverized quicklime shall be slaked for not less than 48 hours, and shall be cool when used.

3. Lime putty prepared from hydrated lime may be used immediately after mixing.

4. Lime putty prepared from quicklime or pulverized quicklime shall have a plasticity figure, after slaking and screening, of not less than 200, and shall weigh not less than 83 lbs. per cubic foot. Lime putty prepared from hydrated lime shall conform to ASTM C 207, Type S.

E. Aggregate:

1. For Mortar: ASTM C144.

2. For Grout: ASTM C404.

F. Admixture: “Sika Grout Aid” , “Rhoepel Plus”

G. Water: Suitable for domestic consumption.

2.02 MORTAR

A. Mortar shall be Cement-lime, Type S and shall conform to CBC Section 2103.2.

B. Mortar shall be made with admixtures that are proportioned, added and mixed in strict accordance with manufacturer's directions.

2.03 GROUT

A. Grout shall have a 28-day compressive strength of 2000 psi or f’m, whichever is greater. Grout shall conform to CBC Section 2103.3

B. Fine Grout: Fine grout shall be used for all grout spaces less than 3" wide.

C. Coarse Grout: Coarse grout shall be used in grout spaces 3" wide or more.

D. Add grout admixture in accordance with the manufacturer’s recommendations.

PART 3 **-** EXECUTION

3.01 MIXING MORTAR AND GROUT

A. Mix mortar and grout in accordance with TMS 602-13 Articles 2.6A and 2.6B.

B. Accurately measure materials in suitably calibrated devices; shovel measurements are not acceptable.

C. Place sand, cement and water in mixer in that order and mix for at least 2 minutes; then add lime putty and continue mixing as long as necessary to secure a uniform mass, but in no case less than 10 minutes.

D. Use mixers of at least 1 sack capacity; batches requiring fractional sacks will not be permitted unless cement is weighed for each batch.

3.02 GROUTING PROCEDURES

A. Specified under Sections 04 22 00.

3.03 RETEMPERING

A. When necessary to retemper mortar, add water and remix; retempering by dashing water over mortar will not be permitted.

B. Any mortar which is unused within 30 minutes after initial mixing and any mortar that has begun to set shall not be used.

3.04 DEFECTIVE MORTAR OR GROUT

A. Should the strength of mortar or grout fall below that specified, remainder of Work shall be adjusted to reach required strength. Work in place representing inferior grout and mortar and indicating a strength less than the minimum specified shall be tested by taking and testing core samples. Number and location of cores shall be determined by Structural Engineer.

B. Should compression tests of cores fail to meet required strength, masonry shall be deemed to be defective and shall be removed and replaced at no cost to Owner.

C. Costs relative to taking and testing of core samples shall be paid by Owner and will be deducted from Contract Amount. Cost of patching core holes shall be borne by Contractor.

END OF SECTION

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of Division 1 apply to all Work of this Section.

1.02 SCOPE

A. Furnish and install all concrete unit masonry, reinforcement, and all required accessories and materials as shown on the Drawings and specified here.

1. Cooperate with other trades for embedded items, furnished under those sections and installed here.

2. Supervise setting of dowels for masonry furnished and installed under Section 03 21 00, Reinforcing Steel.

1.03 RELATED WORK (See also Table of Contents):

A. Reinforcing Steel: Section 03 21 00.

B. Cast-in-Place Concrete: Section 03 30 00.

C. Mortar and Grout: Section 04 05 00.

D. Structural Steel: Section 05 12 00.

E. Miscellaneous Metal: Section 05 50 00.

1.04 QUALITY ASSURANCE

A. Allowable Tolerances: Maximum deviation from indicated line or plane of installed concrete masonry units shall not exceed 1/4 inch in 10 feet in any direction.

B. Standards and References: (Latest Edition unless otherwise noted):

1. 2019 California Building Code (CBC)

2. TMS 402-13/ACI 530-13/ASCE 5-13 – Building Code Requirements for Masonry Construction

3. TMS 602-13/ACI 530.1-13/ASCE 6-13 – Specification for Masonry Structures

4. ASTM C90 – Specification for Loadbearing Concrete Masonry Units

5. ASTM C140 – Test Method Sampling and Testing of Concrete Masonry Units and Related Units

6. ASTM C426 – Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units

C. Submittals: Refer to Section 01 33 00 for submitting the following items:

1. Suppliers certificate indicating units comply with material standards indicated below:

2. See Section 03 21 00 for reinforcing steel submittals.

D. Tests and Inspections:

1. A testing program is required prior to start of construction. Testing program to be done in Compliance with CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.

2. All tests and inspections herein are to be performed by an independent testing laboratory approved by the Building Official.

3. If masonry tests are indicated as required on the structural drawings, three sample units will be tested during construction for each 5,000 square feet of wall area. Test also three sample units prior to construction.

a. Units will be tested for compressive strength on both the net and gross area per ASTM C140.

b. Units will be tested for linear drying shrinkage per ASTM C426.

4. If masonry placement and grouting inspection is indicated as required on the structural drawings, a special inspector shall be employed per CBC Section 1704 to inspect the placement of all units, placement of all reinforcing steel, during all grouting operations and during taking of all test specimens.

5. See Section 03 21 00 for reinforcing steel tests and inspections.

1.05 PRODUCT HANDLING

A. Scaffolding, runways and ladders required for work under this Section shall be provided by masonry contractor, and shall be heavy trades type substantially built and in compliance with State labor laws, safety codes and other regulatory agencies as applicable to this project.

B. Store masonry units off the ground in a dry location, covered and protected from absorbing moisture.

PART 2 **-** PRODUCTS

2.01 MASONRY UNITS

A. Masonry units shall be hollow load bearing masonry units conforming to ASTM C90 and CBC Section 2103.1.

1. Weight: Medium weight.

2. Maximum lineal shrinkage from saturated to oven dry condition of not more than 0.065 percent.

3. Twenty-eight day compressive strength of 2000 psi.

4. Moisture controlled units.

B. Unit Type

1. 8" wide by 8" high x 16" long unless specified otherwise.

C. Provide bond beam units, open end units and other special units as indicated. Use open end units at cells containing vertical reinforcement wherever possible.

2.02 MORTAR AND GROUT

A. Specified under Section 04 05 00.

2.03 ACCESSORY MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 40 or 60, as indicated in Section 03 21 00, deformed bars. Where bars are to be welded, ASTM A706 Grade 60 bars shall be used.

1. Tie Wire: Black annealed steel wire not lighter than 16 gauge.

B. Provide spacers to firmly hold reinforcement in place.

C. Anchor Bolts: All anchor bolts cast in masonry shall be headed studs or headed bolts with cut threads conforming to ASTM F1554 Grade 36 or ASTM A307 or ASTM A36 - as indicated on drawings.

D. Expansion Anchors: All expansion bolts installed in masonry shall be Hilti Kwik Bolt 3 per ICC ESR-1385, Simpson Wedge-All per ICC ESR-1396 or Dewalt/Powers Power-Stud+ per ICC ESR-2966. See Structural Drawings for installation requirements, testing and special head requirements as applicable. Substitution of other brands or anchors shall proceed only after written approval from the Structural Engineer and the Building Official has been obtained.

E. Adhesive Anchors: All drill and epoxy threaded rods shall be ASTM F1554 Grade 36 or Grade 50, as indicated on drawings, and installed in masonry with Hilti HIT-HY 270 per ICC ESR-4143, Simpson SET-XP per ICC ESR-1772 or Dewalt/Powers AC100+ Gold per ICC ESR-3200. See Structural Drawings for installation requirements, testing and special head requirements as applicable. Substitution of other brands or anchors shall proceed

only after written approval from the Structural Engineer and the Building Official has been obtained.

F. Screw Anchors: All screw anchors installed in masonry shall be Hilti Kwik HUS-EZ per ICC ESR-3056, Simpson Titen HD per ICC ESR-1056 or Dewalt/Powers Wedgebolt+ per ICC ESR-1678. See Structural Drawings for installation requirements, testing and special head requirements as applicable. Substitution of other brands or anchors shall proceed only after written approval from the Structural Engineer and the Building Official has been obtained

2.04 JOINTS

A. All joints shall be 3/8" thick joints for concrete block, Tool exposed interior and exterior joints and concealed exterior joints to produce a dense slightly concave surface that is well bonded to unit at edges. Tool joints behind room base, switches, and outlet plates to produce a smooth dense joint flush with the face of adjacent masonry units, where occurring on the job. Cut joints flush on concealed interior surfaces and surfaces to be plastered.

2.05 SEALER

A. Contractor shall provide and install minimum two coats, Thoroseal masonry sealer at all CMU walls. Thoroseal product shall meet all state vapor requirements. Sealer shall be clear and non-gloss product.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive masonry and verify following:

1. That foundation surface is level to permit bed joint with range of 1/4 to 3/4 inch.

2. That edge is true to line to permit projection of masonry to less than 1/4-inch.

3. That projecting dowels are free from loose scale, dirt, concrete, or other bond-inhibiting substances and properly located.

B. Do not begin work before unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean concrete surfaces to receive masonry. Remove laitance or other foreign material lodged in surfaces by sandblasting or other means as required. Joints between concrete and masonry shall be considered construction joints. See Concrete specifications.

B. Ensure masonry units are clean and free from dust, dirt, or other foreign materials before laying. Do not use damaged masonry units, damaged components of structure, or damaged packaged materials.

C. Establish lines, levels, and coursing. Protect from disturbances.

D. Provide temporary bracing during erection of masonry work. Maintain in place until masonry has set to provide permanent bracing.

3.03 COURSING

A. Erect masonry in accordance with CBC Section 2104.

B. Place masonry to lines and levels indicated to the following tolerances:

1. Variation from Unit to Adjacent Unit: 1/32-inch max.

2. Variation from Plane of Wall: 1/4-inch in 10 feet.

3. Variation from Plumb: 1/4-inch in 10 feet; ½-inch maximum.

4. Variation from Level Coursing: 1/8-inch in 3 feet; 1/4-inch in 10 feet; ½-inch maximum.

5. Variation of Joint Thickness: 1/8-inch between masonry courses.

C. Bond: Unless noted otherwise in Drawings, lay concrete masonry units in running bond with vertical joints located over score of unit in course below (and vice versa).

D. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.

E. Preserve the vertical continuity of cells in concrete unit masonry. The minimum clear horizontal dimensions of vertical cores shall be 3 x 3 inches for 8-inch wide block.

3.04 PLACING AND BONDING

A. Do not install cracked, broken or chipped masonry units.

B. Lay only dry concrete masonry units.

C. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.

1. Block Cap: Lay with full mortar coverage on horizontal and vertical joints.

2. Install grout cap where and as indicated.

D. Fully bond intersections and external and internal corners.

E. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.

F. Remove excess mortar.

G. Perform job-site cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.

H. Step back unfinished work for joining with new work. Do not use toothing.

I. Provide cleanouts as indicated in “grouting” below.

3.05 JOINTS

A. Horizontal and vertical joints at masonry units shall be 3/8-inch wide and as follows:

1. Point joint tight in unpurged masonry below ground.

2. All end joints shall be fully filled with mortar and joints squeezed in bed joints shall be held back approximately ½-inch from cell to provide positive bond with grout.

3. Joints shall be struck flush at all areas to receive plaster finish.

3.06 MASONRY REINFORCEMENT

A. Place reinforcement in accordance with Article 3.4B of TMS 602-13.

B. Reinforcing steel shall not be bent or straightened in a manner that will damage the material. Bars with kinks or bends not shown on the plans shall not be used. Heating of bars for bending will not be permitted.

1. Bars shall conform accurately to the sizes, shapes, lines and dimensions shown on drawings and with hooks and beds made as detailed. Bars shall be placed as indicated on the drawings and centered on grout space.

2. At the time grout is place around it, reinforcing steel shall be clean of mill scale or other coatings that will destroy or reduce bond.

3. All vertical reinforcing steel shall be installed in one piece, full height of wall, and braced throughout its height in a manner that will retain the steel in proper position and provide the proper clearance.

C. Reinforcing steel shall be secured to all foundation dowels and held in place at spacing not to exceed 192 bar diameters.

3.07 GROUTING

A. General Requirements:

1. All cells shall be grouted solid.

2. Use of grout lifts above or below 5 feet 4 inches at Contractor's option.

3. Use grout pump, hopper or bucket to place grout.

4. Place grout in final position within 1-1/2 hours after introduction of mixing water.

5. Stop grout approximately 1½ inches below top of last course; except at top course bring grout to top of wall. Do not form grout keys within beams.

B. Grout pours 5 feet 4 inches or less:

1. Do not lay units higher than 64 inches before grouting.

2. If mortar has been allowed to set prior to grouting, remove all fins protruding more than ½-inch into grout space.

3. Consolidate each lift with mechanical vibration twice per Article 3.5 E of TMS 602-13. Once while placing grout and once more after initial absorption of water but before set.

C. Grout pours greater than 5 feet 4 inches:

1. Lay up walls, subject to maximum height limitations of Table 7 under Article 3.5 of TMS 602-13.

2. Provide clean out holes at the bottom of every pour in cells containing vertical reinforcement. Construct clean out courses with open-bottom bond beam units inverted to permit cleaning of all cells by flushing. Cleanouts shall be not less than 3x4inch openings cut from one face shell. Do not plug clean out holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected.

3. Clean mortar droppings from the bottom of the grout space and from reinforcing steel. Remove mortar fins protruding more than ½-inch into the grout space by dislodging the projections with a rod or stick as the work progresses or by washing the grout space at least twice a day during erection using a high pressure stream of water.

4. Do not place grout in hollow unit masonry until mortar joints have set for at least 24 hours and clean out plugs have cured 24 hours.

5. Place grout in lifts not to exceed 12 feet 8 inches in height, with a waiting period between lifts, dependent on weather and absorption rate of the masonry, in order to place the succeeding lift after the preceding lift becomes plastic but prior to initial set. The first lift shall be consolidated using mechanical vibrators. After the required waiting period, place the second lift and consolidate with the vibrator, reconsolidating the lift below to a depth of 12 to 18 inches. Repeat the waiting, placing and consolidating process until the top of the grout pour is reached. Reconsolidate the top lift after the required waiting period. The high-lift grouting of any section of wall between lateral flow barriers shall be completed to the top of a pour in one working day unless a new series of clean out holes is established and the resulting horizontal construction joint cleaned.

3.08 WEATHER PROVISIONS FOR CONSTRUCTION

A. Cold Weather Construction to be in accordance with Article 1.8C of TMS 602.

B. Hot Weather Construction to be in accordance with Article 1.8D of TMS 602.

3.09 EXPANSION AND CONTROL JOINTS

A. See drawings for type and location of expansion and/or control joints.

3.10 BOND BEAMS

A. Bond beams shall be located where shown and detailed on the drawings, and shall be reinforced as indicated and as herein after specified.

3.11 BUILT-IN WORK

A. Miscellaneous Embedded Items: All items indicated to be embedded in masonry shall be carefully located and anchored to prevent movement during grouting operations. Avoid cutting and patching.

3.12 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.

3.13 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damage, or if units do not match adjoining units.

B. Pointing: During the tooling of joints, enlarge any voids or holes and completely fill with mortar.

C. Dry brush masonry surface after mortar has set, at each day's work and after final pointing.

D. Leave work and surrounding surface clean and free of mortar spots and droppings.

E. Cleaning: Upon completion of masonry installation, repair all holes. Defective joints shall be cut out and rejointed. Exposed masonry surfaces shall be cleaned free of mortar, green stain and efflorescence.

3.14 SEALER

A. Contractor shall install sealer as directed by the manufacturer. Coverage and installation rates shall be as per manufacturer’s recommendations. Install sealer in minimum two coats at the rates required.

3.15 DEFECTIVE MASONRY

A. Materials or workmanship not conforming to appearance or strength specified, will be deemed defective and shall be removed and replaced at no cost to Owner.

B. Defective mortar and grout, as defined under Section 04 05 00; “Mortar and Grout” shall constitute defective masonry.

END OF SECTION

SECTION 04 73 15

THIN ADHERED CALCIUM SILICATE

PART 1 – GENERAL

1.01 SUMMARY

A. Scope of work - Provide manufactured adhered veneer (units size thickness ranging from a minimum ¼" [6mm] up to a maximum 2-5/8" [65mm] and a maximum weight of 15 psf according to IBC – Chapter 14 Exterior Walls or applicable local building codes for thin adhered masonry veneer), veneer installation materials and accessories as indicated on drawings, as specified herein, and as needed for complete and proper installation.

B. Related Documents - provisions within General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings apply to this Section.

1.02 SECTION INCLUDES

A. Thin adhered calcium silicate masonry units (also referenced as thin CSMU) equal to ARRIS▪tile Units

B. Insulated Concrete Board Panels

C. Installation Products; adhesives, mortars, grouts and sealants

D. Air and Water Barriers

1.05 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

A. Environmental Performance Criteria: The following criteria are required for products included in this section. Refer to Division 1 for additional requirements:

1. Adhesive products must meet or exceed the VOC limits of South Coast Air Quality Management District Rule #1168 and Bay Area Resources Board Reg. 8, Rule 51.

1.06 RELATED SECTIONS

A. Section 03 30 00 Cast-in-Place Concrete.

B Section 04 22 00 Unit Masonry (CMU wall substrates)

C. Section 07 13 26 Self Adhesive Sheet Waterproofing

E. Section 07 62 00 Sheet Metal flashing and Trim: Veneer Flashing

F. Section 07 92 00 Joint Sealers: Perimeter sealing at Openings

G. Not used

H. Section 09 96 23 Graffiti-Resistant Coatings

1.09 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) A118.1 - A118.12 American National Standard Specifications For The Installation Of Ceramic Tile

B. American Society For Testing And Materials (ASTM) C36 Standard Specification for Gypsum Wallboard

C. American Society For Testing And Materials (ASTM) C482 Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement

D. American Society For Testing And Materials (ASTM) C920 Standard Specification for Elastomeric Joint Sealants

E. American Society For Testing And Materials (ASTM) E96 Standard Test Methods for Water Vapor Transmission of Materials

F. Terrazzo, Tile And Marble Association Of Canada (TTMAC) Specification Guide 09300 Tile Installation Manual

G. American Society For Testing And Materials (ASTM) C578 – Standard Specification for Rigid Cellular Polystyrene Insulation

H. American Society For Testing And Materials (ASTM) D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics

I. Tile Council Of North America (TCNA) Handbook For Ceramic Tile Installation

J. ACI 530/ASCE 5/TMS 402-13, Building Code Requirements for Masonry Structures.

K. ACI 530.1/ASCE 6/TMS 602-13, Specifications for Masonry Structures.

L. ASTM C73-17: Standard Specification for Calcium Silicate Face Brick.

1.10 SYSTEM DESCRIPTION

A. Thin Adhered CSMU installed over concrete masonry units substrate with liquid air and water barrier, Insulated concrete board panels with drainage plane(s), latex portland cement mortar and portland cement pointing mortar.

1.11 SUBMITTALS

A. Submit profile drawings and manufacturers' product data under provisions of Section 01 33 00.

B. Submit three (3) samples of each type/style/finish/size/color of adhered masonry veneer and trim unit under provisions of Section 01 33 00

C. Submit manufacturers' installation instructions under provisions of Section 01 33 00

D. Submit proof of warranty.

E. Submit sample of installation system demonstrating compatibility/functional relationships between air barriers, waterproofing membranes, adhesives, mortars pointing mortars and other components under provision of Section 01 33 00.

F. For alternate materials, at least thirty (30) days before bid date submit independent laboratory test results confirming compliance with specifications listed in Part 2 - Products.

G. Submit independent product elevation report from ICC or NTA verifying insulation values and fastening requirements.

H. Differed Submittal: Submit Structural Calculations prepared by a California Licensed Structural Engineer indicating the fastener size, length, embedment and spacing for each zone of the building wall using the structural criteria listed on the structural drawings and the California Building Code. Allow sufficient State Agency review time for this Differed Submittal.

I. Provide manufacturers statement accepting all products in the system as being compatible with the system warrantee.

1.12 QUALITY ASSURANCE

A. Adhered Masonry Veneer Manufacturer (single source responsibility): Company specializing in adhered masonry veneer, trim units with ten (10) years minimum experience. Obtain adhered masonry veneer from a single source with resources to provide products of consistent quality in appearance and physical properties.

B. Installation System Manufacturer (single source responsibility): Company specializing in air barriers, waterproofing membranes, adhesive mortars, pointing mortars and other installation materials with ten (10) years minimum experience and ISO 9001 certification. Obtain installation materials from single source manufacturer to insure consistent quality and full compatibility.

C. Submit positive laboratory testing to confirm applicability of air barrier, waterproofing membranes, adhesive mortars, pointing mortars, and other installation materials for specified job conditions.

D. Installer qualifications: company specializing in installation of adhered masonry veneer and trim units with five (5) years documented experience with installations of similar scope, materials and design

E. Insulated Concrete Board Panel Manufacturer; Company specializing in insulated concrete boards with five (5) years minimum experience.

1.13 MOCK-UPS

A. Provide mock-up of each type/style/finish/size/color of adhered masonry veneer and trim unit along with respective installation air barrier, waterproofing membranes, insulated concrete boards, adhesive mortars, pointing mortars and other installation materials, under provisions of Section 01 33 00.

1.14 PRE-INSTALLATION CONFERENCE

A. Pre-installation conference: At least three weeks prior to commencing the work attend a meeting at the jobsite to discuss conformance with requirements of specification and job site conditions. Representatives of owner, architect, general contractor, adhered masonry veneer subcontractor, adhered masonry veneer manufacturer, Installation System Manufacturer and any other parties who are involved in the scope of this installation must attend the meeting.

1.15 DELIVERY, STORAGE AND HANDLING

A. Refer to Manufacturer's Requirements

B. Deliver calcium silicate masonry units in protective film. Prevent damage to units.

C. Lift skids with proper and sufficiently long slings or forks with protection to prevent damage to units. Protect edges and corners.

D. Store units in a manner designed to prevent damage and staining of units.

E. Stack units on timbers or platforms at least 3 inches above grade.

F. Place polyethylene or other plastic film between wood and other finished surfaces of units when stored for extended periods of time.

G. Cover stored units with protective enclosure if exposed to weather.

H. Do not use salt or calcium-chloride to remove ice from masonry surfaces.

I. Store adhered masonry veneer and installation system materials in a dry location; handle in a manner to prevent chipping, breakage, and contamination.

J. Protect latex additives, liquid air barriers, waterproofing membranes, epoxy adhesives and sealants from freezing or overheating in accordance with manufacturer's instructions; store at room temperature when possible.

K. Store portland cement mortars and pointing mortars in a dry location.

1.16 PROJECT/SITE CONDITIONS

A. Provide ventilation and protection of environment as recommended by manufacturer.

B. Prevent carbon dioxide damage to adhered masonry veneer, trim, as well as adhesives, liquid air and water barrier, adhesive mortars, pointing mortars and other installation materials, by venting temporary heaters to the exterior.

C. Maintain ambient temperatures not less than 37ºF (3ºC) or more than 100ºF (38ºC) during installation and for a minimum of seven (7) days after completion. Setting of portland cement is retarded by low temperatures.

1. Protect work for extended period of time and from damage by other trades.

2. Epoxy mortars and epoxy pointing mortars require surface temperatures between 60ºF (16ºC) and 90ºF (32ºC) at time of installation.

3. Liquid air barrier and waterproofing Membranes require surface temperatures between 50ºF (10ºC) and 90ºF (32ºC). It is the General Contractor’s responsibility to maintain temperature control.

1.17 SEQUENCING AND SCHEDULING

A. Coordinate installation of adhered masonry veneer work with related work.

B. Proceed with adhered masonry veneer work only after curbs, vents, drains, piping, and other projections through substrate have been installed and when substrate construction and framing of openings have been completed.

1.18 WARRANTY

A. Thin Adhered CSMU installed over concrete masonry units substrates when using insulated concrete board panels:

1. The Contractor warrants the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period of 15 years. The manufacturer of adhesives, liquid air and water barrier, mortars, pointing mortars and other installation materials shall provide a written fifteen (15) year warranty, which covers materials and labor - reference LATICRETE Warranty Data Sheet 230.15SPD for complete details and requirements.

1.19 EXTRA MATERIAL STOCK

A. Upon completion of the work of this Section, deliver to the Owner 2% minimum additional adhered masonry veneer and trim shapes or a minimum of 2 additional pieces of each type, color, pattern and size used in the Work, as well as extra stock of adhesive mortars, pointing mortars and other installation materials for the Owner's use in replacement and maintenance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with paragraphs 1.12 and performance requirements, provide products by one of the following manufacturers. Manufacturers of calcium silicate masonry units having products considered acceptable for use:

1. Arriscraft International.

2. Or Approved Equal.

B. Manufacturers of Adhered Masonry Veneer Installation Materials and Accessories having Products considered acceptable for use:

1. Laticrete International.

2. Or Approved Equal.

C. Manufacturers of Insulated Concrete Board Panels and Accessories having Products considered acceptable for use:

1. T-Clear Inc.

2. Tech-Crete

3. Or Approved Equal.

2.02 ADHERED MASONRY VENEER MATERIALS

A. Thin Adhered Calcium Silicate Masonry Units (Thin Adhered CSMU): to ASTM C73, Grade SW; solid units that have been pressure formed and autoclaved; and then cut to 3/4” thickness; special shapes as indicated; and as follows:

1. Modular Size: 11-5/8" high, 23-5/8" long

2. Texture: smooth finish on exposed faces and ends

3. Color: color as schedule on finish schedule; Fabricate calcium silicate masonry units to the following tolerances:

4. Unit Length: plus or minus 1/16".

5. Unit Height: plus or minus 1/16".

6. Deviation From Square: plus or minus 1/16", with measurement taken using the longest edge as the base.

7. Custom Unit Dimensions: plus or minus 1/8".

2.03 INSULATED CONCRETE BOARD PANELS

A. Insulated Concrete Board Panels: ¼" thick Concrete Board, that is water durable; surfaced with fiberglass reinforcing mesh on front and back and with long edges wrapped and then laminated to [Expanded Polystyrene Insulation], [Extruded Polystyrene Insulation], [Mineral Wool Insulation] (ProGUARD®DP Insulated Concrete Board) with the following properties:

1. ProGUARD®DP Expanded Polystyrene Rigid Insulation (EPS) Insulated Concrete Board Sizes (Single Drainage Plane):

ProGUARD Insulated Concrete Board Panel Pricing (EPS Foam Insulation with Single Drainage Plane)					
ProGUARD Size and thickness	**Insulation Thickness**	**Continuous Insulation thickness (net of single 3/8" Drainage Plane)**	**R-value (most typical) per ASTM C-578 (4.35/in) @75ºF**	**R-value per ASTM C-578 (4.76/in) @40ºF**	**R-value per ASTM C-578 (5.00/in) @25ºF**
3'-0" x 8'-0" x 4-1/4" EPS DP-1 (Single Drainage Plane)	4"	3-5/8"	15.76	17.26	18.13

2. Concrete Board Edges: Tapered.

3. Compressive Strength of Concrete Board: not less than 2600 lbs. per sq. in. when tested in accordance with ASTM D 2394.

4. Flexural Strength of Concrete Board: not less than 1500 lbs. per sq. in. when tested in accordance with ASTM C 947.

5. Surface Burning Characteristics of Concrete Board:

    a. Flame Spread – 5 when tested in accordance with ASTM – E84

    b. Smoke Developed – 0 when tested in accordance with ASTM – E85

6. Density of Expanded Polystyrene Rigid Insulation not less than 1.8 lbs. per c.f.

7. Water Absorption of Expanded Polystyrene Rigid Insulation not more than 2% by volume

8. Expanded Polystyrene Rigid Insulation to meet ASTM C 578 – 08b Type IX

9. Finished edges of insulated concrete board panels to be ship lapped

B. ProGUARD®DP Concrete or Masonry Fasteners:

1. Concrete Masonry, Poured Concrete, or Masonry Screws: Sentry Plus Five Screws with Truss Head and Epoxy Coated

    a. Length: #14x7"

C. Screw Spacing: Contractor's Engineer to select the screw spacing based on the worst case scenario based on the below three requirements supported panels, unsupported panels and wind pressure:

1. Unsupported Panel Application (where the screws will support the weight of the veneer, ProGUARD®DP panels and Laticrete Mortar). Reference the below NTA report. The Contractor's Engineer to calculate the screw spacing based on the weight of the veneer, ProGUARD®DP panels (3 psf) and Laticrete Mortar (1.5 psf).

D. Joint Treatment:

1. Tape: minimum 4" ProGUARD®DP Blue Alkali-resistant fiberglass mesh tape intended for use with concrete board.

E. Joint Mudding Materials:

1. Latex Portland Cement Mortar: Equal to LATICRETE Hi-Bond Masonry Veneer Mortar ** to be weather, frost, shock resistant, non-flammable and meet the following physical requirements:

    a. Compressive strength (ANSI A118.4): >2500 psi (17.2 MPa)

    b. Bond strength (ANSI A118.4): >450 psi (3.1 MPa)

    c. Smoke & Flame Contribution (ASTM E84 Modified): 0

d. Total VOC Content: < 0.05 mg/m3

2.04 ADHERED MASONRY VENEER INSTALLATION MATERIALS AND ACCESSORIES

A. Air and Water (and Vapor) Weather Barrier Membrane: Equal to LATICRETE® Air & Water Barrier ** to be thin, cold applied, single component liquid and load bearing. Waterproofing Membrane to be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured:

1. Air Barrier Test (AC 212): Pass
2. Air Permeance (ASTM E2178): Pass
3. Elongation @ break (ASTM D751): 20-30%
4. 7 day Tensile Strength (ANSI A118.10): >265 psi (1.8 MPa)
5. 7 day Shear Bond Strength (ANSI A118.10) >200 psi (1.4 MPa)
6. 28 Day Shear Bond Strength (ANSI A118.4): >214 psi (1.48 – 2.4 MPa)
7. Service Rating (TCA/ASTM C627): Extra Heavy
8. Total VOC Content: < 0.05 mg/m3]

B. Epoxy Waterproofing Flashing Mortar: Equal to LATAPOXY® Waterproof Flashing Mortar to be 3 component epoxy, trowel applied specifically designed to be used under adhered masonry veneer:

1. Breaking Strength (ANSI A118.10): 450-530 psi (3.1-3.6 MPa)
2. Waterproofness (ANSI A118.10): No Water penetration
3. 7 day Shear Bond Strength (ANSI A118.10): 110-150 psi (0.8-1 MPa)
4. 28 Day Shear Bond Strength (ANSI A118.10): 90-120 psi (0.6–0.83 MPa)
5. 12 Week Shear Bond Strength (ANSI A118.10): 110-130 psi (0.8-0.9 MPa)
6. Total VOC Content: <3.4 g/L

C. Latex Portland Cement Mortar: Equal to LATICRETE Hi-Bond Masonry Veneer Mortar ** to be weather, frost, shock resistant, non-flammable and meet the following physical requirements:

1. Compressive strength (ANSI A118.4): >2500 psi (17.2 MPa)

2. Bond strength (ANSI A118.4): >450 psi (3.1 MPa)
3. Smoke & Flame Contribution (ASTM E84 Modified): 0
4. Total VOC Content: < 0.05 mg/m3

D. Latex Portland Cement Pointing Mortar / Grout: Equal to LATICRETE Premium Masonry Pointing Mortar ** to be weather, frost and shock resistant, as well as meet the following physical requirements:

1. Compressive Strength (ANSI A118.7): 4500 psi (31 MPa)
2. Tensile Strength (ANSI A118.7): >500 psi (3.45 MPa)
3. Flexural Strength (ANSI A118.7): >1250 psi (8.6 MPa)
4. Water Absorption (ANSI A118.7): < 5%
5. Linear Shrinkage (ANSI A118.7): < 0.05 %
6. Smoke & Flame Contribution (ASTM E84 Modified): 0
7. Total VOC Content: < 0.05 mg/m3

E. Expansion and Control Joint Sealant: Equal to LATICRETE Latasil™ to be a one component, neutral cure, exterior grade silicone sealant and meet the following requirements:

1. Tensile Strength (ASTM C794): 280 psi (1.9 MPa)
2. Hardness (ASTM D751; Shore A): 25 (colored sealant) /15 (clear sealant)
3. Weather Resistance (QUV Weather-ometer): 10000 hours (no change)

G. Base Flashing – Provide a 16 gauge G-90 galvanized panel support base flashing. Flashing shall extend up the masonry wall 6” and drip leg shall extend ½” beyond the outside face of the calcium silicate veneer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify site conditions are ready to receive work

B. Inspect materials for fit and finish prior to installation. Do not set unacceptable units and materials.

C. Beginning of installation means acceptance of existing conditions

3.02 CUTTING AND SIZING OF INSULATED CONCRETE BOARD PANELS

A. Cut concrete board with a masonry saw

B. If cutting foam insulation to form mitered corners cut using a hot wire saw.

C. Clean cut panels. After being cut use clean water and a sponge to remove all cutting dust from the panel surfaces.

3.03 CUTTING MASONRY UNITS

A. Cut masonry units with wet-saw.

B. Pre-soak units using clean water prior to cutting.

C. Clean cut units using a stiff fibre brush and clean water. Allow units to surface dry prior to placement.

D. Finish cut edges to match face when exposed in wall.

3.04 COURSING

A. Place masonry to lines and levels indicated.

B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.

C. Lay masonry units in half-running bond.

D. Course one masonry unit and one mortar joint to equal 12 inches.

E. Tool joints when thumbprint hard, to a concave finish.

3.05 FIELD QUALITY CONTROL

A. Not used.

B. Inspection: State Inspector will inspect installed masonry and reject masonry that is chipped, cracked, or blemished (streaked, stained or otherwise damaged), as described below.

1. Masonry will be inspected to be free of cracks or other blemishes on the finished face or front edges of the masonry units exceeding 3/8 inch or that can be seen from a distance of 10 feet.

2. Units shall exhibit a texture approximately equal to the approved sample when viewed under diffused daylight illumination at a 20 foot distance.

3. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under diffused daylight illumination from a 20 foot distance.

C. Make Good rejected masonry as directed by the State Inspector.

3.06 ADJUSTING AND CLEANING

A. Repair chips on smooth finished units with patch kits furnished by manufacturer.

B. Clean masonry units as indicated in the Manufacturer's written Instructions.

OR

C. Clean a 100 square foot area of wall designated by the Architect as directed below and leave for one week. If no harmful effects appear or all objectionable stains have been removed and after mortar has set and cured, clean masonry as follows:

1. Protect windows, sills, doors, trim and other work from damage.

2. Remove large particles with [stiff fiber brushes] [wood paddles] without damaging surface.

3. Saturate masonry with clean water and flush off loose mortar and dirt.

4. Dilute cleaning agent with clean water in controlled proportions.

5. Apply solution to pre-soaked wall surface using soft-bristled brush.

6. Thoroughly rinse cleaning solution and residue from wall surface.

D. Use alternative cleaning solutions and methods for difficult to clean masonry only after consultation with masonry unit manufacturer.

3.07 PROTECTION

A. Protect units from damage resulting from subsequent construction operations.

B. Use protection materials and methods which will not stain or damage units.

C. Remove protection materials upon Substantial Completion, or when risk of damage is no longer present.

3.08 SUBSTRATE EXAMINATION

A. Verify site conditions are ready to receive work.

B. Inspect finish materials for fit and finish prior to installation. Do not set unacceptable units.

C. Beginning of installation means acceptance of existing conditions.

D. Verify that surfaces to be covered with adhered masonry veneer, brick, stone, trim or waterproofing are: Sound, rigid and conform to good design/engineering practices;

1. Systems, including the framing system (including lateral bracing, purlins, battens and other framing member stiffeners), flashings, water resistive barriers, air barriers, cement backer unit panels, wire lath over which adhered masonry veneer or stone will be installed shall be in conformance with the California Building Code (CBC).

2. Clean and free of dust, dirt, oil, grease, sealers, curing compounds, laitance, efflorescence, form oil, loose plaster, paint, and scale.

3. Adhered Masonry Veneer installations have a specified subsurface tolerance, for instance ¼" in 10' (6mm in 3m) and 1/16" in 1' (1.5mm in 300mm), to conform with the ANSI specifications. Because medium-bed mortars are not intended to be used in truing or leveling the work of others, the subsurface typically should not vary by more than what is called for in 04 22 00 Concrete Unit Masonry Spec between adjoining edges where applicable (e.g. between sheets of insulated cement backer boards. Should the architect/designer require a more stringent tolerance e.g. 1/8" in 10', the subsurface specification must reflect that tolerance, or the adhered masonry veneer specification must include a specific and separate requirement to bring the ¼" (6mm) subsurface tolerance into compliance with the 1/8" (6mm) tolerance desired.

4. Not leveled with gypsum or asphalt based compounds.

5. Dry as per American Society for Testing and Materials (ASTM) D4263 "Standard Test for Determining Moisture in Concrete by the Plastic Sheet Method."

E. Concrete surfaces shall also be:

1. Cured a minimum of 28 days at 70°F (21°C), including an initial seven (7) day period of wet curing;

F. Advise General Contractor and Architect of any surface or substrate conditions requiring correction before adhered masonry veneer work commences. Beginning of work constitutes acceptance of substrate or surface conditions.

3.09 SURFACE PREPARATION

A. MASONRY SUBSTRATES

B. Remove excess mortar at joints or on concrete masonry surface.

C. Clean masonry surface as required by the Air and Water Barrier Manufacturer.

3.10 INSTALLATION ACCESSORIES

A. Air Barrier and Waterproofing.

B. Joints between primary sheathing panels.

1. Apply a liberal coat over entire substrate of Air and Water Barrier (Air and Water Barrier Material that is Vapor Permeable).

C. Install 16-gauge steel flashing/panel support at the base of all walls, above wall openings. Attach the steel flashing at 16” O.C. to a solid substrate behind using the same screws used to attach the insulated concrete panels (shorter versions of the same screws).

D. Waterproofing the Wall: Allow any pre-treated areas to dry to the touch. Apply a liberal coat* of Air and Water Barrier with a paint brush or heavy napped roller over substrate including pre-treated areas and allow to dry to the touch. Install another liberal coat* of Air and Water Barrier over the first coat. Let the top coat of Air and Water Barrier dry to the touch approximately 1 – 2 hours at 70°F (21°C) and 50% RH. When the top coat has dried to the touch inspect the surface for pinholes, voids, thin spots or other defects. Use additional Air and Water Barrier to seal any defects.

E. Treat Penetrations and Flashings - Allow for a minimum 1/8” (3mm) space between drains, pipes, lights, or other penetrations and surrounding adhered masonry veneer. Flash Waterproof Flashing Mortar onto and around penetration openings to create a waterproof seal. Bring Waterproof Flashing Mortar up to the finish level of the adhered masonry veneer. When Waterproof Flashing Mortar has dried to the touch and the finishes have been installed, seal the gap around the penetration with sealant.

F. Install first insulated concrete panels. The bottom ship-lapped edge of the panel shall be cut so that the concrete board and insulation are flush at the base of the wall. Set the bottom of the panel down on the steel flashing support and shims. Where masonry control joints are located, align panel edges. Panels may have to be cut to length to accomplish this. Always set the 8’-0” dimension in the horizontal dimension on the wall (3’-0” is always the vertical dimension).

G. Provide fasteners at the spacing required by the Structural Calculations. When fastening the panels, the screw heads should not break the outside skin of the concrete board. Only use approved screws and do not substitute with any other screw.

H. Install second insulated concrete panel adjacent to the first panel (following similar procedures to the first). Slip the foam insulation edge of the second panel behind the ship lapped edge of the concrete board of the first panel. Screw the ship-lapped edge of the first panel back to the studs. Continue in the same fashion along the base of the wall until all panels are installed. Install the next row of panels above and ensure the panel joints are offset and do not align vertically, offsetting the vertical panel joints in increments of 16” O.C. (i.e. 16”, 32”, 48” etc…). Insulated concrete panels cannot be

oriented vertically (i.e. the 8'-0" length of the panel must always be in the horizontal direction for the drainage grooves to align). To promote drainage of the assembly, the panels must be installed with the insulation grooves aligned. Offsetting the vertical panel joints in increments of 16" O.C. (i.e. 16", 32", 48" etc.) will help to align the drainage grooves, however using a 3/8" diameter wood dowel slid into the drainage grooves to align the joints may be required. Remove the wood dowel once the next panel has been screwed into place and repeat as required.

I. Once all panels are installed, treat all joints between panels with a 4" wide alkali-resistant mesh tape. Apply tape across all joints (2" on either side of joint), pressing firmly to ensure adhesion to substrate. Spread a thin coat of Masonry Veneer Mortar over the alkali resistant mesh tape. Allow Masonry Veneer Mortar to fully cure.

J. Once all panels are installed, treat all joints between panels with a 4" wide alkali-resistant mesh tape. Apply tape across all joints (2" on either side of joint), pressing firmly to ensure adhesion to substrate. Spread a thin coat of Masonry Veneer Mortar over the alkali resistant mesh tape. Allow Masonry Veneer Mortar to fully cure.

K. Ensure installed insulated concrete panels are free of dust and debris. Using a notched trowel, spread Masonry Veneer Mortar across panels and ensuring to burn the mortar into the concrete board surface. Pull notched side of the trowel across mortar to create a grooved surface and to gauge the mortar thickness. Notched trowel selection is dependent on the material being installed and the tolerances on the substrate. Apply only a workable area of mortar that will allow stone to be properly set before surface drying occurs. This area will vary depending on site environmental conditions.

L. Clean unit backs of any dust, laitance, loose material and any excess film that could impede bond. With the point trowel "back-butter" the stone units, ensuring to burn the mortar into the back of the units and filling any surface irregularities and ensuring 100% coverage.

M. Begin with the corner pieces. Press the corner piece onto the wall, rotating back and forth slightly. This process should force some of the mortar to "squeeze out" and work out any air gaps in the mortar. Remove any excess mortar with a square flat trowel and use the excess on the next piece of stone. After the corner pieces are installed, apply flat stretcher pieces starting at an outside corner unit and working your way in. Set the stretcher unit. Once set on the wall push the unit up and at an angle and then return it back to desired position. This process should force some of the mortar to "squeeze out" and work out any air gaps in the mortar. Remove any excess mortar with a square flat trowel and use the excess on the next piece of stone. Remove excess mortar droppings from the stone face with a clean wet sponge and a stiff fibre brush. Check for 100% mortar coverage by removing two stone units from the wall per bag of mortar used.

N. To point the joints between the stone units, allow the Laticrete Hi-Bond Masonry Veneer Mortar to fully cure and then use the Laticrete Pointing Mortar to point the joints between the stone units. Place pointing mortar into a grout bag or grout gun and squeeze the grout into the joints between the stone units. Once the mortar is thumbprint hard, tool the joints to a concave finish ensuring to push the mortar into the joint during this process. Allow the wall to fully cure.

O. Use only specified materials (insulated concrete board panels, screws, alkali resistant mesh tape) supplied from a single source to ensure 15 year insulated cement board panel and system warranties are maintained.

3.11 INSTALLATION – ADHERED MASONRY VENEER

A. General: Install in accordance with current versions of American National Standards Institute, Inc. (ANSI) “A108 American National Standard Specifications for Installation of Ceramic Tile” and TCNA “Handbook for Ceramic Tile Installation.” Cut and fit adhered masonry veneer neatly around corners, fittings, and obstructions. Perimeter pieces to be a minimum of a half unit, brick or stone. Chipped, cracked, split pieces and edges are not acceptable. Make joints even, straight, plumb and of uniform width to tolerance +/- 1/16" over 8’ (1.5mm in 2.4m). Install divider strips at junction of flooring and dissimilar materials.

B. Direct Adhere Method to Install Masonry Veneer: Install latex portland cement mortar in compliance with current revisions of ANSI A108.02 (3.11), A108.1B and ANSI A108.5. Use the appropriate trowel notch size to ensure proper bedding of the adhered masonry veneer, selected so that 100% coverage of the back surface of the Thin Adhered CSMU is achieved. Work the latex portland cement mortar into good contact with the substrate and comb with notched side of trowel. Spread only as much latex portland cement mortar as can be covered while the mortar surface is still wet and tacky. When installing large format (>8” x 8”/200mm x 200mm) units, spread latex portland cement mortar onto the back of (i.e. ‘back-butter’) each piece/unit in addition to troweling latex portland cement mortar over the substrate. Beat each piece/unit into the latex portland cement mortar with a beating block or rubber mallet to insure 100% full bedding and flatness. Allow installation to set until firm. Clean excess latex portland cement mortar from adhered masonry veneer face and joints between pieces.

   Use the following LATICRETE System Materials: LATICRETE® Hi-Bond Masonry Veneer Mortar

C. Pointing Joints:

   Polymer Fortified Pointing Mortar - for joint widths ≥1/16”(1.5mm) and ≤1” (25mm]); Allow Thin Adhered CSMU veneer to cure a minimum of 24 hours @ 70° F (21°C). Verify grout joints are free of dirt, debris, wedges or spacers. Sponge or wipe dust/dirt off veneer face and remove any water standing in joints. Surface temperature must be between 40-90° F (4-32°C). Pour approximately 4 quarts (3.8 L) of clean, potable water into a clean mixing container. Add a 50 lb. (22.7 kg) bag of Masonry Pointing Mortar to the container while mixing. Mix by hand or with a slow speed mixer to a smooth, stiff consistency. Install latex fortified cement grout in compliance with current revisions of ANSI A108.1A (7.0), ANSI A108.02 (4.5) and ANSI A108.10. Dampen dry surfaces with clean water.

   Place Masonry Pointing Mortar into a high quality masonry mortar pointing bag. Carefully bag the pointing mortar into the joints. Once the mortar has become stiff in the joint, (“thumb-print dry”) typically 15-20 minutes after pointing @ 70° F (21°C), using a striking

or joint tool, strike the mortar joints to the desired finish/contour. Remove excess mortar using a masonry brush or sponge. Do not over wash the mortar joint.

Higher temperatures may require faster time to initial cleaning; wider joints or lower temperatures may require a longer time to initial cleaning. Allow grout joints to become firm. Inspect joint for pinholes/voids and repair them with freshly mixed grout. Within 24 hours, check for remaining haze and remove it with warm soapy water and a nylon scrubbing pad, using a circular motion, to lightly scrub surfaces and dissolve haze/film. Do not use acid cleaners on latex portland cement grout less than 10 days old.

D. Expansion and Control Joints: Provide control or expansion joints as located in contract drawings and in full conformity, especially in width and depth, with architectural details.

1. Substrate joints must carry through, full width, to surface of adhered masonry veneer.

2. Install expansion joints in adhered masonry veneer work over construction/cold joints or control joints in substrates.

3. Install expansion joints where adhered masonry veneer abut restraining surfaces (such as perimeter walls, curbs, and columns), changes in plane and corners.

4. Joint width and spacing depends on application - follow TCNA “Handbook for Ceramic Tile Installation” Detail "EJ-171 Expansion Joints" or consult sealant manufacturer for recommendation based on project parameters.

5. Joint width: ≥ ⅛” (3mm) and ≤ 1” (25mm).

6. Joint width: depth ~2:1 but joint depth must be ≥ ⅛” (3mm) and ≤ ½” (12mm).

7. Layout (field defined by joints): 1:1 length: width is optimum but must be ≤ 2:1. Remove all contaminants and foreign material from joint spaces/surfaces, such as dirt, dust, oil, water, frost, setting/grouting materials, sealers and old sealant/backer. Use Primer for underwater and permanent wet area applications, or for porous stone (e.g. limestone, sandstone etc…) installations. Install appropriate backing material (e.g. closed cell backer rod) based on expansion joint design and as specified in Spec Section 07 92 00. Apply masking tape to face of adhered masonry veneer, brick or stone veneer. Use caulking gun, or other applicator, to completely fill joints with sealant. Within 5-10 minutes of filling joint, ‘tool’ sealant surface to a smooth finish. Remove masking tape immediately after tooling joint. Wipe smears or excess sealant off the face of adhered masonry veneer or other absorptive surfaces immediately.

E. Adjusting: Correction of defective work for a period of one (1) year following substantial completion, return to job and correct all defective work. Defective work includes, without limitation, adhered masonry veneer units stones broken in normal abuse due to deficiencies in setting bed, loose grout, and all other defects, which may develop as a result of poor workmanship.

3.12 CLEANING

A. Clean excess mortar/epoxy from veneer surfaces with water before they harden and as work progresses. Do not contaminate open grout/caulk joints while cleaning. Sponge and wash veneers diagonally across joints. Do not use acids for cleaning. Polish with clean dry cloth. Remove surplus materials and leave premises broom clean.

3.13 PROTECTION

A. Protect finished installation Close areas
to other trades and traffic until adhered masonry veneer being installed has set firmly. Extend period of protection of veneer work at lower temperatures, below 60°F (15°C), and at high relative humidity (>70% R.H.) due to retarded set times of mortar/adhesives. Replace or restore work of other trades damaged or soiled by work under this section.

3.14 HEALTH AND SAFETY

A. The use of personal protection such as rubber gloves, suitable dust masks, safety glasses and industrial clothing is required. Follow Material Safety Data Sheet recommendations and OSHA requirements in handling and processing all system materials. Discarded packaging, product wash and waste water should be disposed of as per local, state or federal regulations.

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Requirements of Division 1 apply to all Work of this Section.

1.02 SCOPE

A. Furnish and install all structural steel as shown and specified including, but not necessarily limited to the following:

1. Prime coat painting and touch up.

2. All cast-in-place anchor bolts, nuts, plates, etc.

3. 10 gauge steel or 3/4 inch plywood templates for column anchor bolts.

1.03 RELATED WORK (See also Table of Contents

A. Metal Decking: Section 05 30 00.

B. Metal Fabrications: Section 05 50 00.

C. Cast-In-Place Concrete: Section 03 30 00.

1.04 QUALITY ASSURANCE

A. General:

1. Comply with the referenced ASTM standards for materials.

2. Perform all welding only with AWS certified welders.

3. Verification of accuracy:
   a. Engage and pay for a registered civil engineer or licensed land surveyor to check the alignment, plumbness, elevation, and overall accuracy of the erected framing at appropriate stages during construction and at completion of erection. Prior to erection, a survey shall be made of the as-built locations of all anchor rods and other embedded items associated with the attachment of structural steel. The party providing the survey shall submit written verification that the entire installation is in accordance with the contract documents and meets the allowable erection tolerances as set forth in the AISC "Code of Standard Practice for Steel Buildings and Bridges”.
   b. Columns shall be verified at each lift. Column shim details and procedures shall be submitted for review.

4. Paint:
   a. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use thinners approved by paint manufacturer, and use within recommend limits.
   b. Coordination of Work: Review other Sections in which prime paints are to be provided to ensure compatibility of coatings system for various substrates. Upon request, furnish information or characteristics of finish materials to be used.
   c. Requirements of Regulatory Agencies: Comply with applicable rules and regulations of governing agencies for air quality control.

B. Except where other requirements are specified, comply with the following standards (latest edition unless noted otherwise)

1. AISC 360-10 "Specification for Structural Steel Buildings".

2. AISC 303-10 "Code of Standard Practice for Steel Buildings and Bridges".

3. AISC 341-10 “Seismic Provisions for Structural Steel Buildings”

4. AISC 358-10 “Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications”

5. RCSC "Specifications for Structural Joints Using High Strength Bolts".

6. AISC 303-10 Section 10, Architecturally Exposed Structural Steel, Code of Standard Practice for Steel Buildings and Bridges

7. AWS D1.1 "Structural Welding Code - Steel" – latest edition

8. AWS D1.8 “Structural Welding Code – Seismic Supplement” – latest edition

9. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

10. SSPC-Vis 1 Pictorial Surface Preparation Standards for Painting Steel Structures

11. SSPC-SP2 Hand Tool Cleaning

12. SSPC-SP3 Power Tool Cleaning

13. SSPC-SP6 Commercial Blast Cleaning

14. SSPC-PA2 Measurement of Dry Paint Thickness with Magnetic Gauges

15. California Building Code (CBC) – latest edition

C. Submittals: (Submit under provisions of Section 01 33 00)

1. Product Data: Include laboratory test reports and other data to show compliance with specifications (include specified standards). Include certified copies of mill reports

covering chemical and physical properties of each type of structural steel.

2. Shop Drawings:

   a. Shop drawings shall include complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.

   b. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.

   c. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

   d. Dimensions required to locate structural steel for manufactured items such as mechanical equipment, electrical equipment, dock levelers, etc., shall be coordinated and provided by the General Contractor. General Contractor shall also coordinate and provide dimensions to locate structural steel for window washing supports such as davits, tie-backs, etc.

3. Procedures:

   a. Provide weld procedures for both prequalified welds and special welds to be submitted to the Owner's Testing Laboratory and the Architect.

   b. Provide installation procedure and inspection for direct tension indicator washers detailed in supplemental specifications provided by the manufacturer for approval.

   c. Procedures shall be submitted for both shop and field welds.

D. Tests and Inspections:

1. Provide special inspections and testing as described in the “Statement of Structural Special Inspections and Testing” within the structural drawings and as required by this section.

2. Testing Laboratory:

   a. All materials, work, methods and equipment shall be subject to inspection at the mill, fabricating plant and at the building site. Material or workmanship not complying fully with the Contract Documents will not be accepted. The Contractor shall give the Testing Laboratory reasonable notice when ready for inspection and shall supply samples and test pieces and all facilities for inspection without extra charge. The Owner will assume the expense of making the tests and inspection except as otherwise specified in Division 1.

3. Cost of Testing and Inspection: Costs of testing and inspection of structural steel, except as specified hereunder and in Division 1, will be paid for by the Owner.

a. All transportation costs and per diem living costs for inspection at fabricators' plant further than 75 miles from the job site will be back-charged to the Contractor.

b. It is assumed that all fabrication will take place in one shop location only. All additional inspection costs will be back-charged to the Contractor.

c. All mill tests and costs of re-test of plain materials shall be at the expense of the Contractor.

d. Costs of tests required due to Contractor's failure to provide steel identifiable in accordance with the indicated ASTM designation shall be at the expense of the Contractor.

4. Structural Steel Testing and Inspection:

a. Structural Steel: If structural steel tests are indicated as required on the structural drawings, one tension and one bend test shall be made for each size of structural shape, plate and for each tube and pipe size. Tests to be made in accordance with requirements of appropriate ASTM designations.

b. If structural steel tests are not indicated as required on the structural drawings, then for shapes, plates, bars, pipe and tubing, manufacturer's certified mill test reports and analysis for each heat will be acceptable for steel identifiable in accordance with indicated ASTM designation. Mill test reports shall indicate the physical and chemical properties of all structural steel used. Correlate individual heat numbers with each specified structural section.

c. Unidentifiable Steel:

1) For Fy less than or equal to 36.0 ksi : Provide one tension and elongation test and one bend for each 5 tons or fraction thereof for each size.

2) For Fy greater than 36.0 ksi : Provide one tension and elongation test and one bend or flattening for each piece.

d. Costs of retests and additional testing required by the use of unidentifiable steels shall be the Contractor's responsibility. Additional costs of testing incurred by the Owner shall be deducted from the Contract Final Payment.

5. Expansion Anchors: Load test as indicated on drawings.

6. Welding Inspection:

a. For Moment Resisting Frame Welding inspection and testing requirements, see specification Section 05 50 00 - Metal Fabrications.

b. If shop or field welding inspection is indicated on the structural drawings or required by the applicable referenced standards, shop and field welded operations shall be inspected in accordance with AISC 360 Section N by a qualified welding inspector employed by the Testing Laboratory. Such inspector

will be a person trained and thoroughly experienced in inspection of welds. The inspector's ability to distinguish between sound and unsound welding will be reliably established

c. The welding inspector will make a systematic record of all welds. This record shall include:

   1) Identification marks of welders.

   2) List of defective welds.

   3) Manner of correction of defects.

d. The welding inspector will check the material, equipment and procedure, as well as the welds. He will also check the ability of the welder. He will furnish the Architect with a report, duly verified by him that the welding which is required to be inspected is proper, and has been done in conformity with the Contract Documents, and that he has used all means to determine the quality of the welds.

e. All full penetration groove welds will be subject to ultrasonic testing, as per AWS D1.1, Clause 6 "Inspection, Part "F", Ultrasonic Testing (UT) of Groove Welds. All defective welds shall be repaired and retested with ultrasonic equipment at the Contractor's expense.

f. Column Flanges: An area extending 6 inches above and below point where girder flanges are attached will be inspected. Column flange edges will be inspected visually and entire area ultrasonically for lamination, plate discontinuities, and non-metallic inclusions.

g. When ultrasonic indications arising from the weld root can be interpreted as either a weld defect or the backing strip itself, the Engineer will be notified. The Engineer may require the removal of backing strip. The backing strip will be removed at the expense of the Contractor, and if no root defect is visible the weld will be retested. If no defect is indicated on this retest, and no significant amount of base and weld metal have been removed, no further repair of welding is necessary. If a defect is indicated, it will be repaired and retested at Contractor's expense.

h. The ultrasonic instrumentation will be calibrated by the technician to evaluate the quality of the welds in accordance with AWS D1.1.

i. Other methods of inspection, for example, X-Ray, gamma ray, magnetic particle, or dye penetrant, may be used on welds if felt necessary by the inspection laboratory, and with the approval of the Engineer.

j. Base metal thicker than 1-1/2 inches, when subjected to through thickness weld shrinkage strains, shall be ultrasonically inspected for discontinuities directly behind such weld before and after joint completion.

k. End-welded studs shall be sampled, tested, and inspected per the requirements of AWS D1.1, Clause 7 Stud Welding.

l. At the discretion of the owner's testing agency, the ultrasonic testing frequency may be reduced but may not be less than the following:

m. Initially, all welds requiring ultrasonic testing will be tested at the rate of 100 percent in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5 percent of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25 percent. If the reject rate increases to 5 percent or more, 100 percent testing will be re-established until the rate is reduced to less than 5 percent. The percentage of rejects will be calculated for each welder independently.

n. A sampling of a least 40 completed welds will be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3 ft in length where the effective throat is 1” or less, each 12 inch increment or fraction thereof shall be considered as one weld. For evaluating the reject rate of continuous welds over 3 ft in length where the effective throat is greater than 1”, each 6 inch of length or fraction thereof shall be considered one weld.

7. High Strength Bolting Tests and Inspection:

a. Furnish certified test reports for each lot of bolts in accordance with Section 9 of ASTM A325 and A490. Install bolts under the supervision of a qualified inspector in accordance with Section 9, Research Council "Specifications for Structural Joints using ASTM A325 or A490 Bolts".

b. If high strength bolting inspection is indicated on the structural drawings or required by the applicable referenced standards, the testing laboratory shall provide inspection in accordance with AISC 360 Section N.

c. While the work is in progress, the Inspector shall determine that the requirements of this Specification are met in the work. The Inspector shall observe the calibration procedures and shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is properly used to tighten all bolts.

1) In addition to the requirement of the foregoing paragraph, for all connections specified to be slip critical (SC), the Inspector shall assure that the specified procedure was followed to achieve the pretension specified in the AISC. The pretension shall be verified by the inspector for these bolts.

2) Bolts in connections identified as not being slip-critical nor subject to direct tension need not be inspected for bolt tension other than to ensure that the piles of the connected elements have been brought into snug contact.

1.05 PRODUCT HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

B. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.06 SEQUENCING/SCHEDULING

A. Cooperate and coordinate this work with other trades for anchor bolts, and other required inserts, templates, etc. Align this work prior to installation of other materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel: Except where indicated on drawings.

1. W shapes: ASTM A572-50 or ASTM A992-50 unless indicated otherwise on drawings.

2. Channels and other rolled shapes: ASTM A36 unless indicated otherwise on drawings.

3. Angles, plates and bars: ASTM A36 unless indicated otherwise on drawings.

B. AISC group 4 and 5 shapes and plates greater than 2 inches thick: ASTM A36 and/or ASTM A572 Grade 50 with supplementary requirements S91 Fine Austenitic Grain Size and S5 Charpy V-Notch Impact Test. For location of Charpy V-Notch test, see ASTM A6 Supplementary Requirement S30. Charpy V-Notch test shall be per ASTM A673, frequency P and shall meet a minimum average value of 20 ft-lbs absorbed energy at 70^{o} F.

C. Cold-Formed Steel Tubing: ASTM A500, Grade B.

D. Steel Pipe: ASTM A53, Type E or S, Grade B.

E. Anchor Bolts: All anchor bolts cast in concrete or masonry shall be headed bolts with cut threads conforming to ASTM F1554 grade 36, 55 (weldable per S1 Supplementary Requirements), or 105 as indicated on drawings.

F. Machine Bolts: ASTM A307.

G. High Strength Bolts, Nuts and Washers: Install in accordance with requirements for A325 and A490 slip critical and snug tight conditions as indicated on drawings. Install high strength bolts with snug tight type connections with threads included in shear plane except as otherwise noted. Install hardened washers in conformance with AISC Specifications.

1. Bolt Specifications: Bolts shall conform to the requirements of the current edition of the Specifications of the American Society for Testing and Materials for High-Strength Bolts for Structural Steel Joints, ASTM A325, Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength, ASTM A490 as indicated on drawings.

2. Bolt Geometry: Bolt dimensions shall conform to the current requirements of the American National Standards Institute for Heavy Hex Structural Bolts, ANSI Standard B18.2.1. The length of bolts shall be such that the end of the bolt will be flush with or outside the face of the nut when properly installed.

3. Nut Specifications: Nuts shall conform to the current chemical and mechanical requirements of the American Society for Testing and Materials Standard Specification for Carbon and Alloy Steel Nuts, ASTM A563, Appendix Table X1.1. Provide Grade A Heavy Hex nuts for Grade 36 and 55 threaded rods. Provide Grade DH or ASTM A194-2H Heavy Hex nuts for Grade 105 threaded rod.

4. Washers: Flat circular washers and square or rectangular beveled washers shall conform to the current requirements of the American Society for Testing and Materials Standard Specification for Hardened Steel Washers, ASTM F436. Washers for base plates shall be placed top and bottom of plate and shall be ASTM A36 square or circular unless ASTM F844 are permitted on the drawings.

5. Tension Control Fastener System: Bolts shall conform to the requirements of the current edition of the Specifications of the American Society for Testing and Materials for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, ASTM F1852, providing equivalent properties to ASTM A325 or A490 as indicated on drawings.

H. Headed Stud-Type Shear Connectors: ASTM A108 Grade 1015 or 1020 Cold-finished carbon steel with dimensions complying with AISC Specifications.

1. Tensile strength, 60,000 psi.

2. Elongation in 2 inches, 20 percent

3. Reduction of area, 50 percent.

I. Provide hexagonal heads and nuts for all connections per ASTM A563, Appendix Table X1.1.

J. Electrodes for Welding: Comply with AWS Code, E70 Series minimum. Fabricator to select proper electrodes according to weld procedures as submitted.

K. Shop Primer – See Section 3.4, Painting and Cleaning

L. Powder Driven Fasteners (Shot Pins): Tempered steel pins with special corrosive resistant plating or coating. Pins shall have guide washers to accurately control penetration. Fastening shall be accomplished by low-velocity piston-driven power activated tool. Pins and tool shall be as manufactured by Hilti Fastening Systems.

M. Expansion Bolts: Hilti Fastening Systems “Kwik-Bolt Concrete Expansion Anchors” to concrete; Ramset “Dynabolt Sleeve Anchors” to masonry or approved equal.

PART 3 - EXECUTION

3.01 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assembly structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated to provide the flattest floor possible. The contractor shall coordinate member tolerances with finishes.

Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Connections: Weld or bolt shop connections, as indicted. Bolt field connections, except where welded connections or other connections are indicated.

C. Unless noted otherwise, make holes 1/16 inches larger than the nominal bolt diameter.

D. Welding, Shop and Field: Weld by shielded arc method, submerged arc method, flux cored arc method, or other method approved by AWS. Perform welding in accordance with AWS Code. All welders, both manual and automatic, shall be certified in accordance with AWS "Standard Qualification Procedure" for the Work to be performed. See paragraph "welding" herein, for detailed requirements. If sizes of fillet welds are not shown on drawings, use AWS minimum weld size but not less than 3/16 inch fillet welds.

E. Bolt Holes for Other Work: Provide holes required for securing other work to structural steel framing.

Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.

Cut, drill, or punch holes perpendicular to metal surfaces and remove all burrs. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

F. AISC Group 4 and 5 shapes and built up members shall meet the requirements for joints in AISC Sections J1.5, J1.6, J2.7 and M2.2.

G. High Strength Bolts:

1. Installation and Tightening:

a. Handling and Storage of Fasteners: Fasteners shall be protected from dirt and moisture at the job site. Only as many fasteners as are anticipated to be installed and tightened during a work shift shall be taken from protected storage.

Fasteners not used shall be returned to protected storage at the end of the shift. Fasteners shall not be cleaned of lubricant that is present in as-delivered condition.

b. Tension Calibrator: A tension measuring device shall be required at all job sites where bolts in slip-critical joints are being installed and tightened. The tension measuring device shall be used to confirm: (1) the suitability to satisfy the requirements of AISC for the complete fastener assembly, including lubrication if required to be used in the work, (2) calibration of wrenches, if applicable, and (3) the understanding and proper use by the bolting crew of the method to be used. The frequency of confirmation testing, the number of tests to be performed and the test procedure shall be as specified in 1.d. below, as applicable. The accuracy of the tension measuring device shall be confirmed through calibration by an approved testing agency at least annually.

c. Joint Assembly and Tightening of Shear/Bearing Connections: Bolts in connections not within the slip-critical category shall be installed in properly aligned holes, but need only be tightened to the snug tight condition. The snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. If a slotted hole occurs in an outer ply, a flat hardened washer or common plate washer shall be installed over the slot.

d. Joint Assembly and Tightening of Connections Requiring Full Pre-tensioning. Slip-critical connections shall be installed in properly aligned holes and tightened by one of the following methods.

    1) Turn-of-nut Tightening: When turn-of-nut tightening is used, hardened washers are not required except as specified in the AISC. A representative sample of not less than three bolts and nuts of each diameter, length and grade to be used in the work shall be checked at the start of work in a device capable of indicating bolt tension. The test shall demonstrate that the method of estimating the snug-tight condition and controlling turns from snug tight to be used by the bolting crews develops a tension not less than five percent greater than the tension required for slip-critical connections.

    2) Installation of Alternate Design Bolts: A representative sample of not less than three bolts of each diameter, length and grade shall be checked at the job site in a device capable of indicating bolt tension. The test assembly shall include flat hardened washers, if required in the actual connection, arranged as in the actual connections to be tensioned. The calibration test shall demonstrate that each bolt develops a tension not less than five percent greater than the tension required by AISC. Manufacturer's installation procedure shall be followed for installation of bolts in the calibration device and in all connections. When alternate design features of the fasteners involve an irreversible mechanism such as yield or twist-off of an element, bolts shall be installed in all holes of the connection and initially brought to a snug tight condition. All fasteners

shall then be tightened, progressing systematically from the most rigid part of the connection to the free edges in a manner that will minimize relaxation of previously tightened fasteners prior to final twist-off or yielding of the control or indicator element of the individual fasteners. In some cases, proper tensioning of the bolts may require more than a single cycle of systematic tightening.

e. Mark bolts that have been completely tightened with an identifying symbol.

3.02 WELDING

A. General: Quality of materials and design and fabrication of all welded connections shall conform to AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Building," "AWS Code for Welding in Building Construction," and requirements of this section.

Location and type of all welds shall be as shown. Make no other welded splices, except those shown on drawings, without prior approval of the architect.

B. Automatic Welding: Use electrode wire and flux for automatic and semi-automatic welding acceptable to Structural Engineer. All methods, sequences, qualification and procedures, including preheating, and post heating if necessary, shall be detailed in writing and submitted to the Structural Engineer for review.

C. Qualification of Welders:

1. Structural steel welding: Manual and automatic welds for structural steel construction shall be made only by operators who have been previous qualified by tests, as prescribed in AWS D1.1 to perform type of work required.

2. Welders shall be checked by welding inspector. Those not doing satisfactory work may be removed, and may be required to pass qualification tests again. All qualification testing shall be at the Contractor's expense.

3. Only welders whose weld procedures and pre-qualification by testing that have passed shall be considered qualified for such welds.

D. Control cooling process after weld is completed by either step down post heat or thermal blankets as determined by procedures and prequalification.

E. Box columns and built-up members shall have ultrasonic testing before and after welding.

F. Flame cut surfaces shall be ground to remove contaminated steel layer to provide welds proper fusion without impurities.

G. Preparation of surface: Surfaces to be welded shall be free of loose scale, slag, rust, grease, paint, and any other foreign material.

H. Welding equipment: Welding equipment to be used in each case shall be acceptable to welding inspector. Use equipment with suitable devices to regulate speed, and manually

adjust operating amperage and voltage. The amperage capacity shall be sufficient to overcome line drop, and to give adequate welding heat.

I. Remove runoff tabs and grind surfaces smooth where the tabs would interfere with fireproofing and architectural finishes.

J. End-welded studs:

1. Automatic end-welded studs: Automatically end-weld in accordance with the manufacturer's recommendations in such a manner as to provide complete fusion between the end of the stud and the plates. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate. The stud shall decrease in length during welding approximately 1/8 inch for 5/8 inch, and 3/16 inch for 3/4 inch diameter. Stud sizes indicated on drawings represent the finish stud height.

2. Fillet-end welded studs: Studs may be welded using prequalified FCAW, GMAW, or SMAW processes provided the requirements of the AWS D1.1 Chapter 7 Section 7.5.5 are met as well as any other pertinent requirements of D1.1.

K. Provide mill camber as shown on the construction documents within AISC tolerance. Place mill tolerance upward for all beams specified no camber.

3.03 ERECTION

A. Structural steel erection: Comply with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Building", latest edition.

B. Erection Sequence: Erect steel in accordance with special erection sequences where special erection sequences are indicated on the contract documents.

C. Before and during erection, keep all structural steel clean. Ship, handle and store steel in manner to avoid injury to members. Steel members showing evidence to rough handling or injury will be rejected.

D. Mark each member with erection identification corresponding to mark shown on erection drawings. Carefully plan erection of structural steel so that no cutting and removal of material will be necessary. Do not torch burn in the field, unless specifically permitted by Engineer.

E. Provide sufficient bracing, shoring and guys to effect safe and satisfactory erection. Provide bracing and shoring capable of holding steel work plumb and properly aligned while field connections are being made, and until lateral force resisting elements are deemed by Architect capable of bracing structure. Temporary bracing shall be adequate to resist lateral forces from wind or seismic prior to the completion of the lateral resisting system.

F. Set bearing and base plates with extreme care. Bring level, to line and grade with leveling plates or by leveling nuts and bolts. Grout solid under plates with a flowable non-shrink grout per Section 03 30 00 prior to applying vertical load.

G. Field Assembly: Set structural framing accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces which will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

Shimming or other adjustments not indicated on drawings shall be approved by the Engineer prior to installation. Level and plumb individual members of the structure within specified AISC tolerances except as noted herein. Column shimming shall be 1/4 inch.

H. All welds shall be full and clean, and conform to AISC and AWS specifications.

I. Erection Tolerances: Individual pieces shall be erected so that the deviation from plumb, level and alignment shall not exceed 1 to 500 plus:

1. The maximum displacement of the center line of columns adjacent to elevator shafts, from the established column line, shall not be more than 1 inch at any point.

2. In order to provide a true, flat plane for the exterior elevations, install all steel framing at the exterior walls of the building, so that the center lines of such framing does not vary by more than 1 inch for the length of the building. Also install each vertical member on such grids so that its vertical center line does not vary by more than 1/2 inch from a vertical line for each story and 1 inch for its full height.

3. All columns and beams shall adhere to Section M2.7 of the referenced "Specification for Structural Steel for Buildings" which states that completed members shall be free of twists, bends, and open joints. Take special care that column base plates are parallel and perpendicular to faces of columns and that bolt holes are accurately placed.

J. Temporary Flooring:

1. Provide planking and scaffolding necessary in connection with erection of structural steel, support of erection machinery, and construction materials. Temporary floors and use of steel shall be as required by applicable regulatory requirements.

2. If steel decking is used as a working platform, it shall be temporarily tack-welded to supports to extent necessary for such use in accordance with applicable regulatory requirements. The concentrated loading from welding machines and other heavy machinery required for steel erection shall be distributed by planking or other approved means. Metal decking that becomes damaged as the result of being used as a working platform shall be replaced at no additional cost to the Owner.

K. Tower Crane: The design for the support and bracing for a tower crane shall be the responsibility of the General Contractor. The design shall be prepared by a structural engineer licensed in the state of California. Drawings and calculations shall be stamped and signed by the structural engineer. Concentric, torsional, and/or eccentric loading to the main structure shall be resolved by the addition of structural steel for shear tabs, stiffeners, drag ties, bracing struts, etc., Such items shall be designed, detailed, furnished and installed by the contractor.

3.04 PAINTING AND CLEANING

A. Prior to prime coat application, clean all loose rust, mill scale, oil, dirt, and all other materials from all steel to be left exposed. Use hand tool, power tool, sandblasting, chemical cleaning, and any other method necessary to provide a smooth, sound surface for painting.

B. Shop prime all steel except the following:

1. Steel encased in concrete.

2. Contact surfaces for slip-critical (sc) high strength bolts.

3. Areas within 4 inches of field welds.

4. Tops of members to receive metal decking.

5. Steel to be fireproofed.

6. Surfaces to be galvanized.

C. Use the following Type A shop painting systems on all normal environment interior steelwork:

1. Surface Preparation: SSPC-SP2 Hand Tool Cleaning or SSPC-SP3 Power Tool Cleaning. Where jobsite exposure is expected to exceed 6 months, SSPC-SP6 Commercial Blast Cleaning is required.

2. Application: Follow coating manufacturer's printed directions.

3. Material: Type A Tnemec Company, Inc., Series V10; Sherwin Williams Steel Spec Universal; Metal Case 94-231 Series or approved equal

4. Number of Coats: One

5. Dry Film Thickness: 2.0 mils minimum.

6. Volume Solids: 56.0 +/- 2.0% minimum

7. Generic Description: Modified Alkyd.

D. Unless noted otherwise in subsection H, use the following Type B shop painting systems on all exterior steelwork and interior steelwork subjected to wet conditions or fumes (see subsection H for additional requirements)

1. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

2. Application: Follow coating manufacturer's printed directions.

3. Material: Type B Tnemec 90-97 Tneme-Zinc primer or approved equal

4. Number of Coats: One

5. Dry Film Thickness: 2.5 to 3.5 mils

6. Volume Solids: 63% +/- 2%

7. Generic Description: Zinc-Rich Urethane

E. Unless noted otherwise in subsection H, use the following finish painting systems on all exterior steelwork and interior steel work subjected to wet conditions or fumes (see subsection H for additional requirements):

1. Application: Follow coating manufacturer's printed directions. Apply over Type B primer system above.

2. Material: Tnemec Series 750 UVX paint or approved equal

3. Number of Coats: One

4. Dry Film Thickness: 2.5 to 5 mils

5. Volume Solids: 72% +/- 2%

6. Generic Description: Polyfunctional Hybrid Polyurethane

F. Primers and paints shall meet all federal and state environmental and air quality requirements.

G. Apply two shop prime coats to areas which will be inaccessible after erection.

H. All exterior steelwork and all interior steelwork subjected to wet conditions or fumes, including all welds, bolts, washers and other connection components, shall be primed and painted or hot-dip galvanized, as specified by the Architectural finish specifications. In the absence of Architectural finish specifications, all exterior steelwork and all interior steelwork subjected to wet conditions and fumes, including all welds, bolts, washers and other connection components, shall be hot-dip galvanized, conforming to the requirements set forth in ASTM A123/A123M and ASTM A153/A153M.

I. Clean contact surfaces of high strength bolts of all burrs and material which might prevent solid seating of the parts. Steel to receive bolts shall be primer painted except beneath the contact area of slip-critical bolts.

J. After erection, field touch up all welded areas, high strength bolts and damaged areas. For all steel to remain exposed, remove all blemishes, paint drips, and touch up prime coat.

3.05 HOISTING AND BRACING

A. Provide all hoisting and erecting equipment and power.

B. Provide and maintain any and all safety railings, toe boards, etc., required for the erection of steel framing and metal decking.

C. Brace the erected frame in a manner which will assure safety and proper alignment to receive the metal decking and until the concrete slabs have been poured and have set.

D. Erect building frame true and level. Erect columns in a manner to allow for movement due to welding shrinkage and thermal expansion and contraction of framing. Check plumbness after erection of each level. Maintain structural stability of frame during erection. Provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.

END OF SECTION

SECTION 05 21 00

STEEL JOISTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Requirements of Division 1 apply to all Work of this Section.

1.02 SCOPE

A. Design, furnish and install all steel floor joists, steel roof joists, joist girders and related bridging, blocking and connection necessary for a complete installation as indicated herein and on the Drawings.

1.03 RELATED WORK (See also Table of Contents)

A. Loads supported from Structure: Section 01 84 15.

B. Metal Fabrications: Section 05 50 00.

C. Structural Steel: Section 05 12 00.

1.04 QUALITY ASSURANCE

A. General:

1. Provide joists fabricated in compliance with Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders

2. Qualification of Field Welding:

a. Qualify welding processes and welding operators in accordance with American Welding Society (AWS) "Structural Welding Code", AWS D1.1.

b. Joists welded in place are subject to inspection and testing. Expense of removing and replacing any portion of steel joists for testing purposes will be borne by Owner if welds are found to be satisfactory. Remove and replace work found to be defective and provide new acceptable work.

3. Each joist unit shall have a current ICC-ES evaluation report listing allowable loads.

B. Standards and References: (Latest Edition unless otherwise noted)

1. Steel Joist Institute Specifications (SJI K-1.1, SJI LH/DLH-1.1, SJI JG-1.1).

2. American Society for Testing and Materials:

a) "High Strength Bolts" (ASTM A325 or A490).

3. American Welding Society "Structural Welding Code (AWS D1.1).

4. International Code Council (ICC-ES).

5. California Building Code (CBC).

C. Submittals: (Submit under provisions of Section 01 33 00)

1. ICC-ES Evaluation report for each type of steel joist.

a. Certification that joints comply with SJI “specifications”.

b. Manufacturers Specification and installation instruction for each type of joist and accessories.

c. ICC-ES in plant inspection (See Section 1.04.D.1)

2. Shop Drawings:

a. Submit detailed drawings showing layout of joists, special connections, jointing and accessories. Include mark, number, type, locations and spacing of joists and bridging.

b. In accordance with CBC 2207.3, submit structural calculations signed by a licensed California Civil Engineer. Calculations shall include a statement noting that the joist design complies with all criteria provided in the approved construction documents and has been based on configurations, details, spacing, etc. as shown in the steel joist manufacturer’s steel joist placement plans.

D. Tests and Inspections:

1. Provide special inspections and testing as described in the “Statement of Structural Special Inspections and Testing” within the structural drawings and as required by this section.

2. A testing program is required prior to start of construction. Testing program to be done in Compliance with the CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.

3. Manufacturing facilities shall have been inspected by an independent ICC-ES approved inspection agency within the past year.

4. Special inspections of open-web steel joists and joist girders shall be in accordance with CBC section 1705 and Table 1705.2.3.

5. All field welding shall be special inspected as required by CBC Section 1705 and AISC 360.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle joists in manner to prevent damage or deformation in accordance with SJI "Specification".

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel: Comply with SJI "Specifications" for Chord and Web Sections.

B. Steel Prime Paint: SJI "Specifications".

C. Bolts: ASTM A490 or A325 Heavy Hexagon Structural bolts with nuts and hardened washers.

D. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular hexagon type, low-carbon steel.

E. Steel Bearing Plates: ASTM A36.

2.02 FABRICATION

A. General: Fabricate steel joists in accordance with SJI "Specification".

B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.

C. Extended Ends: Provide extended ends of joists where shown, complying with manufacturer's standards and requirements of applicable SJI "Specifications" and load tables.

D. Ceiling Extensions: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suite manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 2 inch of finished wall surface unless otherwise indicated.

E. Bridging: Provide horizontal or diagonal type bridging for "open web" joists, complying with SJI "Specifications".

1. Provide diagonal type bridging for "longspan" joists, complying with SJI "Specifications".

2. Provide bridging anchors for ends of bridging lines terminating at walls or beams.

F. End Anchorage: Provide end anchorages to secure joists to adjacent construction, complying with SJI "Specifications", unless otherwise indicated.

G. H Series Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.

H. Shop Painting: Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint.

I. Apply one shop coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.

J. In accordance with CBC 2207.5, at the completion of fabrication, the steel joist manufacturer shall submit a certificate of compliance stating that the work was performed in accordance with the approved construction documents and the SJI standard specifications.

PART 3 - EXECUTION

3.01 INSPECTION

A. Erector must examine areas and conditions under which steel joists are to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Erector.

3.02 ERECTION

A. Place and secure steel joists in accordance with SJI "Specifications", final shop drawings, and as herein specified.

B. Anchors: Furnish anchor bolts and other devices to be built into concrete and masonry construction. Furnish templates for accurate location of anchors in other work.

1. Furnish unfinished threaded fasteners for anchor bolts, unless otherwise indicated.

2. Refer to Division 3 sections for installation of anchors set in concrete.

3. Refer to Division 4 sections for installation of anchors set in masonry.

C. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.

1. Provide temporary bridging, connection, and anchors to ensure lateral stability during construction.

2. Install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines where open web joist length exceeds erection stability limits, as determined by the manufacturer.

D. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams. Bridging shall not attach to wood panelized roof framing.

E. Fastening Joists:

1. Field weld joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.

2. Secure joists resting on masonry or concrete bearing surfaces by bedding in mortar and anchoring to masonry or concrete construction as specified in SJI "Specifications" for type of steel joist used.

3. Bolt joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used.

4. Provide unfinished threaded fasteners for bolted connections except where high-strength bolts or welded connections are shown.

5. Provide high-strength threaded fasteners for bolted connections of steel joists to steel columns and at other locations where shown, installed in accordance with AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts".

F. Touch-Up Painting: After joist installation, paint field bolt heads and nuts, welded areas, and abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.

END OF SECTION

SECTION 05 30 00

METAL DECKING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of Division 1 apply to all Work of this Section.

1.02 SCOPE

A. Provide all steel decking, accessories and cutting and reinforcing of all holes as indicated on Drawings and specified here.

1.03 RELATED WORK (See also Table of Contents):

A. Cast-in-place concrete: Section 03 30 00.

B. Structural Steel: Section 05 12 00.

C. Metal Fabrications: Section 05 50 00.

D. Holes for Mechanical and Electrical Work: Divisions 21, 22, and 26.

1. Cutting and reinforcing of holes for plumbing and electrical conduits shall be part of this work providing holes are located by the mechanical and electrical contractors prior to or during installation. Cutting and reinforcing of holes after installation shall be the responsibility of those trades requiring them.

2. Miscellaneous connection requirements for Mechanical and Electrical Work: Divisions 21, 22 and 26.

E. Supporting from Structure: Section 01 84 15

1.04 QUALITY ASSURANCE

A. Standards and References: (Latest Edition unless otherwise noted)

1. 2019 California Building Code (CBC),

2. American Iron and Steel Institute (AISI). "Specification for the Design of Cold-Formed Steel Structural Members."

3. American Welding Society (AWS): AWS D-1.3 "Structural Welding Code - Sheet Steel".

B. Submittals: (Submit under Provisions of Section 01 33 00)

1. Shop Drawings. Submittal required. Indicate deck sheet layout and all installation details. Contract documents may not be used as shop drawings.

2. Manufacturer's specifications for each Deck Type. Submittal required.

3. Certification: Provide affidavits from the manufacturer listing mill test certificates by number for each size and type of decking.

4. Manufacturer shall provide affidavits of approval by the International Code Council Evaluation Service (ICC-ES) for the metal decking shapes proposed.

5. Floor areas to receive concrete fill over metal deck: Provide a work plan detailing the means and methods to be used for placement of concrete, including screeding procedures and locations of any construction joints, which will achieve the performance criteria noted in Section 2.1. A pre-construction meeting shall be scheduled by the General Contractor, to include the concrete sub-contractor, Architect, Structural Engineer, and Owner's Representative to discuss the work plan and performance objectives.

C. Tests and Inspections:

1. Provide special inspections and testing as described in the "Statement of Structural Special Inspections and Testing" within the structural drawings and as required by this section.

2. A testing program is required prior to start of construction. Testing program to be done In Compliance with the CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.

3. All materials, methods and equipment shall be subject to inspections by the Testing Laboratory at any time.

4. Material Testing: Test reports establishing conformity to the specifications shall be furnished to the Owner for each heat prior to installation.

5. Welding Inspection: Welding of metal deck shall be performed under the inspection of the Testing Laboratory. Inspection shall be in accordance with SDI QA/QC.

6. Powder Actuated Fasteners (shotpins): Where decking is attached with shotpins, the pins shall be inspected for proper installation by a special inspector. Twenty-five percent (25%) of all pins shall be verified using the inspection tool supplied by Hilti Inc.

1.05 PRODUCT HANDLING

A. Protect metal decking before installation and protect the installed work and materials of other trades.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS - DECK SYSTEMS

A. Acceptable Manufacturers:

1. ASC Steel Deck.

2. Verco Manufacturing Co.

3. Manufacturers of materials are indicated to set a standard for design and product performances.

4. Subject to the requirements of Division 1, products of manufacturers not indicated may be proposed for substitution, provided that they are equal in design, product performance and warranty to the products specified and have ICC approval.

5. The burden of proof of equality of proposed products is on the Contractor.

B. Provide deck sections, type and gage as indicated on the drawings. Other manufacturers producing deck complying with these Specifications, and having equivalent properties and dimensions will be subject to the Architect's review upon submission of substantiating data, and may be used only if equivalent to deck sections specified, in the Architect's opinion.

C. All deck units shall be approved by International Code Council Evaluation Service (ICC-ES) for use as a diaphragm.

1. Diaphragm shear capacities shall be comparable (within 5%) to those listed on the drawings for the deck, welding, and spans indicated.

D. Units shall be in lengths to span two or more supports. Where steel layout does not permit two-span minimums, notify the Structural Engineer prior to fabrication.

E. For limitations of loads to metal decking see Section 01 84 15.

F. All deck units shall have male and female interlocking side joints.

G. All deck units with concrete or insulating concrete shall be vented to provide 1% open area.

H. Prior to covering or filling with insulation, roofing, or placing concrete over metal decking, verify and coordinate installation requirements of suspended metal framing, suspended acoustical ceiling systems, mechanical and electrical work or other items as required. Provide inserts, clips, anchors or fasteners as indicated or as otherwise required to provide for the complete and proper installation of suspended items from the metal deck.

1. Verify and coordinate locations, patterns, spacing, etc. of suspension members and connectors required by other Sections of the Specifications and as shown on drawings.

2. Where suspension or hanger wires are required under other Sections, verify and coordinate locations, patterns, spacings, etc. with the appropriate trade. Drill holes at bottom of deck flutes of sufficient size to pass support wires. Wire supports shall be looped and secured with a minimum of three (3) tight turns around a minimum 1-1/2" x 8" long furring channel or No. 3 x 12" long reinforcing bar centered above the hole and laid in the deck flutes. Pig-tail loops into the concrete will not be permitted unless approved by the General Contractor. Place no wires in flute with side lap.

3. At unfilled metal deck or as otherwise indicated, required or shown, provide individual 18 gauge by 1-1/2" wide galvanized hanger tabs 6" long and having 2" round holes for attaching tie wires. Tabs shall be hooked over male portion of each edge joint at 16" on center before female joint of next sheet is placed over it. As an alternate, #3x12" long reinforcing bars centered above the hole and laid in the deck flutes may be used. No loading other than suspended ceilings may be suspended from metal deck without concrete fill. Suspend all piping, ducting, conduit and equipment from steel beams.

I. Structural Properties: Deck shall have minimum structural properties as indicated on Structural Drawings.

J. Accessories to be furnished shall include the following:

1. Cell closures where shown on Drawings.

2. Light gauge plate fillers attached to deck to provide an uninterrupted roof plane.

3. Drain sumps and/or roof drain mounting plates as detailed.

4. Cell end closures column flashing and miscellaneous closures to prevent concrete leakage.

5. Miscellaneous accessories incidental to erection of deck.

K. At concrete filled metal deck floors:

1. The final top of concrete elevation shall not deviate by more than 3/8” above or below the top of concrete elevation noted on plan.

2. Floor flatness for concrete over metal deck shall conform to ACI 117. Unless stricter requirements are specified by the Architect, floor flatness for the completed overall floor area shall meet the following minimum values:

Specified Overall Value for Flatness (SOF_F): 25

Minimum Local Value for Flatness (MLF_F): 17

Areas of non-compliance shall be reviewed by the Owner and Architect and may require additional floor leveling or grinding. The cost of any remedial action shall be borne by the Contractor.

3. In no case shall the depth of concrete over metal deck be less than that specified on plan. Note that the concrete depth will vary due to deck and beam deflections during concrete placement, and shall be considered in the estimating of concrete volume, cost and placement strategies.

L. At concrete filled metal deck roofs:

1. Concrete over metal deck at roofs shall be placed to maintain the design thickness specified on plan at all locations within the roof area. Additional concrete (ponding) which increases the thickness above the design thickness to achieve flatness, levelness or maintain roof slope should not be provided.

2.02 MATERIALS

A. Provide deck of type and gage shown on the drawings. Deck units and all necessary items shall be formed from steel sheets conforming to ASTM-A653, structural quality. The steel sheets shall have received, before being formed, a metal protective coating of zinc conforming to ASTM-A653 Class G60 coating.

B. Powder Actuated Fasteners (shotpins): Where decking is attached with shotpins, they shall be by Hilti Inc., of the type indicated on the drawings and ICC-ES approved for use in a diaphragm.

C. Welding rods: E60XX minimum.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas to receive work specified. Do not begin work until underlying work is complete, all required inspections have been made, and all conditions which might prevent proper installation or impair performance of work have been corrected.

B. Beginning installation means accepting conditions of underlying work.

C. If supporting steel work is not properly aligned or sufficiently level to permit proper bearing of metal decking, such deficiency shall be corrected by the Contractor before placing units.

3.02 ERECTION

A. Deck shall be laid true to line, shall conform to profile shown on Drawings, and shall be without deformations, creases, wrinkles or noticeable defects.

B. Connections: Deck shall be secured to structural frame by use of 15/16" visible diameter (1/2” effective diameter) fusion welds. Minimum number and spacing of connections shall be as indicated on Structural Drawings.

C. The metal deck shall be fastened to all structural members both parallel and perpendicular. Spread deck and modify layout where structural members are parallel to the metal deck ribs.

D. Bend decking to conform to slopes and warps as required for solid contact to framing that allows proper welding.

E. Shoring for metal decking shall be provided by the contractor as required and as indicated in the corresponding ICC-ES report. Coordinate shoring requirements for construction live load (and concrete placement) with the manufacturer.

F. All deck units shall break over beams.

G. Provide low ribs at all beams parallel to deck. As an alternate, the deck may be broken and infilled with a flat pan to provide deck welding to parallel beams.

H. Butt deck units tight over steel beams.

I. Provide ¾" clear concrete cover around all welded studs.

3.03 DEFECTIVE DECK

A. Units of decking that become deformed or damaged to such extent that they are weakened or unsuitable for use shall be removed and replaced at no cost to the Owner.

3.04 TOUCH UP AND CLEANING

A. All welds and abrasions on deck surfaces not covered by concrete shall be touched up using a zinc dust-zinc oxide primer.

B. Burn spots on supporting exposed steel shall be touched up with same primer as used on adjacent surface.

C. Clean surfaces of installed deck by effective means to receive sprayed-on fireproofing or finish painting as indicated.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of Division 1 apply to all Work in the Section.

1.02 SCOPE

A. Furnish and install all components and related items pertaining to cold-formed metal framing systems.

1.03 RELATED WORK SPECIFIED ELSEWHERE (See also Table of Contents)

A. Cast-in-place concrete: Section 03 30 00.

B. Structural Steel: Section 05 12 00.

C. Metal Deck: Section 05 30 00.

1.04 QUALITY ASSURANCE

A. General:

1. Welders: Qualified for welding in horizontal, vertical, and overhead positions in accordance with AWS D1.3.

2. Wall system shall provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperatures.

3. Wall system shall accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

B. Standards and References: (Latest Edition unless noted otherwise)

1. California Building Code (CBC),

2. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process..

3. Framing components shall conform to Standards of the Steel Stud Manufacturers Association (ICC-ES ER-3064P).

C. Submittals: (Submit under provisions of Section 01 33 00).

1. Manufacturers catalog with sizes to be used indicated.

2. ICC-ES report.

3. Mill certificates verifying steel properties.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect metal framing units from rusting and damage.

B. Deliver to Project site in manufacturer's unopened containers or bundles, identified with name, brand, type and grade.

C. Store off ground in a dry ventilated space or protect with suitable waterproof covering.

PART 2 - PRODUCTS

2.01 ACCEPTED MANUFACTURERS

A. Members of the Steel Stud Manufacturer’s Association (SSMA), or approved equal.

2.02 METAL FRAMING

A. System Components: Provide steel studs, joists, tracks, straps, runners, blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as shown on the Drawings for applications indicated. All studs, joists, tracks, and blocking shall conform to ICC-ES ER-3064P.

B. Materials and Finishes:

1. 54 Mils (16 Gauge) and Thicker: Fabricate metal framing components of structural quality (SQ) steel sheet with a minimum yield point of 50,000-psi, conforming to ASTM A653, SS Grade 50 Class 1 or ASTM A1003, Grade 50 Type H (ST50H).

2. 43 Mils (18 Gauge) and Thinner: Fabricate metal framing components of structural quality (SQ) steel sheet with a minimum yield point of 33,000-psi, conforming to ASTM A653, SS Grade 33 or ASTM A1003, Grade 33 Type H (ST33H).

3. Finish: Galvanized complying with ASTM A653, G60. Finish accessories to match main framing components.

C. See drawings for section properties and details.

D. Studs and joists shall be of the size, shape, and gauge indicated, with a flange and flange return lip as shown on the Structural Drawings.

E. Welding Electrodes: E60XX (43 Mil material and thinner), E70XX (54 Mil material and thicker)

F. Galvanizing Repair Paint: High zinc-dust content paint for repair of galvanized surfaces damaged by welding.

G. Material Thickness: All sections are to be roll formed in various depths with the following minimum bare metal thicknesses:

Minimum Thickness (inch)	Minimum Design Thickness (inch)	Gauge	Mils
0.0179	0.0188	25	18
0.0329	0.0346	20	33
0.0428	0.0451	18	43
0.0538	0.0566	16	54
0.0677	0.0713	14	68
0.0966	0.1017	12	97
0.1180	0.1240	10	118

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install metal framing systems in accordance with the Structural Drawings. Where drawings conflict with manufacturer's recommendations, the Structural Drawings will govern.

B. Runner Tracks:

1. Install continuous tracks sized to match studs. See Structural Drawings.

2. Align at base and tops of studs.

3. Attach tracks with screws, welding, bolting or shot pins as indicated on the Structural Drawings.

4. Fasten corners and ends of tracks as shown.

C. Studs:

1. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces.

2. Where studs abut structural columns or walls, anchor ends of stiffeners to supporting structure.

3. Secure studs to top and bottom runner tracks by screw fastening at both flanges.

4. Install studs in one piece for full height; splicing of studs is not permitted.

5. Provide deflection allowance of 1/2" minimum in stud track, directly below horizontal building framing for all non-bearing wall framing. See Structural Drawings.

6. Install ends of studs tight to web of track at all bearing wall framing. Compress track against end of stud as required to achieve tight fit prior to installation of stud to track screw attachments. See Structural Drawings.

7. Install supplementary backing and bracing wherever walls or partitions are indicated to support equipment, services, casework, heavy trim and furnishings and similar work requiring attachment to wall or partition. Comply with stud manufacturer's instructions and industry standards.

8. See Structural Drawings for opening framing.

9. Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system.

10. Install one row of metal blocking or bridging at mid-height of all studs over 10'-0" in height in addition to bracing that may be required at studs that do not receive sheathing (see item 11 below).

11. Install strapping to all sides of studs that do not receive sheathing as indicated on the structural drawings.

3.02 TOUCH-UP PAINTING

A. Touch-up shop-applied protective coatings damaged during handling and installation.

B. Use compatible primer for prime coated surfaces; use galvanizing repair paint for galvanized surfaces.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Requirements of Division 1 apply to all Work of this Section.

1.02 SCOPE

A. Shop fabricated metal items and miscellaneous metal work.

B. Refer to Schedule at end of this Section.

1.03 RELATED WORK (See also Table of Contents)

A. Structural Steel: Section 05 12 00.

1.04 QUALITY ASSURANCE

A. Standards and References: (Latest Edition unless otherwise noted)

1. California Building Code (CBC)

2. American Society for Testing and Materials (ASTM) Specifications as listed in the Section.

B. Submittals: (Submit under provisions of Section 01 33 00)

1. Shop Drawings: Submit shop drawings indicating profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevation, and details where applicable. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.

2. Manufacturer's descriptive data: Submit for manufacturer's items.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver all parts ready for erection; store in close proximity to final locations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Sections: ASTM A36.

B. Steel Tubing: ASTM A500, Grade B.

C. Steel Pipe: ASTM A53, Type E or S, Grade. B.

D. Steel Bolts, Nuts, and Washers: ASTM A307.

E. Welding Materials: AWS D1.1; type required for materials being welded.

F. Galvanizing: Hot-dip process ASTM A123 typical and ASTM A153 for threaded fasteners performed after fabrication into largest practical section. Weight of coating not less than 2 oz. per sq. ft. of surface. Where damaged, repair surface with one coat of hot process galvanizing repair compound, "Galvalloy", Galvweldalloy", or approved equal.

G. Primer: Tnemec Company "Series V10 Red Primer", Sherwin-Williams "Steel Spec Universal Primer"; or approved equal.

H. Dissimilar Materials: Separate dissimilar surfaces in contact with or in close proximity to non-compatible metals, concrete masonry, or plaster with neoprene gasket; or other approved means.

I. Expansion Bolts: Hilti "Kwik Bolt TZ" Expansion Anchor Bolts, galvanized unless otherwise indicated.

J. Non-shrink Grout: Master builders 928 or equal.

2.02 FABRICATION

A. Verify dimensions on site prior to shop fabrication.

B. Fabricate items with joints tightly fitted and secured.

C. Fit and shop assemble in largest practical sections, for delivery to jobsite.

D. Grind exposed welds flush and smooth adjacent finished surfaces. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.

F. Make exposed joints butt tight, flush and hairline.

G. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, except where specifically noted otherwise.

2.03 FINISH

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact bond with concrete or where field welding is required.

C. Prime paint interior items with one coat unless scheduled to be galvanized.

D. Galvanize exterior items and scheduled interior items to minimum 2.00 oz/sq ft zinc coating.

PART 3 - EXECUTION

3.01 PREPARATION

A. Obtain Architect's approval prior to site cutting or making adjustments not scheduled.

B. Clean and strip primed steel items to bare metal where site welding is scheduled.

C. Make provision for erection loads with temporary bracing. Keep work in alignment.

D. Supply items required to be cast into concrete with setting templates, for installation under appropriate Sections.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Perform field welding in accordance with AWS D1.1.

C. After installation, touch-up field welds, scratched or damaged surfaces with primer, except repair exposed galvanized work (not to be painted) with hot process field galvanizing, in accord with manufacturer's published directions.

3.03 SCHEDULE

A. Provide and install items listed in Schedule and shown on Drawings with anchorage and attachment necessary for installation. The following Schedule lists principal items only. Refer to drawing details for items not specifically scheduled.

1. Miscellaneous plates or angles not attached to structural steel; complete with anchorage for embedment.

2. Exterior mounted ladders.

3. Handrails and guardrails.

4. Bollards.

5. Gates for trash enclosure.

END OF SECTION

SECTION 05 52 00

PIPE BOLLARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

A. Provide all materials, labor and accessories as required and specified for complete pipe bollard installation.

1.03 RELATED REQUIREMENTS

A. Cast-In-Place Concrete: Section 03 30 00

B. Structural Steel: Section 05 12 00

C. Steel Canopy: Section 13 34 20

1.04 SUMMARY

A. This section includes the following:

1. Pipe Bollards

1.05 SUBMITTALS

A. Shop Drawings: Show installation details for each product

B. Product Data: Include physical characteristics such as shape, dimensions, and finish for each product.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of site furnishings similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing site furnishing products similar to those required for this project and with a record of successful in-service performance.

C. Steel Pipe:

1. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

D. Hot-Dipped Galvanized Finish:

1. ASTM A123 Standard Specification for Zinc (Hot-Dipped Galvanized) Coating on Iron and Steel Products

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in original undamaged packages and containers until ready for installation.

PART 2 - PRODUCTS

2.01 PIPE BOLLARDS

A. Pipe Bollards:

1. Bollards shall be constructed of ASTM A53, Pipe 6 Std.

B. Bollard Covers at each bollard:

1. Bollard covers shall be constructed from 1/8" thick Polyethylene (HDPE and MDPE) material and colored as shown on drawings.

2. Size shall fit steel pipe bollards.

3. Provide reflective band.

C. Where required, provide removable pipe bollards where equipment or structure will require servicing.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install bollards in accordance with manufacturer’s recommendations and per the construction documents.

B. Bollards shall be installed with a dimension of 36” above grade and filled with concrete.

C. Install Bollards in accordance with California Fire Code, Section 312.

END OF SECTION

SECTION 06 40 23

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Plastic-laminate cabinets.

2. Solid-surfacing-material countertops.

B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated including cabinet hardware and accessories, finishing materials.

B. Product Data: For high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, cabinet hardware and accessories, and finishing materials.
1. Provide available Environmental Product Declarations for LEED documentation.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2. Product Certificates: For materials manufactured within 100 miles (160 km) of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.

3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.

4. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

5. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

D. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets and other items installed in architectural woodwork.

3. Apply WI-certified compliance label to first page of Shop Drawings.

E. Samples for Initial Selection:

1. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish with sample applied to core material and specified edge.

2. Thermoset decorative-panels, 8 by 10 inches for each type, color, pattern, and surface finish

3. Solid-surfacing materials, 6 inches square.

4. Corner pieces as follows:

a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.

b. Miter joints for standing trim.

F. Qualification Data: For fabricator and installer

G. Product Certificates: For each type of product, signed by product manufacturer.

H. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

I. AWS Certifications.

J. Provide Environmental Product Declarations, meeting LEED requirements, for Countertop, Laminate and Fiber / Particle Board.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certifications indicating that woodwork including installation complies with requirements of grades specified.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.06 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide materials that comply with requirements of AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Certified Wood: Interior architectural woodwork shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

C. Wood Products: Shall meet the requirements for formaldehyde as specified in the California Green Building Code Table 5.504.4.5 Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

1. Recycled Content of Medium-Density Fiberboard and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

2. Low-Emitting Materials: Composite wood products shall comply with the testing and product requirements of the California Department of Public Health' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. Medium-Density Fiberboard: ANSI A208.2, Grade MD made with binder containing no urea formaldehyde.

4. Particleboard: ANSI A208.1, Grade M-2 Exterior Glue.

5. Softwood Plywood: DOC PS.

D. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges. Note, refer to specific Room Descriptions for woodwork to receive hardwood edge banding.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

   a. Panolam Industries International, Inc; Pionite.

   b. Formica Corporation.

   c. Wilsonart International; Div. of Premark International, Inc.

F. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. DuPont USA; Zodiaq.

   b. LG Chemical, Ltd.

   c. Wilsonart International; Div. of Premark International, Inc.

   d. Or approved equal.

2. Type: Standard type.

3. Colors and Patterns: Multi color and pattern.

2.02 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Hinges Heavy Duty Self Closing: ANSI/BHMA 156.9, Grade 1.

C. Wire Pulls: Back-Mounted, stainless steel BHMA 630, 4 inches long, 5/16 inch in diameter. BHMA A156.9, B02011.

D. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

E. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty Grade 1HD: Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.

3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.

F. Door Locks: BHMA A156.11, E07121.

G. Drawer Locks: BHMA A156.11, E07041.

2.03 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

2.04 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Type A, Frameless.

C. AWI Door and Drawer Front Style: Flush Overlay.

D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.

2. Postformed Surfaces: Grade HGP.

3. Vertical Surfaces: Grade HGS.

4. Edges: Grade VGS.

E. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies High-pressure decorative laminate, Grade VGS.

a. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

2. Drawer Sides and Backs: Thermoset decorative panels.

3. Drawer Bottoms: Thermoset decorative panels.

F. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected from manufacturer's full range in the following categories:

a. Solid colors and wood grains, matte finish.

2.05 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Custom; Solid surface is defined as nonporous, material maintaining the same composition throughout the part with a composition of acrylic polymer, Quartz (silica) filler recycled glass and pigment.

B. Solid-Surfacing-Material Thickness: 3/4 inch.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material.

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges equal to a 3/4 inch profile.

2. Fabricate tops with coved backsplashes and sidesplashes. Provide coved backsplashes and sidesplashes at all walls and adjacent millwork.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2. Fasten wall cabinets through back, near top and bottom.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.

4. Caulk space between backsplash and wall with sealant.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 06 64 00

PLASTIC PANELING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Product Data: For each type of product indicated.
1. Provide and Environmental Product Declaration and Health Product Declarations meeting LEED requirements.

C. Samples for Initial Selection: For plastic paneling and trim accessories.

D. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25

2. Smoke-Developed Index: 450.

3. Testing Agency: Approved by CAL FIRE for the ASTM testing above.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 PLASTIC SHEET PANELING (FRP)

A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Panolam Industries International, Inc

b. Kemlite Company Inc.

c. Marlite.

d. Nudo Products, Inc.

e. Or approved equal.

2. Low-Emitting Materials: Paneling shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. Nominal Thickness: Not less than 0.09 inch.

4. Surface Finish: As selected by State from manufacturer's full range.

5. Color: As selected by the State from manufacturer's full range.

2.02 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, and caps as needed to conceal edges.

1. Color: As selected by the State from manufacturer's full range.

B. Trim Accessories: Manufacturer's standard two-piece, snap-on vinyl extrusions designed to cover edges of panels. Provide division bars, inside corners, and caps as needed to conceal edges.

1. Color: As selected by the State from manufacturer's full range.

C. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

D. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

E. Adhesive: As recommended by plastic paneling manufacturer.

1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Sealant: Latex sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

1. Sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Sealant shall comply with the testing and product requirements of the California Department of Public Health "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.

2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.03 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.

1. Drill oversized fastener holes in panels and center fasteners in holes.

2. Apply sealant to fastener holes before installing fasteners.

D. Install factory-laminated panels using concealed mounting splines in panel joints.

E. Install trim accessories with adhesive. Do not fasten through panels.

F. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant. Color of sealant is to be consistent with adjacent panel color.

I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 07 13 26

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Modified bituminous sheet waterproofing.

2. Modified bituminous sheet waterproofing, fabric reinforced.

3. Protection/ Drain Board (Molded sheet drainage panel)

1.03 PREINSTALLATION MEETINGS

1.04 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.

2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

3. Provide and Environmental Product Declaration and Health Product Declarations meeting LEED requirements..

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Samples: For each exposed product and for each color and texture specified, including the following products:

1. 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.

2. 4-by-4-inch (100-by-100-mm) square of drainage panel.

D. Qualification Data: For Installer.

E. Field quality-control reports.

F. Sample Warranties: For special warranties.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are approved in writing by waterproofing manufacturer

B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.

a. Size: 100 sq. ft. (9.3 sq. m) in area.

b. Description: Each type of wall installation.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Acceptance of the Work.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Acceptance of the Work.

B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

1. Warranty includes removing and reinstalling protection board, drainage panels, concrete paving, landscaping, and irrigation.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials and molded-sheet drainage panels from single source from single manufacturer.

2.02 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include:

a. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.

b. Meadows, W.R.,Inc; SealTight Mel-Rol.

c. Polyguard Products, Inc; Polyguard 650.

d. Or approved equal.

2. Physical Properties:

a. Tensile Strength, Membrane: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.

b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.

c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.

d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.

e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.

f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.

g. Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.

h. Hydrostatic-Head Resistance: 200 feet (60 m) < minimum; ASTM D 5385.

3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.03 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.

2.04 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No.70 (0.21-mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).

1. Products: Subject to compliance with requirements, provide one of the following available products:

a. Carlisle Coatings & Waterproofing Inc; CCW MiraDRAIN 6000.

b. Meadows, W.R.,Inc; SealTight Mel-Drain 5035.

c. Polyguard Products, Inc; Polyflow 15.

d. Or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.

2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).

F. Bridge and cover Control Joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to manufacturer’s written instructions.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:

    a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

    b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to manufacturer's written instructions.

3.03 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and 6 inch (153 - mm end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

    1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

D. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

E. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (153 mm) beyond repaired areas in all directions.

F. Immediately install protection course with butted joints over waterproofing membrane.

    1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.04 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to

maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.05 FIELD QUALITY CONTROL

A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.

B. Prepare test and inspection reports.

3.06 PROTECTION, REPAIR, AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 19 00

WATER REPELLENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:

1. Cast in place concrete.

2. Cast stone.

3. Concrete unit masonry.

4. Thin Adhered Calcium Silicate

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Water repellents shall meet performance requirements indicated without failure due to defective manufacture, fabrication, or installation.

1. Water Repellents: Comply with performance requirements specified, as determined by testing on manufacturer's standard substrate assemblies representing those indicated for this Project.

B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.

1. Cast-in Place Concrete: ASTM C 642.

2. Cast Stone: ASTM C 1195.

3. Concrete Masonry Units: ASTM C 140.

4. Thin Adhered Calcium Silicate: ASTM C73, Grade SW.

C. Water-Vapor Transmission: Comply with one or both of the following:

1. Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, according to ASTM E 96/E 96M.

2. Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, according to ASTM D 1653.

D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, according to ASTM E 514.

E. Durability: Maximum 5 percent loss of water-repellent properties after 2500 hours of weathering according to ASTM G 154 in comparison to water-repellent-treated specimens before weathering.

F. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.

1. Reduction of Water Absorption: 80 percent.

2. Reduction in Chloride Content: 80 percent.

1.04 SUBMITTALS

A. Submit under the provisions for Section 01 33 00.

B. Product Data: For each type of product indicated.

1. Include manufacturer's printed statement of VOC content.

2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

3. Provide available Environmental Product Declarations for LEED documentation.

C. Compatibility Statement: Manufacturers statement on Company letterhead indicating the product’s compatibility with the integral water repellant of the substrate.

D. Warranty: Special warranty specified in this Section. (For language)

E. Maintenance Data.

F. Special Warranty.

G. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

H. Qualification Data: For qualified Applicator.

I. Product Certificates: For each type of water repellent, from manufacturer.

J. Closeout submittals:

1. Preconstruction Testing Reports: For water-repellent-treated substrates.

2. Field quality-control reports.

3. Warranty: Executed Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. Conduct field quality control testing as indicated in Part 3 below.

1.06 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.

2. Building has been closed in for not less than 30 days before treating wall assemblies.

3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.

4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.

5. Rain or snow is not predicted within 24 hours.

6. Not less than seven days have passed since surfaces were last wet.

7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Five years from date of Acceptance of the Work.

PART 2 - PRODUCTS

2.01 PENETRATING WATER REPELLENTS

A. Silane, Penetrating Water Repellent: Clear, containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Construction Chemicals, LLC; MasterProtect H 200.

b. Degussa Corp; Protectosil Aqua-Trete 20

c. Or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.

2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.

3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.

4. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:

1. Cast-in-Place Concrete, Cast Stone and Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857.

B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

C. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

D. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.03 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using 15 psi- pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

1. Cast Stone: At Contractor's option, first application of water repellent on units may be completed before installing them. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

D. Field Quality Control Test – Contractor shall perform a RILEM tube test at 6 locations selected by the State’s Inspector of Record (IOR). Locations shall be on smooth concrete of Masonry surface.

1. Allow water repellent to cure 10 days minimum

2. RILEM tube shall be filled to the 0.0 liter level (simulating a 98.1 mph wind driven rain). A drop of water volume of 20% or more in a 20 minute test period shall

constitute a failure and require additional coats using the above procedure until the RILEM test passes.

3. Tests are to be observed by the IOR.

4. Repeat testing steps 1 thru 3 above after application of an additional coat, in the event of a failed test.

3.04 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Sound attenuation insulation.

1.03 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide slag-wool-fiber/rock-wool-fiber insulation in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per “Erosion Test” and “Mold Growth and Humidity Test” described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500 fpm air velocity.

2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100% relative humidity in the dark.

B. All Thermal Insulation material and installation shall meet the requirements of California Title 24 Section 110.8 MANDATORY REQUIREMENTS FOR INSULATION, ROOFING PRODUCTS AND RADIANT BARRIERS

1.04 QUALITY ASSURANCE

A. Retain ASTM test method below based on product and kind of fire resistance characteristic specified for each product in Part 2. Fire Test Response Characteristics: Provide insulation and related materials with the fire test response characteristics indicated, as determined by testing identical products per ASTM E84, for surface burning characteristics, by UL or another testing and inspecting agency acceptable to authorities

having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

B. Recycled Content: Provide glass or slag-wool-fiber/rock-wool-fiber insulation with recycled content so post-consumer recycled content plus one half of pre-consumer recycled content constitutes a minimum of 40% by weight.

1.05 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Product Data: For each type of product indicated.

C. Maintenance Data.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

E. Provide available Environmental Product Declarations for LEED documentation.

F. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

PART 2 - PRODUCTS

2.01 GLASS-FIBER BLANKET INSULATION

A. Un-faced, Glass-Fiber Blanket Insulation in interior walls: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame spread and smoke developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

B. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-1/2 inches thick with a thermal resistance of 13 degrees F x h x sq. ft./Btu at 75 degrees F.

2. 3-5/8 inches thick with a thermal resistance of 11 degrees F x h x sq. ft./Btu at 75 degrees F.

3. 5-1/2 inches thick with a thermal resistance of 19 degrees F x h x sq. ft./Btu at 75 degrees F.

4. 9-1/2 inches or 10 inches or 10-1/4 inches thick with a thermal resistance of 30 degrees F x h x sq. ft./Btu at 75 degrees F.

C. SLAB EDGE RIGID INSULATION shall be closed cell extruded polystyrene, R-6 minimum.

PART 3 - EXECUTION

3.01 PREPARATION

A. Retain option in paragraph below if vapor retarders are included in Project either separately or as insulation facing.

B. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelope entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

3.04 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are set into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

3.05 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.06 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 42 13

METAL WALL PANELS AND SOFFIT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Where references are made herein to specific items and / or system requirements, the Contractor is directed to the Contract, including the Facility Design Program, for scope and characteristics required.

1.02 SUMMARY

A. Section includes

1. Profiled metal panels, exposed fasteners.
2. Insulating Metal Wall Panels.
3. Miscellaneous materials.
4. Panel fabrication.
5. Panel supports and anchorage.
6. Soffit panels.

B. Related Requirements

1. Section 03 30 00 Cast-In-Place Concrete
2. Not used
3. Section 05 30 00 Metal Decking
4. Section 05 40 00 Cold-Formed Metal Framing
5. Section 07 54 19 Polyvinyl-Chloride (PVC) Roofing
6. Section 07 62 00 Sheet Metal Flashing and Trim
7. Section 07 92 00 Joint Protection

1.03 REFERENCES

A. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A792/ASTM A792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

C. ASTM A924/A924M – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

1.04 SUBMITTALS

A. Additional Requirements

1. Product data including manufacturer's product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total panel system.
2. Samples for verification purposes of wall panels. Provide sample panels 12 inches long by actual panel width, in the profile, style, color, and texture indicated. Include clips, battens, fasteners, closures, trim, and other panel accessories.

    a. Include cap trim installed on panel.

3. Shop Drawings

    a. Include elevations showing layouts of panels on walls, sections of each condition, metal thickness, finish, methods of installation, anchorage, joints necessary to accommodate thermal movements, and special details. Distinguish between factory and field assembly work.
    b. Tolerances: Indicate panel length, width bow, camber and squareness tolerances.

4. Warranties: Sample of special warranties.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Installer's responsibilities include fabricating and installing prefinished metal panel assemblies and providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of data for prefinished metal panels, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of metal wall panels through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package wall panels for protection against transportation damage.

B. Handling: Exercise care in unloading, storing, and erecting wall covering panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal wall panels so that they will not accumulate

water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Project completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Project completion.

PART 2 - PRODUCTS

2.01 SHEET MATERIALS

A. Substrate: Aluminum-zinc alloy-coated steel sheet ASTM A 792, AZ50 coating designation, structural quality, Grade 50.

2.02 CORRUGATED METAL PANELS

A. Manufacturer/Product: Subject to compliance with requirements, provide the following:

1. Metal Sales Manufacturing Corporation; 1 ½-inch Corrugated; Exposed Fastener T10-B Profile Metal Panels: 24 gauge.

a. Profile: Alternating 90 degree box ribs at 6-inch centers, 30 inch coverage, factory finish with PVDF Kynar 500.

2. Or equal by Centria, Floline, or Flexospan, Inc.

B. Alternate Manufacturers: Proposed equals are subject to substitution process per Section 01 33 00 SUBMITTAL PROCEDURES. Refer to additional requirements for individual items.

C. Soffit Panel Materials: 18 Ga., Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Class AZ50 Coating designation, Grade 40. "Galvalume" or "Zincalume" protective Coating.

1. Panel Description:

a. Panel Width: 12 Inches
b. Soffit Profile: Concealed F-12-S (Morin basis of design).
c. Panel Thickness: 1 ½" thick.
d. Panel Joint: Tongue and Groove interlock joint.
e. Texture: Smooth: NO STIFFENER RIBS
f. Soffit Panels shall be perforated w/ 1/8" round holes x 3/8" spacing for a 10% open area.

2.03 INSULATING METAL PANELS

A. Manufacturer/Product: Subject to compliance with requirements, provide the following:

1. Continuous closed-cell factory-injected foam insulation composited between dual steel facings equal to Metal Sales FL40 Flat Wall System

a. Or equal by MBCI.
b. Or equal by Kingspan Insulating Panels Inc.

2. Metal Skin: 22 gauge smooth finish.
3. Insulation: 2 ½-inch closed cell polyisocyanurate foam.

a. R-Value 8 per inch

4. Panel Size: 40 inch wide.

2.04 METAL FINISHES

A. General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching color for touch-up.

1. Color: As selected from manufacturer's Premium Finishes.

B. Fluoropolymer Coating: Manufacturer's standard.

1. Coating Thickness: 0.25 mil primer with 0.8 mil topcoat.

2.05 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other fasteners per approved shop drawings.

1. Use corrosion-resistant steel, or stainless steel fasteners for exterior application.

B. Accessories: Except as indicated as Work of another Section, provide components required for a complete wall panel system, including trim, copings, fascias, gravel stops, mullions, sills, corner units, end-to-end panel joints, clips, seam covers, fixture mounting plates, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

1. Closure Strips: Closed-cell, self-extinguishing, expanded cellular rubber or cross-linked polyolefin foam flexible closure strips. Cut or premold to match configuration of wall panels. Provide closure strips where indicated or necessary to ensure weathertight construction.
2. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
3. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as recommended by the building manufacturer.

2.06 PANEL FABRICATION

A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements.

B. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials that are noncompatible or could result in corrosion or deterioration of either material or finishes.

C. Fabricate panel joints with captive gaskets or separator strips, which provide a tight seal and prevent metal-to-metal contact in a manner that will minimize noise from movements within panel system.

D. Outside Corners, Roof Screen: Fabricate as detailed, for free draining assembly and application of trim shapes.

2.07 PANEL ANCHORAGE

A. Provide anchorage based on the approved shop drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify adjacent construction is ready to receive the Work of this Section.

B. Verify that framing members are ready to receive panel system.

C. Do not commence Work until unsatisfactory conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.02 PANEL SUPPORTS AND ANCHORAGE

A. Secondary structural panel support members and anchorage shall be installed in accordance with AISC Manual of Steel Construction “Code of Standard Practice” and approved shop drawings.

3.03 PANEL INSTALLATION

A. General: Comply with manufacturers’ instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement, in accordance with approved shop drawings:

1. Field cutting of exterior panels by torch is not permitted.
2. Install panels with concealed fasteners.
3. Install panels in horizontal orientation as shown on Drawings. Use longest possible panel lengths; install end lap joints where indicated.

B. Accessories: Install components required for a complete wall panel system, including trim, copings, fascias, corner units, clips, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated. Provide types of gaskets, sealants, and fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer.

D. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20 feet on level/plumb and location/line as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.04 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and provide for thermal expansion in accordance with approved shop drawings. Coordinate installation with flashings and other components.

B. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

C. Flashing and Trim: Comply with performance requirements, manufacturer’s written installation instructions, and SMACNA’s “Architectural Sheet Metal Manual.” Provide concealed fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams.

D. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

E. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Water-Spray Test: After completing the installation and before installation of interior insulation and gypsum board, test assembly for water penetration according to AAMA 501.2 of each end to end splice joint, corners, and joints with door frames.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories. Report results in writing.

D. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional Work with specified requirements.

3.06 CLEANING AND PROTECTION

A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. Cleaning: Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

END OF SECTION

SECTION 07 42 49

SINTERED CERAMIC FAÇADE SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Design, labor, products, equipment and services necessary for large format interior/exterior Sintered Ceramic Facade System (SCFS) work, in accordance with the Contract Documents.

1.02 SYSTEM DESCRIPTION

A. Work of this section to be designed by a Professional Engineer registered in state/province of location of project.

B. Design, fabricate and erect work to satisfy the requirements of this section.

C. Design system based on rainscreen principle.

D. Structural & Thermal Movements: Accommodate movement of building structure and movement caused by thermal expansion and contraction of system component parts without causing bowing, buckling, cracking, oil canning, failure of joint seals, excessive stress on fasteners or any other detrimental effects.

E. Dead Loads: Support self-weight of system components.

F. Panel Removal: Design system to allow removal of any individual panel.

G. Design panel joint system in conformance with manufacturer’s requirements; any components behind the panel system should not be visible.

H. Panel joint system to be free of extruded trim returning on the face of the SCFS.

I. All outside panel corners to be reinforced, mitred and chamfered where detailed.

1.03 QUALITY ASSURANCE

A. Installer Qualification: Trained and approved by the manufacturer, and having the necessary experience, staff, and training to install manufacturer's products. Manufacturer's willingness to sell its products to installers does not in itself confer qualification on installer. Provide letter of certification from manufacturer stating that installer is a certified applicator of its products, and is familiar with proper procedures and installation requirements recommended by the manufacturer. Installer shall have proven experience with exterior facade systems for a minimum of ten (10) years and to have completed at least ten (10) wall facade projects.

B. Pre-Installation Meeting: Three weeks prior to commencing work of this section, arrange for the manufacturer's qualified installer to visit the site and review preparatory and installation procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this section. Consultant is responsible for scheduling the date and time of the meeting.

C. Manufacturer’s Site Inspection: The manufacturer’s qualified installer will inspect the site weekly, providing inspection reports and photographs, to verify that the work of this section is correctly installed.

D. Provide available Environmental Product Declarations for LEED documentation.

E. Source Limitations: Obtain each type of product from a single manufacturer.

F. Panel Lines and Angles: sharp and true.

1.04 PERFORMANCE REQUIREMENTS

A. LEED ISO 14021:1999

B. ASTM C1026-10 Measuring Resistance to Freeze-Thaw Cycling

C. ASTM E695-2003 (R2009) Standard Test Method of Measuring Relative Resistance of Wall Construction to Impact Loading

D. BS EN 14019-2004 Curtain Walling—Impact resistance—Performance requirements standards specification

E. CAN/ULC S102.2-10 Standard Method of Test for Surface Burning Characteristics

F. CAN/ULC S114-05 Standard Method of Test for Determination of Non-combustibility in Building Materials

G. NFPA 285 Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing

H. Wall Assemblies

I. CAN/ULC S134-92 Standard Method of Fire Test of Exterior Wall Assemblies

J. ASTM C794 Adhesion-in-Peel of Elastomeric Structural Silicone

K. AAMA 508-07 Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems: Pressure Equalized Behaviour and Water Penetration Resistance

L. ASTM E1233 Structural Performance by Cyclic Static Air Pressure Differential

M. ASTM E283-04(2012) (TAS 202-94) Rate of Air Leakage Under Specified Pressure Difference Across the Specimen

N. ASTM E331-00(2009) (TAS 202-94) Water Penetration by Uniform Static Air Pressure Difference

O. ASTM E330/E330M-14 (TAS 202-94) Structural Performance by Uniform Static Air Pressure Difference

P. ASTM E1886-13a (TAS 203-94) Performance by Missile(s) and Exposed to Cyclic Pressure Differentials

Q. ASTM E84-16a Standard Test Method for Surface Burning Characteristics of Materials.

R. Florida Product Approval FL26341

S. Miami-Dade County, Florida NOA No. 16-1004.05, exp September 6, 2023

T. OTCR - Office of Technical Certification & Research (NYC Dept of Buildings) - Approved

1.05 SUBMITTALS

A. Submit samples in accordance with section 01 33 00

1. 6” (150mm) long of support framing, trims and corners.

2. 6” (150mm) x 6” (150mm) samples of each color selected by Consultant

B. 6” (150mm) x 6” (150mm) mounted samples of four equal sized panels showing four-way joint.

C. Identify samples with project number, date and name of contractor.

D. Shop Drawings and Structural Calculations: Bearing seal and signature of the Professional Engineer who is registered in the state/province of location of project, and who is responsible for the engineering design of work of this section. Clearly indicate finish, type and thicknesses of system components, size, spacing and location of support framing, sub-girts, connections, types and locations of fastenings. Indicate provisions for structural and thermal movement between panel system and adjacent materials.

1.06 MAINTENANCE DATA

A. Provide maintenance data for panel finishes and cleaning procedures for incorporation into operation manual.

1.07 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Store sintered ceramic panels and installation system materials in a dry location; handle in a manner to prevent chipping or breakage. The sintered ceramic panels should be stored in an upright position. Panels stored in their vertical position should be on their long side. This side must be protected by means of wooden crating, cardboard or polystyrene.

1.08 MOCK-UP

A. Submit mock-up in accordance with section 01 33 00.

B. Erect mock-up of the SCFS approximately 20 feet long x 10 feet high in location directed by the Architect.

C. Mock-up of the SCFS shall include all components of the wall system and if approved by Consultant may be incorporated into finished work.

D. Notify 72 hours before installation of mock-up for inspection by the State. Do not proceed with panel system work until mock-up has been approved.

1.09 COORDINATION

A. Coordinate with installers of wall mounted items, equipment, mechanical, and electrical work so that installation will not subvert the integrity of the cladding system.

B. Panel penetrations must be pre-approved by manufacturer before on-site work can commence.

C. Coordinate interface, transition, lapping, flashings and compatibility of membranes with other trades.

1.10 WARRANTY

A. For product finish, warranty from the manufacturer against staining, color fades or product deterioration shall be for a period of ten (10) years from date of substantial completion.

B. For work in this section, warranty by manufacturer and installer against defects or deficiencies in materials or workmanship shall be for a period of one (1) year from date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Specified Products: Work of this section is based on the Ceramitex® SCFS, to meet this system’s function, design, performance, and construction process, complying with requirements set forth in this section and subject to the consultant’s acceptance.

B. All requests for equivalency to be submitted for review no later than 10 days before tender closing. No alternates will be reviewed post tender.

C. For additional information on the Ceramitex® SCFS please contact Elemex Inc. at info@elemex.com, telephone 1(844)435-3639

2.02 MATERIALS

A. Sintered Ceramic Slab:

1. 1/4” (6 mm+) thick Fiber Mesh Reinforced Sintered Ceramic Slab

2. Reinforced fiberglass back layer, complete with resin and fiber mat, conforming to manufacturer’s recommendations.

3. Maximum Dimensional Sizes: 5 ft. x 10 ft.

B. Sintered Ceramic Slab Color #: Per schedule.

C. Attachment Technology:

1. A Concealed Mechanically Fastened Aluminum Framing System equal to that manufactured by Elemex™ Inc. that can support a variety of veneer finishes. ACM (PE and FR) and Plate adjacent to Ceramitex will seamlessly integrate and finish at the same plane. No known equal.

2. Aluminum Infill Treatment: Composite aluminum infill strip; 1 Color: To match Extrusions

3. Compression Gaskets: Continuous extruded EPDM of 80 Durometer A hardness. Insert Gasket to integrate with the Elemex™ Proprietary Unity™ Attachment Technology.

4. Aluminum Treatment:

a. *Standard black:* two-stage anodized (electrochemical process) method;

5. Sintered Ceramic Slab Adhesive: Structural Silicone: Project requires a batch specific modified ASTM C794 Adhesion-in-Peel of Elastomeric Joint Sealants Test Report with Dow Corning Adhesion Performance Warranty Report.

D. Related Products:

1. Supporting Framing: Load bearing, thermal break clip, manufactured from Z-275 galvanized steel with a bonded thermal retardant membrane. Adjustable angles, Z-bars and channel subgirts: manufactured from Z-275 galvanized steel and shall be designed to accommodate expansion and contraction, dynamic movements and design load requirements.

2. Air/Vapor Barrier: Two-coat liquid applied air and water barrier. Air permeance not to exceed .004 cfm/ft² under a pressure difference of .3 inch w.g. when tested in accordance with ASTM E 2357, ASTM E 1677, ASTM E 1680 or ASTM E 283.

3. Semi-rigid, Rigid, Sprayed Insulation. Medium Density closed cell sprayed bio based urethane insulation.

a. Use approved insulation material conforming to local building codes. Must meet ASTM E 84, Class 1.

b. Thickness: 2.5 inch

c. Acceptable Material:
   i. JM Corbond III
   ii. Demilec, Heatlok Soy 200 Plus
   iii. Accella Polyurethane Systems, ECOBAAY CC

4. Trims and Closures: Inside corners, outside corners, control joints, wall fixtures and termination trims. Painted steel.

2.03 FABRICATION

A. Co-ordinate and verify job site dimensions affecting work of this section. Ensure suitability of adjacent building components in relation to work of this section.

B. Sintered Ceramic Slabs to be fabricated with a multi-axis wet bridge saw to ensure cutting accuracy and smooth edge quality. Fabricate slabs square to difference of diagonal measurements of not more than 0.2%. Note: Scoring & cracking the slab using the dry rail tile scorer method, creating, rough edges, will not be accepted.

C. Fabricate exterior corner panels in a continuous mitred and chamfer method. Use the Attachment Technology to maintain the panel's design integrity and match the Structural Calculations.

D. Where noted on architectural drawings, fabricate window sill, jamb and header conditions in a continuous mitred with chamfer details.

E. Panels to be factory fabricated in a controlled environment.

F. Fabricate work to profiles and sizes as indicated on the architectural drawings and confirmed site dimensions, as defined in this section's scope of work; complete with trims, flashings and filler components as required to interface with work of other sections. Make provisions for thermal and structural movements.

G. The location and sizes of all penetrations to be provided by all trades to the manufacturer prior to shop drawings for architect's review. Exterior penetrations greater than 12" x 12" (300mm x 300mm) to be reinforced to details as indicated or to the manufacturer's standard.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine work of other sections upon which work of this section depends.

B. Report any unsatisfactory conditions to consultant in writing. Do not start work until unsatisfactory conditions are rectified.

3.02 INSTALLATION – GENERAL

A. Install supporting framing required to support work of this section.

B. Install work in accordance with manufacturer's written instructions, plumb with intersecting parts joined together to provide accurately fitted joints with adjoining surfaces in true planes. Attach components in manner not restricting movement.

C. Apply isolation coating/tape to concealed surfaces of dissimilar metals and metals in direct contact with concrete or masonry.

D. Installer Qualification: Trained and approved by the manufacturer as per Part 1.

E. Pre chamfer spray foam at flashings to avoid reversing drain slopes.

F. Foam insulation depth is minimum, but must not narrow the air space to less than 1” to back of panel frame.

3.03 INSTALLATION

A. Complete Installation: Provide mounting hardware compatible with the SCFS, manufacturer’s standard profiles, joint closures and perimeter trim as required for a complete installation.

B. Attach thermal clip to the given substrate with the appropriate fasteners as indicated in the submitted Structural Calculations.

C. Mechanically fasten sub-girts to thermal clip; following manufacturer’s installation guidelines.

D. Align panels end-to-end to provide accurate fit with adjacent panels. Ensure adjacent panels are parallel and straight at joints.

3.04 INSTALLATION TOLERANCES

A. Variation in Line Over Entire Area: For positions shown in plan and continuous lines, do not exceed 1:500 or 15 mm, whichever is less.

B. Variation in Plumb Over Entire Area: Vertical lines, external corners and other vertical conspicuous lines, do not exceed 1:500.

C. Variation in Level, Panel to Panel: Horizontal bands, horizontal grooves, and other horizontal conspicuous lines, do not exceed 1:500.

D. Variation in Panel Joint Width: Do not exceed 3 mm.

E. Variation in Plane Between Adjacent Panels (Lipping or Step-in-Face): Do not exceed 1 mm difference between planes of adjacent panels.

F. Jog in Alignment of Edge of Adjacent Panels: Do not exceed 1 mm.

3.05 CLEAN-UP

G. Clean exposed panel surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07 54 19

POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Installation of gypsum roof sheathing and roof insulation materials specified in Section 07 19 00 & 07 21 00.
2. Roofing membrane.
3. Base flashings.
4. Roof Walkways.

B. Related Requirements:

1. Section 03 30 00 Cast-In-Place Concrete
2. Section 03 47 13 Tilt-Up Concrete
3. Section 03 41 00 Precast Structural Concrete
4. Section 04 22 00 Concrete Unity Masonry
5. Section 05 30 00 Metal Decking
6. Section 05 40 00 Cold-Formed Metal Framing
7. Section 07 21 00 Thermal Insulation
8. Not used
9. Section 07 62 00 Sheet Metal Flashing and Trim
10. Section 07 90 00 Joint Sealants

1.02 REFERENCES

A. ASTM D570-Standard Test Method for Water Absorption of Plastics.

B. ASTM D751- Standard Test Methods for Coated Fabrics.

C. ASTM D1204- Standard Test Method for Linear Dimensional Changes of Non-rigid Thermoplastic Sheeting or film at Elevated Temperature.

D. ASTM D2136- Standard Test Method for Coated Fabrics Low Temperature Bend Test.

E. ASTM D2565- Standard Practice for Xenon–ArcExposure of Plastics Intended for Outdoor Applications.

F. ASTM D4434- Standard Specification for Poly (Vinyl Chloride) Sheet Roofing.

G. ASTM E108- Standard Test Methods for Fire Tests of Roof Coverings.

H. ASTM E119- Test Method for Fire Tests of Building Construction and Materials.

I. American Society of Civil Engineers (ASCE) - ASCE 7-05 - Minimum Design Loads for Buildings and Other Structures (1 Jan 2006).

J. CCR Title 24 - California Code of Regulations Title 24, 2019 California Building Code and 2019 California Fire Code.

K. FMG - Factory Mutual Global:

1. FMG 4470 (June 2012) - Approval Standard Class 1 Roof Covers.
2. Approval Guide
3. Single Ply Roofing Institute (SPRI):
4. ANSI/SPRI IA-1-2010 - Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates.
5. 2ANSI/SPRI FX-1-2011 - Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.

6. ANSI/SPRI ES-1-2011 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

L. NRCA - National Roofing Contractors Association: Roofing and Waterproofing Manual.

M. UL - Underwriters Laboratories: Fire Hazard Classifications; Fire Resistance Directory.

N. Cool Roof Rating Council (CRRC).

1.03 SYSTEM DESCRIPTION

A. Mechanically attached PVC single ply membrane roofing system installed over gypsum cover board, roof insulation, vapor retarder and other materials specified in Section 07 19 00 & 07 21 00; related flashings; and accessories.

B. Design Requirements:

1. External Fire Resistance: UL Class A.
2. Internal Fire Resistance: Factory Mutual Class I.
3. Comply with NRCA Roofing and Waterproofing Manual Construction Details for PVC Single Ply Membrane.
4. FM I-105 minimum Uplift Rating. Calculate based on local wind condition using FM Roof Nav Calculator.

C. Performance Requirements:

1. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

D. FMG Listing:

1. Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable.

1.04 SUBMITTALS

A. Submit under provisions of Volume 1.

B. Shop Drawings:

1. Indicate:

a. Outline of roof and roof size.
b. Deck type.
c. Layout of sheathing boards.
d. Vapor retarder location within assembly.
e. Layout of insulation boards showing staggered joints and fastening pattern.
f. Layout of tapered insulation crickets.
g. Type and layout of membrane sheets and membrane attachment methods.
h. Locations and types of penetrations.
i. Perimeter and penetration details.
j. Fastener specifications and special details.
k. Roof walkway cover pattern.

A. Product Data:

1. Provide characteristics on membrane materials, flashing materials, and other components of the membrane system.

D. Samples:

1. Submit two samples of each membrane type proposed for use.
2. Submit two samples of each flashing material.

E. Manufacturer's Installation Instructions: Indicate special precautions required for seaming the membrane, and other instructions specified in this Section.

F. Manufacturer's Certificate:

1. Certify that products and system meet or exceed specified requirements.
2. Certify that products and system meet identified code requirements.
3. Certify that membrane and other components used in conjunction with the work of this Section are compatible with substrates over which they are to be applied.
4. Certify that products and system are "Energy Star compliant, high-reflectance, high-emittance roof with an initial thermal emissivity of 0.9 and an initial solar reflectance of 0.83. 3 Year Solar Reflectance Index (SRI) shall be equal or greater than 0.74.

G. Manufacturer's Field Reports:

1. Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, results of fastener pull-out tests, and other items with possible effect on installation or performance.
2. Submit after each inspection of roofing system to verify satisfactory conditions for start of installation, satisfactory installation methods, and satisfactory completed installation.

H. Quality Control Submittals:

1. Credentials: Prior to starting roofing, submit credentials from roofing manufacturer for approval of applicator including length of time roofs have been installed with this product; list not less than 5 equivalent projects; year of installation with name, title and telephone number of person in charge; and letter from manufacturer signed by officer of the company indicating willingness to provide 10 year warranty jointly and severally with installer and Contractor.
1. Warranty: Provide sample of warranty to be furnished in accordance with the terms specified herein.

I. Approved applicators shall supply manufacturer and Owners Representative with Record (as-built) Shop Drawing for final inspection.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Roof manufacturer licensed applicator.
2. Continuously applied single membrane roofing materials in State of California for minimum of five years.

1.06 REGULATORY REQUIREMENTS

A. Solvents and their application shall conform to the air quality requirements set forth by South Coast Air Quality Management.

1.07 MOCKUP

A. Provide mockup of roof membrane system and associated components and accessories under provisions of Volume 1.

B. Mockup Size: 10 x 10 feet, including gypsum sheathing vapor retarder, insulation, and typical base and counter flashings; at location approved by Owners Representative.

C. Approved mockup may remain as part of the Work.

1.08 PREINSTALLATION CONFERENCE

A. Convene a conference one week prior to commencing the work of this Section, under provisions of Volume 1.

B. Require attendance of parties directly affecting the work of this Section. Include Owners Representative, roofing manufacturer's representative, superintendent, sheet metal installer and associated roofing trades.

C. Review job procedures, precautions and roofing methods to be used.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle, and protect products under provisions of Volume 1.

B. Conform to manufacturer's delivery, storage, and handling requirements.

C. Deliver materials in original manufacturer's unopened containers or wrappings, labeled with manufacturer's name, brand name, installation instructions, and identification of various items.

D. Store materials within temperature range recommended by manufacturer.

E. Protect stored materials from moisture.

F. Store and handle flammable materials away from sparks and open flame. Follow precautions outlined on container, supplied by manufacturer, required by regulatory authorities.

G. Replace materials determined by Owners Representative and manufacturer to be damaged.

1.10 ENVIRONMENTAL REQUIREMENTS

A. A. Do not apply roofing materials during ambient conditions not approved by manufacturer.

B. Do not apply materials to damp or frozen surfaces.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 WARRANTY

A. Provide twenty (20) year written warranty under provisions of Volume 1.

B. Warranty:

1. By material manufacturer, and signed by officer 2. Cover materials and labor required to repair leaks or water intrusion through the membrane roof, and flashing installed in conjunction with the roof system.
2. Cover the supply and replacement of insulation that may be damaged by intrusion of water through the roof membrane.

C. Exclusions: Guarantee need not include damage due to lightning, hailstorms, hurricanes, earthquakes, or similar unusual natural occurrences.

PART 2 - PRODUCTS

2.01 PVC ROOF MEMBRANE SYSTEM

A. Manufacturers (All products must meet criteria stated below in order to be allowed for this project.):

1. Carlisle Syntec Systems
2. IB Systems
3. Fibertite
4. Sarnafil

B. Membrane; ASTM D4434-04: Type III, Class A reinforced Polyvinyl Chloride sheet; 0.080 inch thick minimum. Manufacturer's standard roll widths; white color; conforming to the following criteria:

Properties	Test	Results
Breaking Strength, min.	ASTM D751-00	55 Pounds/inch
Elongation at Break, min.	ASTM D751-00	15 Percent
Seam Strength (Percent of breaking strength), min.	ASTM D751-00	75 Percent
Retention of Properties after heat aging of membrane (168 hours at 90 degrees C.)	ASTM D3045	
Breaking Strength, min.	ASTM D751-00	90Percent
Elongation, min.	ASTM D751-00	90Percent
Tear Resistance, min.	ASTM D751-00	50 Pounds
Low Temperature Bend	ASTM D2136-02(2007)	Pass at -40 Deg C.
Accelerated Weathering Test ()	ASTM G154	5,000 hours
Cracking (7X magnification)		None
Discoloration (by observation)		Negligible
Crazing (7X magnification)		None
Linear Dimensional Change, max.	ASTM D1204	0.5 Percent
Change in Weight After Immersion in Water, max.	ASTM D570-98(2005)	3.0 Percent

C. Seaming Materials: As recommended by membrane manufacturer.

D. Flashings:

1. Flexible Flashings: Type recommended by membrane manufacturer; white color when associated with white PVC roof membrane.
2. Counter flashings: Type recommended by membrane manufacturer; 0

E. Accessories:

1. Separation Sheet: Type recommended by membrane manufacturer, suitable for use in indicated fire-rated assemblies.
2. Roofing Nails: Galvanized hot dipped or non-ferrous type, size as required to suit application.
3. Sealants and Pitch Pocket Fillers: As recommended by membrane manufacturer.
4. Fasteners: FM approved, meeting FM Standard 4470 for corrosion resistance; type recommended by membrane manufacturer, best suited for intended application.
5. Fastener Disks: FM approved corrosion resistant; size, shape, and thickness in accordance with manufacturer's instructions.
6. Solvents: Type recommended by membrane manufacturer.
7. Protection Board: Rigid sheathing; type recommended by membrane manufacturer.

2.02 ROOF WALKWAY SURFACE

A. Walkway Mat; PVC: reinforced, embossed; 0.096 inch thick; light gray color.

PART 3 - EXECUTION

3.01 EXAMINATION BY ROOFING CONTRACTOR

A. Verify existing conditions are suitable to receive the work of this Section.

B. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.

C. Verify deck is supported and secure.

D. Verify deck is clean and smooth, free of depressions, waves, or projections, dry, and properly sloped. Confirm dry deck by moisture meter with maximum moisture in accordance with limits recommended by manufacturer.

E. Verify that work of other trades which penetrates roof deck has been completed; roof openings, curbs, pipes, sleeves, ducts, vents through roof are properly set; wood strips and reglets are in place.

F. Verify elevations of roof drains, drain pans, and scuppers are correct for proper drainage, and that drain lines are open.

G. Roofing applicator to notify Owners Representative in writing of unsuitable substrate conditions.

H. Do not commence installation until unsuitable conditions have been corrected. Beginning of work means acceptance of existing conditions.

3.02 PREPARATION

A. Prepare surfaces to receive membrane in accordance with membrane manufacturer's instructions.

B. Install slip sheet over substrate when required by membrane manufacturer.

C. Verify layout of work before beginning installation.

D. Fill gaps greater than 1/4 inch in substrate.

3.03 PROTECTION DURING INSTALLATION

A. Protect building surfaces against damage from roofing work.

B. Do not use materials not recommended by manufacturer.

C. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat) or direct steam venting to come in contact with roofing system.

D. Do not allow membrane to come into contact with materials or vapors not permitted by manufacturer.

E. Do not expose membrane or accessories to a constant temperature in excess of 180 degrees F.

3.04 INSTALLATION - GENERAL

A. Install roofing system in accordance with manufacturer's instructions.

B. Install materials only under temperature, moisture, and humidity conditions approved by manufacturer.

3.05 VAPOR RETARDER APPLICATION

A. Apply vapor retarder to deck s urface in accordance with manufacturer's instructions.

B. Extend vapor retarder under blocking to deck edge.

3.06 INSULATION APPLICATION

A. Ensure substrate and insulation is clean and dry.

B. Install field insulation in two layers.

C. Mechanical Attachment:

1. Mechanically fasten insulation to deck in accordance with insulation manufacturer's instructions.
2. Place the second layer of insulation with joints staggered minimum 6 inch from joints of first layer.

D. Place the constant thickness first layer and the tapered thickness insulation second layer to the required slope pattern in accordance with manufacturer's instructions.

E. Minimum Total Insulation Thickness: As required to achieve a minimum insulation R-value of 30.

F. Place boards perpendicular to deck flutes with edges over flute surface for bearing support.

G. Lay boards with edges in moderate contact without forcing, 1/4 inch maximum joint width. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

H. Tapered Insulation:

1. Install tapered insulation to form slopes or crickets as indicated or required.
2. Lay tapered boards for a distance of 24 inches back from roof drains for positive drainage.
3. Attach to base insulation as required to prevent shifting.
4. Minimum Slope: 1/4 inch per foot.
5. Provide smooth transitions. Abrupt or vertical drops not allowed at joints.

I. Apply no more insulation than can be covered with membrane in same day and before approaching precipitation.

J. Install temporary water cutoffs at completion of work each day and remove upon resumption of work.

3.07 COVERBOARD APPLICATION

A. Install gypsum roof board coverboard specified in Section 07 21 00.

B. Ensure substrate and roof board is clean and dry.

C. Cut roof board cleanly and accurately at roof breaks and protrusions to provide smooth surface.

D. Install roof board in accordance with manufacturer’s instructions and approved shop drawings. Apply no more cover board than can be covered with membrane in same day, and before approaching rainfall.

3.08 MEMBRANE INSTALLATION

A. Roll out membrane, free from wrinkles and tears; position without stretching. Allow membrane to relax approximately 1/2 hour prior to attachment if required by membrane manufacturer.

B. Shingle joints in direction of drainage whenever possible.

C. Install disks and fasteners to clamp the membrane tightly to the substrate as required by membrane manufacturer.

D. Mechanically fasten to perimeter surfaces using approved fasteners and recommended spacing.

E. Extend membrane up onto vertical surfaces. Flashing materials should extend up 8 inches minimum in accordance with approved manufacturer's details.

F. Terminations: Make terminations according to manufacturer's standard details, NRCA Standard Details, and as indicated.

G. Splices

1. Splice in accordance with manufacturer's instructions, keeping surface of membrane clean.

H. Daily Seal

1. Ensure that water does not flow beneath completed sections of membrane system.

I. Seal membrane around roof penetrations.

3.09 FLASHING INSTALLATION

A. Apply, using longest pieces practicable. Lap and splice using methods, materials and details recommended by manufacturer.

B. Flash around penetrations using factory prefabricated pipe seals where possible.

C. Use minimum 0.060 inch thick membrane at roof drains.

D. Seal flashings and flanges of items penetrating membrane. Field fabricated seals may be used where necessary using manufacturer's standard details.

3.10 ROOF WALKWAY INSTALLATION

A. Clean membrane and install walkway in accordance with manufacturer's recommendations.

B. Install immediately adjacent to and surrounding each piece of roof top equipment, and elsewhere as indicated.

3.11 MANUFACTURER'S FIELD SERVICES

A. Before start, during, and upon completion of installation, membrane manufacturer's technical representative shall conduct inspections to ensure that roofing system is

installed in accordance with roofing manufacturer's recommended specifications and details.

3.12 FIELD QUALITY CONTROL

A. Perform field testing under provisions of Volume 1.

3.13 CLEANING

A. In areas where finished surfaces are soiled by Work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

B. Repair or replace defaced or disfigured finishes caused by Work of this Section.

3.14 PROTECTION OF FINISHED INSTALLATION

A. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.

2. Formed roof-drainage sheet metal fabrications.

3. Formed wall sheet metal fabrications.

4. Formed equipment support flashing.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

2. Color samples: Provide sheet metal samples of available color options for selection by Architect and approval by State.

3. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

4. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

5. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

6. Provide

E. Qualification Data: Provide qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project name, location, and date of completion (within the last 10 years).

F. Product Test Reports: For each product, for tests performed by a qualified testing agency.

G. Provide available Environmental Product Declarations for LEED documentation.

H. Sample Warranty: For special warranty.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.06 WARRANTY

1. Finish Warranty Period: 20 year coverage from date of Acceptance of the Work for material finish, including checking, crazing, peeling, chalking, and fading, in excess of 5 NBS units.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Recycled Content of Steel-Sheet Flashing and Trim.

D. Recycled Content of Zinc-Sheet Flashing and Trim.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient.

2.02 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide zinc-coated galvanized steel sheet according to ASTM A 653/A 653M, G90 coating designation: structural quality.

1. Surface: Smooth, flat and mill phosphatized for field painting.

2. Where flashing exposed to exterior the finish shall be Polyvinylidene fluoride (PVDF) resin meeting the requirements of AAMA 605.2. Color shall be selected by the Architect and approved by the State.

2.03 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; non-perforated.

2.04 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing

and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 49 percent zinc, and 1 percent copper or other compatible Lead Free solder meeting the requirements of ASTM B 32..Use with compatible lead free flux.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.05 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

2.06 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

C. Sealant Joints: Where movable, non-expansion type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Seams: Fabricate non-moving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.07 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

2.08 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 24 gauge/.0276” thick.

2.09 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:

1. Galvanized Steel: 24 gauge/.0276” thick.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: 24 gauge/.0276” thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.03 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.

5. Torch cutting of sheet metal flashing and trim is not permitted.

6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel.

2. Do not use torches for soldering.

3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.04 ROOF-DRAINAGE SYSTEM INSTALLATION

A. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.

2. Provide 1 ½ inch telescoping joint with continuous sealant at transition from downspout to underground storm drain pipe taking water away from the building foundation.

3.05 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.06 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.07 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.08 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
   1. Roof hatches, with accessories:
      a. Telescoping safety posts for roof access ladders.
      b. Safety railings.
   2. Roof Ladders.

B. Related Sections include:
   1. Section 07 54 19 “PVC Roofing” for roofing to be installed with roofing accessories.
   2. Section 07 62 00 “Sheet Metal Flashing and Trim.”

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacturer, fabrication, installation, or other defects in construction.

B. ASTM International (American Society for Testing and Materials):
   1. ASTM A 36: Specification for Carbon Structural Steel.
   2. ASTM A 123: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. ASTM A 240: Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   5. ASTM A 500: Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

6. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc- Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

7. ASTM A 666: Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

8. ASTM A 780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

9. ASTM C 208: Specification for Cellulosic Fiber Insulating Board.

10. ASTM C 726: Specification for Mineral Fiber Roof Insulation Board.

11. ASTM C 920: Specification for Elastomeric Joint Sealants.

12. ASTM C 1311: Specification for Solvent Release Sealants.

13. ASTM D 4397: Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications.

14. ASTM E 90: Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

15. ASTM F 2329: Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

C. Cal/OSHA Standards - California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety.

D. Factory Mutual Global (FMG).

E. National Fire Protection Association (NFPA):

1. NFPA204: Smoke and Heat Venting.

F. Underwriters Laboratory (UL).

1.04 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
3. Provide available Environmental Product Declarations for LEED documentation.

B. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

C. Sample Warranties: For manufacturer's special warranties.

D. Closeout Submittals

1. Operations and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer’s authorized representative who is trained and approved for installation of roof hatches.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.08 COORDINATION

A. Coordinate layout and installation of roof accessories with roof membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weather tight, secure, and noncorrosive installation.

B. Roof hatch shall not interrupt roof drainage routes, roof expansion joints, or other roof-mounted items.

C. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.01 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 (Z275) coating designation and mill phosphatized for field painting.

    1. Factory Prime Coating: Apply pretreatment and manufacturer's factory-applied baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.

B. Stainless-Steel Sheet and Shapes: ASTM A 240 or ASTM A 666, Type 304.

C. Steel Shapes: ASTM A 36, hot-dip galvanized to comply with ASTM A 123, unless otherwise indicated.

D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123.

2.02 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

C. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

E. Underlayment:

    1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

    2. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.

    3. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq ft.

F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

    1. Fasteners for Zinc-Coated Steel: Series 300 stainless-steel or hot-dip zinc- coated steel according to ASTM A 153 or ASTM F 2329.

    2. Fasteners for Stainless-Steel Sheet: Series 300 stainless-steel.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.03 ROOF HATCHES

A. Roof Hatch: Metal roof-hatch unit with lid and insulated single-walled curb, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weather tight perimeter gasketing, and integrally formed deck- mounting flange at perimeter bottom.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Bilco Company; Type S.
b. Or approved equal.

B. Type and Size: Single-leaf lid, 30 inches (hinge side) by 36 inches.

C. Loads: Minimum 40 lbf/sq ft external live load and 20 lbf/sq ft internal uplift load.

D. Hatch Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick (14 gage).

1. Finish: Factory prime coating.

E. Construction:

1. Insulation:

a. Lid: Glass-fiber board, 1 inch thick.

b. Curb: Cellulosic-fiber board, 1 inch thick.

2. Hatch Lid: Opaque, insulated, and double-walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

3. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.

4. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces or perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

a. Where tapered leveling blocks area shown below roof hatch curb, fabricate hatch curb with constant height.

F. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

1. Provide lift-assistance mechanism consisting of compression spring operators enclosed in telescoping tubes with built-in dampers to achieve a controlled rate of opening of lid.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with Cal/OSHA standards and authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bilco Company; Bil-Guard Hatch Rail System.

b. Or approved equal.

2. Height: 42 inches above finished roof surface.

3. Posts and Rails: Pultruded fiberglass with integral color and UV inhibitor,

a. Color: High-visibility yellow.

4. Self-Closing Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard aluminum hinge and latching hardware.

5. Mounting Hardware: Galvanized steel.

6. Design Build Entity shall determine if this is required.

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof access ladder.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bilco Company; LU-2.

b. Or approved equal.

2. Operation: Post locks in place on full extension; release mechanism returns post to closed position.

3. Height: 42 inches above finished roof surface.

4. Material: Galvanized-steel tube.

I. Mounting Hardware: Adjustable brackets to fit ladder rung spacing up to 14 inches on center and clamp brackets to accommodate ladder rungs up to 1-3/4 inches in diameter.

2.04 ROOF ACCESS LADDERS

A. Folding Ladder: Basis of Design is ALACO Ladder Co., MP70 (465) extendible ladder, or approved equal.

B. Roof Hatch Access Ladder: Basis of Design is ALACO Ladder Co., Model 560 fixed ladder, or approved equal.

2.05 FABRICATION

A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
4. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
5. Where units are to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches O.C.

B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other sections as needed to complete the work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate steel girders from continuous steel shapes.
2. Fabricate steel pipe columns with steel baseplates and top plates welded to pipe with fillet welds the same size as pipe wall thickness.

C. Miscellaneous Steel Trim: Fabricate units from steel shapes, plates, and bars with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Exterior Miscellaneous Steel Trim: Galvanize.

2.06 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.

B. Steel and Iron Finishes:

1. Hot-dip galvanized items to comply with ASTM A123 or ASTM A153 as applicable. Hot-dip galvanize:

a. Items exposed to outside air.
b. Items installed in unconditioned interior spaces.
c. Items specifically noted to receive galvanized finish.

2. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed metal fabrications.

3. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, to comply with SSPC-PA 1, "Paint Application Specification No.1: Shop, Field, and Maintenance Painting", for shop painting.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that conditions are satisfactory for the installation of roof hatches.

B. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install hatches and ladders in accordance with the manufacturer's printed instructions and approved shop drawings.

B. When complete, hatch covers shall operate smoothly, quietly, and free from binding; exposed surfaces shall be clean and free from dents or other defects and damage; and each assembly shall be watertight.

END OF SECTION

SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.

2. Penetrations in horizontal assemblies.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Product Data: For each type of product indicated.
1. Provide available Environmental Product Declarations for LEED documentation.

C. Product Schedule: For each penetration firestopping system include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

D. Qualification Data: For qualified Installer.

E. Closeout Items:

1. Installer Certificates: Provide certificate from Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

F. Product Test Reports: Provide product test reports based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests have been performed by a qualified testing agency acceptable to authorities having jurisdiction.

2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.

b. Classification markings on penetration firestopping correspond to designations listed by the following:

1) UL in its "Fire Resistance Directory."

2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

3) FM Global in its "Building Materials Approval Guide."

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.05 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hilti, Inc.

2. 3M Fire Protection Products.

3. Tremco, Inc.; Tremco Fire Protection Systems Group.

4. Or Approved Equal

2.02 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Fire-resistance-rated walls include fire walls and fire partitions.

2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Horizontal assemblies include ceiling membranes of roof/ceiling assemblies.

2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.

3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (USEPA Method 24):

1. Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.

3. Sealant Primers for Porous Substrates: 775 g/L.

G. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Public Health’s document' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:

a. Slag-wool-fiber or rock-wool-fiber insulation.

b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.

c. Fire-rated form board.

d. Fillers for sealants.

2. Temporary forming materials.

3. Substrate primers.

4. Collars.

5. Steel sleeves.

2.03 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.04 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.03 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."

2. Contractor's name, address, and phone number.

3. Designation of applicable testing and inspecting agency.

4. Date of installation.

5. Manufacturer's name.

6. Installer's name.

3.05 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Acceptance of the Work. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Polysulfide joint sealants.
4. Latex joint sealants.
5. Solvent-release-curing joint sealants.
6. Preformed joint sealants.
7. Acoustical joint sealants.
8. Security sealants.

1.02 SUBMITTALS

A. Submit under the provisions of Section 01 33 00 Submittal Procedures.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Data: For each joint-sealant product indicated.
   a. Product Data: For sealants, indicating VOC content.
   b. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
   c. Provide available Environmental Product Declarations for LEED documentation.

E. Warranties: Sample of special warranties.

F. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.

3. Joint-sealant formulation.

4. Joint-sealant color.

G. Qualification Data: For qualified Installer.

H. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

I. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

K. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

L. Closeout Items
1. Warranties: Executed special warranties.
2. Maintenance Data.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

1.04 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 degrees F.

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.05 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Acceptance of the Work.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 10 years from date of Acceptance of the Work.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.

2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.

3. Sealant Primers for Porous Substrates: 775 g/L.

C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

E. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

F. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 SILICONE JOINT SEALANTS

A. Single-Component, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

B. Single-Component, Non-sag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.

C. Mildew-Resistant, Single-Component, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

2.03 URETHANE JOINT SEALANTS

A. Single-Component, Non-sag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.

B. Immersible, Single-Component, Non-sag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.

2.04 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.05 SECURITY SEALANT

A. Flexible 2-Part Epoxy Sealant: ASTM D2240 Shore A hardness, 75 minimum; Tensile Strength, minimum 650 psi at 14 days; Elasticity strength, 1,800 psi minimum.

2.06 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

   a. Concrete.

   b. Masonry.

   c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

   a. Metal.

   b. Glass.

   c. Porcelain enamel.

   d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.

5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.

2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.

3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.

4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Acceptance of the Work. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Standard hollow metal door and frames.

2. Standard hollow metal window frames.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Steel Door Institute (SDI) Industry Alerts shall be incorporated. All recommendations for the following alerts shall become part of this section requirements:

1. 127G – 06, Environmental Considerations Relating to Factory Painted Steel Doors and Frames.

2. 127E – 06, Prime Painted Materials.

3. 127D - 06, Electric Strikes in Stud Walls.

4. 127C - 06 Frame Cutout Limits.

5. 127B – 06, Door Edge Cutouts.

6. 127A – 06, End Closure Location.

C. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.

2. Division 08 Section “Door Hardware” for door hardware for hollow metal doors.

3. Division 09 Sections “Exterior Painting and Interior Painting” for field painting hollow metal doors and frames.

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to NAAMM-HMMA 803 or SDI A250.8.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating and finishes.
   1. Provide available Environmental Product Declarations and Health Product Declarations meeting LEED requirements.

C. Shop Drawings: Include the following:

   1. Elevations of each door design.

   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.

   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

   4. Locations of reinforcement and preparations for hardware.

   5. Details of each different wall opening condition.

   6. Details of anchorages, joints, field splices, and connections.

   7. Details of accessories.

   8. Details of moldings, removable stops, and glazing.

   9. Details of conduit and preparations for power, signal, and control systems.

   10. ANSI/SDI A250.8 indicates that manufacturer's published details can replace Shop Drawings for standard hollow metal work.

D. Samples for Verification:

   1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

   2. For the following items, prepared samples to demonstrate compliance with requirements for quality of materials and construction:

      a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.

      b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Show smoke seals for rated frames.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly required to be fire rated.

F. Maintenance Data.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to CBC, NFPA 252 or UL 10C.

2. Oversize (if any) Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

3. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80, that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

4. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80, that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257, or UL 9. Label each individual glazed lite.

5. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.08 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, include but not limited to:

1. Curries Company, an Assa Abloy Group company.

2. Republic Doors and Frames

3. Steelcraft; an Allegion brand.

4. Or approved equal.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.

C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

F. Glazing: Comply with requirements in Division 08 Section "Glazing."

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities. Applied at site on exterior frames.

2.03 STANDARD HOLLOW METAL DOORS

A. General: Provide doors fabricated with smooth surfaces, without visible joints or seams on exposed faces. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.

2. Core Construction: Polystyrene.

a. Fire Door Core: As required to provide fire-protection and temperature rise ratings required.

b. Maximum u-value for all exterior doors shall be 0.7

c. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value R-11 minimum when tested according to ASTM C 1363.

1) Locations: Where indicated on Working Drawings.

2) Install at all non-fire rated exterior doors unless otherwise indicated

3. Vertical Edges for Single-Acting Doors: Bevel edge.

a. Beveled Edge: 1/8 inch in 2 inches

4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick, end closures or channels of same material as face sheets.

5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless filled) edge.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheets. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8.

1. All profiles shall be double rabbit.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered corners.

2. Fabricate frames as face welded.

3. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames with mitered corners.

2. Fabricate frames as face welded unless otherwise indicated.

3. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.

4. Frames for Wood Doors: 0.053-inch- thick steel sheet.

5. Frames for Borrowed Lights integral with frame: 0.053-inch- thick steel sheet.

6. Frames for windows: 0.053-inch- thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates as referenced below.

1. Refer to ANSI/SDI A250.8-2003 (R2008) Table 4 – Minimum hardware reinforcing thickness.

2. Exterior Frames for exterior doors shall have high frequency hinge preparation; Where butts occur provide 12 gauge auxiliary reinforcement welded 3 places.

2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Stud-Wall Type: Multi Purpose designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.06 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, same material as door face sheet.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, same material as frames.

2.07 LOUVERS

A. Provide louvers for exterior doors, that comply with SDI 111C, with blades or baffles formed of 0.035-inch- thick, galvaneal steel sheet set into 0.104-inch- thick frame and perforated security plate. Provide with insect screen. Fasteners to be tamperproof type. Provide 24” x 24” louvers unless otherwise indicated. Locations show on working drawings.

1. “Z” blades for exterior door louvers are required.

2.08 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

2.09 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

2. Glazed Lites: Factory cut openings in doors.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Two anchors per jamb up to 60 inches high.

2) Three anchors per jamb from 60 to 90 inches high.

3) Four anchors per jamb from 90 to 120 inches high.

4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.

2) Four anchors per jamb from 60 to 90 inches high.

3) Five anchors per jamb from 90 to 96 inches high.

4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.

d. Post installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware according to ANSI/SDI A250.8.

2. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

3. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

4. Provide loose stops and moldings on inside of hollow metal work.

5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.10 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place per manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.

b. Install frames with removable glazing stops located on secure side of opening.

c. Remove temporary braces necessary for installation only after frames have been properly set and secured.

d. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

e. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.

c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Standard Steel Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors." & WI's "Manual of Millwork.", whichever is more restrictive.

1. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.

2. Provide WI-Certified Compliance Certificate for installation.

C. Forest Certification: Provide doors made with not less than 70 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

D. Fire-Rated Wood Doors: Doors complying with NFPA 80, that are listed and labeled by a qualified testing agency, for fire-protection ratings required, based on testing at as close to neutral pressure as possible according to NFPA 252.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Samples of finished door skins for selection.

C. Product Data.
1. Provide available Environmental Product Declarations and Health Product Declarations meeting LEED requirements.

D. Forest certification.

E. AWS Certifications.

F. Quality Assurance

G. Maintenance Data.

H. Shop Drawings: (if not delineated on Working Drawings) Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.

2. Indicate dimensions and locations of cutouts.

3. Indicate requirements for veneer matching.

4. Indicate doors to be factory finished and finish requirements.

5. Indicate fire-protection ratings for fire-rated doors.

PART 2 - PRODUCTS

2.01 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. Particle Core Doors for all wood doors except fire rated doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 300 lbf.

b. Screw Withdrawal, Edge: 700 lbf.

C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

2.02 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.

2. Match between Veneer Leaves: Book match.

3. Assembly of Veneer Leaves on Door Faces: Balance match.

4. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

5. Core: Structural composite lumber.

6. Construction: Five plies. Stiles and rails (solid wood) are bonded to core and then entire unit abrasive planed before veneering.

7. Species: FSC certified Cherry (Flat Cut).

2.03 LOUVERS AND LIGHT FRAMES

A. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.04 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

D. When steel frames are used with wood doors, the hardware preparation in the door is governed by the location on the frame. If the doors are factory mortised, the door supplier is responsible for coordinating hardware locations.

2.05 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory that are indicated to receive transparent finish.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: Architectural Woodwork Standards System-10, UV Curable, Water Based.
3. Staining: To be selected by Architect.
4. Sheen: Satin.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Wall access doors.
2. Ceiling access doors.
3. Related hardware.

B. Related Sections
1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section
2. Section 05 40 00 “Cold Formed Metal Framing” for wall framing.
3. Section 08 “Hardware” for locks and accessories.
4. Section 09 “Gypsum Board Assemblies” wall finishes.
5. Section 09 “Acoustical Ceilings” for ceiling finishes.
6. Section 09 “Painting and Coating” for applied finishes.

1.02 REFERENCES

A. UL - Underwriters’ Laboratories, Inc.: Fire Hazard Classifications.

B. ASTM A568/A568M – Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.

C. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

D. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E162 – Standard Test method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

1.03 SUBMITTALS

A. Product Data: Manufacturer’s standard descriptive literature.
1. Provide available Environmental Product Declarations and Health Product Declarations meeting LEED requirements.

B. Shop Drawings: Indicate locations, materials, dimensions, product configuration, finish, fire ratings, and attachment to adjacent construction.

C. Manufacturer’s installation instructions.

1.04 SYSTEM REQUIREMENTS

A. Access Doors: Provide wall and ceiling access doors as indicated on the drawings and as required for access to equipment. Where located in a rated fire-resistive wall or ceiling assembly, the access door shall bear a listing label having the same minimum level of hourly fire-resistance as the wall or ceiling assembly in which the access door is located. The access door fire resistance label shall be as issued by Underwriters' Laboratories Inc., or other testing laboratory recognized and accepted by the State of California, Office of the State Fire Marshal.

B. Coordinate locations of equipment with access doors of size and type appropriate for the use and location.

C. Minimum requirements for ceiling access doors:
1. Ceiling access doors shall be a minimum of 12 inches x 12 inches and a maximum of 24 inches x 30 inches unless directed otherwise by the Napa County Representative.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company with minimum 5 years of experience in the manufacture of products of the type specified; regularly and presently engaged in product manufacture.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer’s standard protective packaging.

B. Do not remove protective packaging until ready for installation.

C. Follow manufacturer’s instructions for storage and handling.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the Work of this Section with other Sections whose work affects or is affected by the Work of this Section.

B. Coordinate the building-in of anchors and similar items.

PART 2 PRODUCTS

2.01 ACCESS DOORS

A. Type AD1: Williams Brothers; Model WB-DW2236, premium access door.
1. Use: Ceiling access doors
2. Size: Nominal 22 inches X 36 inches
3. Material:
a. Door: 14 gauge cold rolled steel
b. Frame: 16 gauge with 1” wide 24 gauge perforated galvanized steel mounting flange
4. Finish: Gray baked enamel

5. Hardware
    a. Concealed continuous piano hinge allowing opening to 165 degrees.
    b. Keyed cylinder lock matching builder's hardware

B. Type AD2: Williams Brothers; Model WB-DW1616, premium access door.
1. Use: Ceiling access doors
2. Size: Nominal 16 inches X 16 inches
3. Material:
    a. Door: 14 gauge cold rolled steel
    b. Frame: 16 gauge with 1" wide 24 gauge perforated galvanized steel mounting flange
4. Finish: Gray baked enamel
5. Hardware
    a. Concealed continuous piano hinge allowing opening to 165 degrees.
    b. Keyed cylinder lock matching builder's hardware

C. Type AD3: Williams Brothers; Model WB-GP2236, premium access door.
1. Use: Ceiling access doors in wet locations.
2. Size: Nominal 24-inches X 36 inches.
3. Material:
    a. Door: 14-gauge cold rolled steel.
    b. Frame: 18-gauge with 1 ¾" depth.
4. Finish: Electrostatically applied baked grey enamel, over rust-inhibiting phosphate treated steel. Finish to match soffit panels.
5. Hardware:
    a. Concealed continuous piano hinge allowing opening to 165 degrees.
    b. Keyed cylinder lock matching builder's hardware
    c. Air tight neoprene gasketing.

2.02 FABRICATION

A. Manufacture each access panel assembly as an integral unit ready for installation.

B. Welded construction: Furnish with a sufficient quantity of 1/4-inch mounting holes to secure access panels to types of supports indicated.

C. Furnish number of latches required to hold door in flush, smooth plane when closed.

2.03 MANUFACTURERS

A. Williams Brothers- Basis of Design.

B. Milcor.

C. Nystrom.

D. J.L. Industries

E. Bilco

2.04 KEYING

A. All keyways shall be the same. Key as directed by the DMV Representative.

B. Provide six keys and one blank per lock.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rough openings for doors and frames are correctly sized and located for access to items behind frames.

B. Verify correct placement of built-in frames and accessories.

C. Verify that conditions are satisfactory for the installation of doors.

D. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install access doors in accordance with manufacturer's instructions and approved shop drawings.

B. Secure rigidly in place in accordance with approved shop drawings.

C. Install frames plumb and level in wall and ceiling openings, parallel to building lines.

D. Position to provide convenient access to valves, ductwork, and other mechanical and electrical work requiring access as indicated and directed.

3.03 CLEANING, ADJUSTMENTS, AND PROTECTION

A. Clean and adjust for smooth, even operation.

B. Protect finished installation.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Exterior storefront framing.

B. Related Work

1. Door hardware 08 71 00.

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

2. Dimensional tolerances of building frame and other adjacent construction.

3. Failure includes the following:

a. Deflection exceeding specified limits.

b. Thermal stresses transferring to building structure.

c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.

d. Noise or vibration created by wind and by thermal and structural movements.

e. Loosening or weakening of fasteners, attachments, and other components.

f. Failure of operating units.

B. Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind Loads: Uniform pressure (velocity pressure) of 21 lbf/sq. ft., acting inward and outward.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Accessible Entrances: Comply with CBC accessibility requirements.

D. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.04 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Acceptance of the Work.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Acceptance of the Work.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Samples for Initial Selection: For units with factory-applied color finishes.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.

2. Anchorage.

3. Expansion provisions.

4. Flashing and drainage.

E. Product Data: For each type of product indicated. Include material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
1. Provide available Environmental Product Declarations for LEED documentation.

F. Shop Drawings: For aluminum-storefront, include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and the following:

1. Mullion details for fenestration combinations including reinforcement and stiffeners.

2. Joinery details.

3. Expansion provisions.

4. Flashing and drainage details.

5. Weather-stripping details.

6. Thermal-break details.

7. Glazing details.

8. Samples of finished metal for color selection by the State.

G. Entrance Door Hardware Schedule: Refer to and coordinate with Section 08 71 00.

H. Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of aluminum-framed systems.

2. Include design calculations.

I. Qualification Data: For qualified Installer.

J. Seismic Qualification Certificates: For aluminum-framed systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

K. Welding certificates.

L. Preconstruction Test Reports: For sealant.

M. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

N. Source quality-control reports.

O. Quality-Control Program for Structural-Sealant-Glazed System: Include reports.

P. Field quality-control reports.

Q. Closeout submittals: Maintenance data and executed warranties.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. EFCO Corporation; Series 406(T) (403(T) where 4 ½ inch depth shown in details).

B. Or approved equal.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.

2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

3. Extruded Structural Pipe and Tubes: ASTM B 429.

4. Structural Profiles: ASTM B 308/B 308M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface

preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.

2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.

3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.03 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally Isolated.
   a. Frame u-value performance based on NFRC (National Fenestration Rating Council) 100 for the 6 1/2-inch deep frame shall be no greater than .43 when using glazing with center of glass U-value of .24. Frame u-value performance based on NFRC 100 for the 4 ½-inch deep frame shall be no greater than .38 when using glazing with a center of glass u-value of .24.

2. Glazing System: Retained mechanically with gaskets on four sides.

3. Glazing Plane: Front.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

2. Reinforce members as required to receive fastener threads.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.05 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.06 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fitted joints with ends coped or mitered.

3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.

5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

6. Provisions for field replacement of glazing from interior.

7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.07 ALUMINUM FINISHES

A. Anodized Aluminum Finish meeting the requirements of AAMA 611, Class I.

B. Color: Equal to Arcadia AB-7 Standard Dark Bronze.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.

2. Do not install damaged components.

3. Fit joints to produce hairline joints free of burrs and distortion.

4. Rigidly secure non-movement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Coordinate first paragraph below with manufacturers' recommendations.

E. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

F. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

G. Install glazing as specified in Section 08 80 00 "Glazing."

1. Structural-Sealant Glazing:

a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

b. Install weatherseal sealant according to Section 07 92 00 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

2. Indicate entrance door hardware mounting heights on Drawings or insert in subparagraph below.

I. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

J. Install perimeter joint sealants as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

3.03 ERECTION TOLERANCES

A. Erection tolerances in this article are examples only and are based on various AAMA references and manufacturers' literature. Coordinate with tolerances for support systems and revise to suit Project.

B. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.

2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).

b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

C. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of all installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.

2. Contractor shall inform Inspector of Record 48 HRs before testing. Inspector of Record shall observe testing.

3. Air Infiltration Testing:

a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.

b. Allowable Air Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

4. Water Resistance Testing:

a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.

b. Allowable Water Infiltration: No water penetration.

5. Test Reports: Prepared according to AAMA 502.

C. Remove and replace noncomplying windows and retest as specified above.

D. Additional testing and inspecting, at Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

B. Door shall be adjusted to meet the requirements or The California Building Code accessibility requirements.

END OF SECTION

SECTION 08 42 29.23

SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes exterior and interior, sliding, power-operated automatic entrances.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for forming recesses in concrete for recessed thresholds.
2. Section 08 71 00 "Automatic Door Operators" for automatic door operators furnished separately from doors and frames.

1.03 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. IBC: International Building Code.

D. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

E. For automatic door terminology, refer to BHMA A156.10 for definitions of terms.

1.04 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed sliding tracks. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.

C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.

D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access-control system.

E. System Integration: Integrate sliding automatic entrances with other systems as required for a complete working installation.
   1. Provide electrical interface to allow for remote monitoring of automatic entrance door panel status.

1.05 SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:
   1. Environmental Product Declaration: For each product.
   2. Health Product Declaration: For each product.
   3. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

C. Shop Drawings: For sliding automatic entrances.

   1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
   2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
   4. Indicate locations of activation and safety devices.
   5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.

D. Samples for Initial Selection: For units with factory-applied color and metal-clad finishes.

   1. Include Samples of hardware and accessories involving color or finish selection.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Delegated-Design Submittal: For automatic entrances.

G. Qualification Data: For Installer and Certified Inspector.

H. Product Certificates: For each type of automatic entrance. Include emergency-exit features of automatic entrances serving as a required means of egress.

I. Product Test Reports: For each type of automatic entrance, for tests performed by a qualified testing agency.

J. Field quality-control reports.

K. Sample Warranties: For manufacturer's special warranties.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer with Company Certificate issued by AAADM indicating that manufacturer has a Certified Inspector on staff.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a Certified Inspector.

1. Maintenance Proximity: Not more than two hours normal travel time from Installer's place of business to Project site.

C. Certified Inspector Qualifications: Certified by AAADM.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Faulty operation of operators, controls, and hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 AUTOMATIC ENTRANCE ASSEMBLIES

A. Source Limitations: Obtain sliding automatic entrances from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Power-Operated Door Standard: BHMA A156.10.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design automatic entrances.

B. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to California Building Code.

1. Seismic Loads: See Structural Drawings for additional information.
2. Wind Loads: See Structural Drawings for additional information.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces

D. Operating Temperature Range: Automatic entrances shall operate within minus 20 to plus 122 deg F (minus 29 to plus 50 deg C)

E. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. (6.4 L/s x sq. m) of fixed entrance-system area when tested according to ASTM E283 at a minimum static-air-pressure difference of [1.57 lbf/sq. ft. (75 Pa)] 6.24 lbf/sq. ft. (300 Pa).

F. Opening Force:

1. As required to meet California Building Code and the ADA.
2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf (222 N) required for a breakaway door or panel to open.

G. Entrapment-Prevention Force:

1. Power-Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.

2.03 SLIDING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances, including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.

B. Sliding Automatic Entrance:

1. Single-Sliding Units:

a. Besam Entrance Solutions; ASSA ABLOY

b. Horton Automatics; a division of Overhead Door Corporation

c. Stanley Access Technologies

2. Configuration: Single-sliding door with one sliding leaf and sidelite.

a. Traffic Pattern: Two way.
b. Emergency Breakaway Capability: Sliding leaf and sidelite.
c. Mounting: Between jambs.

3. Operator Features:

a. Power opening and closing.
b. Drive System: belt.
c. Adjustable opening and closing speeds.
d. Adjustable hold-open time between zero and 30 seconds.
e. Obstruction recycle.
f. On-off/hold-open switch to control electric power to operator, key operated.

4. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.

a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.

5. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless-steel, ball-bearing-center roller wheels.

a. Configuration: Saddle-type threshold across door opening and surface-mounted and recessed guide-track system at sidelites.

6. Controls: Activation and safety devices according to BHMA standards.

a. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
b. Safety Device: Presence sensor mounted on each side of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing.
c. Sidelite Safety Device: Presence sensor, mounted above each sidelite on side of door opening through which doors travel, to detect obstructions and to prevent door from opening.

7. Finish: Finish framing, door(s), and header with Class I, color anodic finish.

a. Color: Dark bronze. Match adjacent Storefront.

2.04 ENTRANCE COMPONENTS

A. Framing Members: Extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 6 inches (45 by 150 mm).
2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch (1.6-mm) wall thickness.

B. Stile and Rail Doors: 1-3/4-inch- (45-mm-) thick, glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.

1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
2. Stile Design: Narrow stile, 2-1/8-inch (55-mm) nominal width.
3. Rail Design: 12-inch (305-mm) nominal height.

C. Sidelite: 1-3/4-inch- (45-mm-) deep sidelite with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members matching door design.

1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.

D. Headers: Fabricated from minimum 0.125-inch- (3.2-mm-) thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

1. Mounting: Concealed, with one side of header flush with framing.
2. Capacity: Capable of supporting doors of up to 175 lb (79 kg) per leaf over spans of up to 14 feet (4.3 m) without intermediate supports.

a. Provide sag rods for spans exceeding 14 feet (4.3 m).

E. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.

F. Signage: As required by cited BHMA standard.

1. Application Process: Door manufacturer's standard process.
2. Provide sign materials with instructions for field application after glazing is installed.

2.05 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B221 (ASTM B221M).
2. Sheet: ASTM B209 (ASTM B209M).

B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

C. Stainless-Steel Bars: ASTM A276/A276M or ASTM A666, type 316.

D. Stainless-Steel Tubing: ASTM A554, Grade MT 316

E. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, type 316, stretcher-leveled standard of flatness, in entrance manufacturer's standard thickness.

F. Bronze Sheet: ASTM B36/B36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper), in entrance manufacturer's standard thickness.

G. Expanded Aluminum Mesh: Expanded and flattened aluminum sheet according to the geometry of ASTM F1267.

H. Polycarbonate Sheet: ASTM C1349, Appendix X1, type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on both surfaces.

I. Glazing: As specified in Section 08 80 00 "Glazing."

J. Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."

K. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C1107/C1107M; of consistency suitable for application.

L. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

M. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

N. Recycled Content of Aluminum Components: Postconsumer recycled content not less than 50 percent.

2.06 DOOR OPERATORS AND CONTROLS

A. General: Provide operators and controls, which include activation and safety devices, according to BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.

1. Door Operator Performance: Door operators shall open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
2. Electromechanical Operators: Concealed, self-contained, overhead units powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; complying with UL 325; and with manual operation with power off.

C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by their plastic housings; adjustable to provide detection-field sizes and functions required by BHMA A156.10.

1. Provide capability for switching between bi- and unidirectional detection.
2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.

D. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection-field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.

E. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

F. Key Switch: Recess-mounted, door-control switch with key-controlled actuator; enclosed in 2-by-4-inch (50-by-100-mm) junction box. Provide faceplate engraved with letters indicating switch functions.

1. Faceplate Material: Stainless steel, as selected by Architect from manufacturer's full range.
2. Functions: Two-way automatic, hold open, one-way exit, off, full open, and partial open.
3. Mounting: As indicated on Drawings, Recess mounted in door jamb.

2.07 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.

B. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be as stipulated in "Performance Requirements" Article. Interrupt powered operation of door operator while in breakaway mode.

1. Include two adjustable detent devices mounted in each breakaway panel; one top mounted and one bottom mounted to control breakaway force.

a. Panel Closer: Factory-installed concealed hydraulic door closer.
b. Limit Arms: Limit swing to 90 degrees, spring loaded with adjustable friction damping.

C. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch- (25-mm-) long throw bolt; BHMA A156.5, Grade 1.

1. Cylinders: by Door Hardware Contractor

2. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
3. Three-Point Locking for Stile and Rail Sliding Doors: Mechanism in stile of active door leaf that automatically extends lockbolts into overhead carrier assembly and threshold.
4. Lock/Unlock Indicator: Lock position indicators integrated with locking system. Stile is mounted on secure side of door. Visual display of lock position as follows: "OPEN" in black letters when unlocked, and "LOCKED" in red letters when locked.
5. Armored Strike: Reinforced security strike plate.

D. Uninterrupted Power Supply: UL 1778, fully integrated unit mounted within header.

1. Power Interruption: Supply power to operator, controls, activation device, and safety systems of sliding automatic door for up to 1.5 hours of normal operation.
2. Include low-battery shutdown feature to safely open or close door prior to complete battery discharge.

3. Include audible battery replacement alarm to indicate that battery will no longer accept a charge and replacement is required.

E. Dustproof Strikes for All-Glass Sliding Doors: Recessed, floor type, BHMA A156.16, Grade 1, to receive deadbolt.

F. Weather Stripping: Replaceable components.

1. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.08 FABRICATION

A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

1. Form aluminum shapes before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk tamper resistant flat-head machine screws, finished to match framing.

    a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
    b. Reinforce members as required to receive fastener threads.

4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.

1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
3. Form profiles that are sharp, straight, and free of defects or deformations.
4. Provide components with concealed fasteners and anchor and connection devices.
5. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
6. Fabricate exterior components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to

exterior. Provide anchorage and alignment brackets for concealed support of assembly from building structure.

7. Allow for thermal expansion of exterior units.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Metal Cladding: Factory-fabricated and -installed metal cladding, completely covering all visible surfaces as part of prefabricated entrance assembly before shipment to Project site.

1. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
2. Form profiles that are sharp, straight, and free of defects or deformations.
3. Provide components with concealed fasteners and anchor and connection devices.
4. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
5. Fabricate exterior components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior. Allow for thermal expansion at exterior entrances.

E. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

F. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

G. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors and breakaway sidelites.

H. Controls:

1. General: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
2. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:

a. Top Beam: 48 inches (1219 mm).
b. Bottom Beam: 24 inches (610 mm).

2.09 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA A156.10 for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.

1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.

2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
4. Level recesses for recessed thresholds using nonshrink grout.

C. Door Operators: Connect door operators to electrical power distribution system.

D. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Glazing: Install glazing as specified in Section 08 80 00 "Glazing."

F. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.

1. Set thresholds, bottom-guide-track system, framing members and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

G. Signage: Apply signage on both sides of each door and breakaway sidelite, as required by cited BHMA standard for direction of pedestrian travel.

H. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.03 FIELD QUALITY CONTROL

A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

C. Automatic entrances will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.04 ADJUSTING

A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust exterior doors for tight closure.

B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (900 cycles).

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide visits to Project during other-than-normal occupancy hours for this purpose.

3.05 CLEANING

A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

1. Comply with requirements in Section 08 80 00 "Glazing" for cleaning and maintaining glass.

3.06 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic entrance Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION

SECTION 08 62 50

TUBULAR SKYLIGHTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Tubular skylights consisting of skylight dome, reflective tube, an diffuser assembly; configuration as indicated on the drawings.

B. The General Provisions of Contract, including General & Supplementary Conditions and Division 1 specifications section apply to the Work of this Section.

1.02 REFERENCES

A. ASTM E 84- Standard Test Method for Surface Burning Characteristics of Building Materials; latest edition.

B. ASTM A 463/A 463M – Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process; latest edition.

C. ASTM A 653/A 653M – Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process; latest edition.

D. ASTM E 283 – Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

E. ASTM E 330 – Structural Performance of Exterior Windows, Curtain Walls and Doors.

F. ASTM E 331 – Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Static Air Pressure Difference.

G. ICBO/ICC AC-16 – Acceptance Criteria for Plastic Skylights; latest edition.

1.03 PERFORMANCE REQUIREMENTS

A. Completed skylight assemblies shall be capable of meeting the following performance requirements:

1. Air Infiltration Test: Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.

2. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hours/sf when tested in accordance with ASTM E 547.

3. Uniform Load Test: No breakage, permanent damage to fasteners, hardware parts, or damage to make system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 60 psf (2.87 kPa) in accordance with ICBO/ICC AC-16 Section A, or Negative Load of 70 psf (3.35 kPA) if tested

per ICBO/ICC AC-16 Section B. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.

4. Labeling

a. Tubular daylighting devices shall be tested and labeled as complying with AAMA/WDMA/CSA 101/I.S.2/A440. (CBC 2405.5

5. Fire Testing:

a. Product must have a smoke-developed index not greater than 450 in accordance with ASTM E84 and have a burning rate of 2.5 inches per minute or less in accordance with ASTM D635. (CBC 2610.1 & 2606.4)

b. Light-transmitting plastic diffusers shall comply with CBC Chapter 8 unless the light-transmitting plastic diffusers will fall from the mountings before igniting, at an ambient temperature of not less than 200°F (111°C) below the ignition temperature of the panels. The panels shall remain in place at an ambient room temperature of 175°F (79°C) for a period of not less than 15 minutes. (CBC 2606.7.2)

1.04 QUALITY ASSURANCE

A. Manufacturer Qualification: Engaged in manufacture of tubular skylights for minimum 10 years.

1.05 WARRANTY

A. Skylights: Manufacturer’s standard warranty for 10 years.

1.06 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01.
   1. Provide configurations, dimensions, locations, fastening methods, wiring diagrams, and installation details.
   2. Provide available Environmental Product Declarations and Health Product Declarations for LEED documentation.
   3. Include characteristics of light admitted, transparency and insulating value of unit.
   4. Submit manufacturer’s installation instructions under provisions of Division 01.
   5. Provide samples of product as requested by the Architect.

PART 2 - PRODUCTS

2.01 TUBULAR SKYLIGHTS

A. Tubular Skylights General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICBO/ICC AC-16. All components made and assembled by one manufacturer.

B. 14-inch Tubes: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

1. Roof Dome Assembly:

    a. Outer Glazing: 0.125 inch minimum thickness injection molded acrylic classified as CC2 material. UV inhibiting, impact modified acrylic blend.

    b. Inner Glazing: 0.115 inch (2.9 mm) minimum thickness high impact resistant injection molded acrylic required for high velocity wind zones.

    c. Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.

2. Flashing Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.

    a. Base Material: Sheet steel, corrosion resistant meeting ASTM A 653/A 653M or ASTM A 463/A 463M, 0.028 inch thick, 8-inches high.

3. Dome Ring: Attached to top of base section; 0.090 inch nominal thickness injection molded high impact ABS; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing; weather sealed.

4. Reflective Extension Tube: Aluminum sheet, thickness 0.015 inch.

    a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface; specular reflectance 99 percent for visible spectrum, less than 93 percent for total solar spectrum at field angle of 1.5 degrees.

    b. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.

    c. Tube Diameter: Approximately 14 inches.

5. Ceiling Ring: Injection molded high impact ABS. Nominal thickness is 0.085 inches.

6. Dress Ring: Injection molded high impact ABS. Nominal thickness is 0.100 inches. Prevents air infiltration and condensation from attic spaces.

7. Dual Glazed Diffuser Assembly:

    a. Upper Glazing: Acrylic plastic classified as CC2 material. Thickness shall not be less than 0.030 inches.

    b. Lower Glazing (prismatic lens): Acrylic plastic classified as CC2 material. Thickness shall not be less than 0.030 inches.

c. Panels may not exceed 10 feet in length nor 30 square feet in area. (CBC 2606.7.3)

2.02 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.

C. Install unit skylights level, plumb, and true to line, without distortion.

D. Anchor unit skylights securely to supporting substrates.

E. Where aluminum surfaces of unit skylights will contact another metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by unit skylight manufacturer.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. After completion of installation and nominal curing of sealant and glazing compounds but before installation of interior finishes, test for water leaks according to AAMA 501.2.

C. Perform test for total area of each unit skylight.

D. Work will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.04 CLEANING

A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Commercial door hardware.

2. Cylinders for doors specified in other Sections.

3. Electrified door hardware.

4. Gate Hardware

5. Padlocks

B. Related work

1. Storefront hardware. Section 08 41 13.

2. Security Steel Fence Section 32 31 19

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to review submittals and consult with Contractor, Architect, and Owner about door hardware and keying.

2. Installer shall also retain the independent Architectural Hardware Consultant to perform field inspections and prepare inspection reports.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 (latest edition) that are listed and labeled by a testing and inspecting agency acceptable to authorities having

jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (latest edition).

1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.

D. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination". Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system.

E. Preinstallation Conference: Conduct conference at Project site.

1.03 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Acceptance of the Work, except as follows:

a. Exit Devices: Two (2) years from date of Acceptance of the Work.

b. Manual Closers: Ten (10) years from date of Acceptance of the Work.

c. Concealed Floor Closers: Ten (10) years from date of Acceptance of the Work.

d. Lock and Latch Sets: Ten (10) years from date of Acceptance of the Work.

e. Electrified Hardware: Two (2) years from date of Acceptance of the Work.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
1. Provide available Environmental Product Declarations for LEED documentation.

C. Other Action Submittals:

1. Door Hardware Sets/Schedule: Prepared by or under the supervision of supplier and Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate

submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.

c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.

d. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.

2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.

3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.

5) Fastenings and other pertinent information.

6) Explanation of abbreviations, symbols, and codes contained in schedule.

7) Mounting locations for door hardware.

8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of supplier, detailing State's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

D. Product Certificates:

1. Builders Hardware Manufacturers' Association.

2. Quality Assurance.

3. For electrified door hardware, from the manufacturer.

a. Certify that door hardware is approved for use on types and sizes of labeled fire-rated doors and complies with listed fire-rated door assemblies.

E. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

a. Details of interface of electrified door hardware with building safety and security systems.

b. Schematic diagram of systems that interface with electrified door hardware.

c. Point-to-point wiring.

d. Risers.

e. Elevations of doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

F. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.

G. Qualification Data: For Installer and Architectural Hardware Consultant.

H. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

I. Closeout Submittals

1. Maintenance Data: For each type of door hardware to include in operation and maintenance manuals. Include final approved hardware and keying schedules.

2. Warranty –fully executed.

1.05 ADDITIONAL MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: One of each function of lock and latch sets and exit device, one basic standard tri-mount door closer, and three ball bearing butt hinges.

2. Electrical Parts: One of each electrical hardware item.

3. Accessories: Furnish (5) percent extra fasteners and other miscellaneous accessories required for installation.

B. Deliver spare hardware and extra accessories to location directed by the DMV Representative.; items will be retained by DMV and will not be released for use in the installation.

PART 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section.

1. Contractor shall develop the door hardware schedule per the function requirements from DGS/DMV.

2.02 HINGES

A. General; Full mortise extra heavy-weight, antifriction hinges with four bearings per hinge. Bearings shall be ball type. Hinges shall not be less than 4-1/2” high by 4-1/2” wide, or BHMA A 156.7 whichever is greater.

B. Hinges: BHMA A156.1. Provider template-produced hinges for hinges installed on hollow-metal doors and hollow metal frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers but are not limited to, the following:

a. McKinney Products Company; an ASSA ABLOY Group company.

b. Hager Companies.

c. Ives Hardware, an Allegion company.

d. Or approved equal

2. Mounting: Full mortise.

3. Bearing Material: Ball bearing, stainless steel.

4. Grade: Grade 1 Extra Heavy weight.

5. Base and Pin Metal:

a. Exterior Hinges: Stainless steel with stainless steel pin.

b. Interior Hinges: Stainless steel with stainless steel pin.

c. Hinges for Fire-Rated Assemblies: Stainless steel with stainless steel pin.

6. Pins: Non-removable at the following locations:

a. All locked reverse bevel doors.

7. Tips: Flat button.

C. Anchor Hinge Set: Grade 1 (extra heavy weight); consisting of one anchor hinge plus two full-mortise hinges; antifriction ball bearings; handed; non-removable pins; flat-button tips.

1. Base Metal: Stainless steel with stainless steel pins.

D. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed.

E. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.

2. Wood Screws: For wood doors and frames.

3. Threaded to the head wood screws: For wood doors.

4. Screws: Phillips flat head; machine screws for metal doors and frames, wood screws for wood doors. Finish screw heads to match surface of hinges.

2.03 MECHANICAL LOCKS AND LATCHES

A. GENERAL

1. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

2. Latches and Locks for Means of Fire Doors: Comply with CBC (latest edition). Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

3. Material: Stainless Steel, satin.

B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1; Series 1000. At all standard access doors.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers but are not limited to, the following

a. Sargent Manufacturing Company; an ASSA ABLOY Group company, 8200 Series.

b. Schlage Commercial Lock Division; an Ingersoll-Rand company, L9000 Series.

c. Or approved equal.

C. Bored Locks: BHMA A156.2; 1; Series 4000. At closet doors and alike only.

D. Electrified Locking Devices: BHMA A156.25, where indicated.

E. Lock Functions: *Lock functions to be provided by DMV at working Drawing Phase.*

F. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.

2. Deadbolts: Minimum 1-inch bolt throw.

G. Lock Backset: 2-3/4 inches.

H. Lock Trim:

1. Levers: Cast Stainless Steel.

a. Sargent L Series, Schlage 03 or equal.

2. Escutcheons: Sargent LW1, Schlage N or equal.

3. Dummy Trim: Match lever lock trim and escutcheons.

I. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

2.04 AUXILIARY LOCKS AND LATCHES

A. Auxiliary Locks: BHMA A156.5, Grade 1.

2.05 STANDALONE ELECTRONIC LOCKS

A. Locks: BHMA A156.25, Grade 1, UL 294, UL10C and FCC Part 15 compliant.

B. Programmable keypad lock.

C. Field programmable using handheld device.

2.06 COMPUTER MANAGED ELECTRONIC LOCKS

A. General: Network managed electrified locks; consisting of complete lockset, motor-driven or solenoid operated lock mechanism, access control management software, programming devices, access credentials, and actuating devices all except locksets to be provided under separate specification Section.

1. Type: Same as Mortised Locks noted above with the exception of electrically controlled.

a. Schlage L9080EU – RE (Request To Exit (REX) where occurs), Sargent 71 Series, or equal.

2. Actuating Device to be provided under separate specification Section:

a. Proximity card readers.

b. Digital keypads.

c. Faceplate Material: Stainless steel.

d. Trim: Lever.

2.07 LOCKSETS WITH DIGITAL KEYPAD

A. Digital Locking Keypads must be pin type with a minimum of 100 user codes and the ability to audit the last 15 transactions. Provide a Master Code as standard. The Master Code assigns emergency, supervisory, and user codes. Locks shall have the ability to print the last fifteen entries via infrared printer. Locking and unlocking of the lever handle shall be done by a motor-driven battery powered unit (solenoid not acceptable) contained completely within the body of the mortise lock. The inside lever is always free for egress. Provide lever design to match other door hardware on the project. Provide LED's on unit to indicate status – unlocked and programming mode. Provide weather seal gasket for keypad at exterior application. Where exterior electronic key pads are specified, a shroud or cover shall be provided over the keypad for added security.

B. Provide locksets as manufactured by Sergeant (KP series basis of Design) or approved equal by Schlage or Corbin Russwin.

2.08 FLUSH BOLTS

A. Locate on inactive leaf of double doors, where occurs.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers but are not limited to, the following:
   a. Ives Hardware, an Allegion company
   b. Rockwood Manufacturing, an ASSA Abloy Group company
   c. Or approved equal

C. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, where applicable.

D. Dustproof Strikes: BHMA A156.16, Grade 1.

E. Manual Flush Bolts: BHMA A156.16, Grade 2; designed for mortising into door edge.

F. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1; designed for mortising into door edge.

2.09 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers but are not limited to, the following:
   a. Von Durpin, an Allegion Company.
   b. Sargent, an ASSA Abloy Group Company.
   c. Or approved equal

C. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

D. Exit Devices for Means of Fire Doors: Comply with CBC (latest edition). Exit devices shall not require more than 15 lbf to release the latch.

E. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

F. Fire Exit Devices: Devices complying with NFPA 80 (latest edition) that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and the current NFPA 252.

G. Outside Trim: material and finish to match locksets, unless otherwise indicated.

2.10 LOCK CYLINDERS – (ALL CORES TO BE REMOVABLE)

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. High-Security Lock Cylinders: BHMA A156.30, Grade 1A;

1. Key Control Level: Category A.

2. Destructive Test Level: Category A.

3. Surreptitious Entry Resistance Level: Category A.

C. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six (6).

2. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A).

D. Permanent Cores: Manufacturer’s standard for locks and cylinders with interchangeable cores, finish face to match lockset.

E. Construction Keying for locks and cylinders with interchangeable cores: Comply with the following:

1. Provide color coded temporary construction cores for use during construction.

2. Provide ten (10) construction keys and three (3) construction core removal keys.

F. Manufacturer: Same manufacturer as for locks and latches.

2.11 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into key system. Allow for one (1) Grand Master Key Set controlling 5 (five) Master Key Sets.

B. Keys: Nickel silver; permanently inscribed with an alpha-numeric visual key control number and including the notation “DO NOT DUPLICATE”.

1. Quantity: Provide one (1) key blank for each lock and cylinder, three (3) change keys for each lock or cylinder, five (5) Master Keys per Set and five (5) grand master keys.

2.12 KEY CONTROL SYSTEM

A. Key Control Cabinet: Provided by the state and installed by the Contractor.

2.13 OPERATING TRIM

A. Standard: BHMA A156.6.

B. Materials: Fabricate from stainless steel, unless otherwise indicated.

2.14 ACCESSORIES FOR PAIRS OF DOORS

A. Carry-Open Bars: Provide carry-open bars for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

1. Material: Polished brass or bronze, with strike plate.

2.15 DOOR CLOSERS

A. Accessibility Requirements: Comply with the following maximum opening-force requirements:

1. Exterior and Interior, Non-Fire-Rated Hinged Doors: maximum 5 lbf applied perpendicular to door.

2. Sliding Doors: maximum 5 lbf applied parallel to door at latch.

3. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers but are not limited to, the following
1. LCN, an Allegion company
2. Sargent, an ASSA Abloy Group company
3. Or approved equal

C. Door Closers for Fire Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

D. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.

E. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather,

and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

F. Concealed Closers: BHMA A156.4, Grade 1.

1. Sargent 278 Power glide series with hold open and back check, LCN 5030 Series or equal.

G. Closer Holder Release Devices: BHMA A156.15.

1. Life Safety Type: On release of hold open, door becomes self-closing. Automatic release is activated by smoke detection system or loss of power.

H. Coordinators: BHMA A156.3.

2.16 PROTECTIVE TRIM UNITS

A. Size: 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in door hardware sets.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers but are not limited to, the following
1. Ives Hardware, an Allegion company.
2. Rockwood Manufacturing, an ASSA Abloy Group company
3. Or approved equal

C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:

1. Material: 0.050-inch- thick stainless steel.

2.17 DOOR STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16, Grade 1.

1. Provide floor stops for doors unless wall or other type stops are specified or indicated. Mount floor stops within four (4) inches of wall. Where floor or wall stops are not appropriate, provide overhead stops.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers but are not limited to, the following
1. Ives Hardware, an Allegion company.
2. Rockwood Manufacturing, an ASSA Abloy Group company
3. Or approved equal

C. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.

D. Silencers for Door Frames: BHMA A156.16, Grade 1; neoprene or rubber; fabricated for drilled-in application to frame.

2.18 DOOR OPENING SEALS

A. Standard: BHMA A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Seal Materials: ASTM D2000 and AAMA 701/702.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers but are not limited to, the following
   a. Pemko Manufacturing, an ASSA Abloy Group company
   b. Or approved equal

2.19 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Provide thresholds with a slope of not more than 1:2 and not more than 1/2 inch high. Thresholds shall meet California Building Code accessibility requirements.

2.20 MISCELLANEOUS DOOR HARDWARE

A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure, filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.

2.21 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Comply with NFPA 80 (latest edition) for fasteners of door hardware in fire-rated applications.

2. Hardware at bullet resistant openings shall be equal to hardware in tested assembly.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine rough-ins for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings and to comply with the following unless otherwise indicated or required to comply with governing regulations. Report contradictions to architect for direction before proceeding.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

2. Custom Steel Doors and Frames: HMMA 831.

3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

4. All operable hardware shall meet the requirements of California Building Code accessibility requirements.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in any way, coordinate removal, storage, and reinstallation of door hardware. Do not install surface-mounted items until finishes have been completed and cured.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards and/or manufacturer’s instructions.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

E. Lock Cylinders: Install construction keyed or construction cores to secure building and interior areas as required or directed during construction period.

1. For interchangeable core locks and cylinders replace construction cores with permanent cores as indicated in keying schedule.

2. Furnish permanent cores to DMV for installation. All permanent cores and keys are to be factory sealed and delivered directly from the manufacturer to DMV. This shall include bitting list. Delivery shall be fully tracked and require signature for delivery. Due to the nature of the security of this facility the chain of custody of the cores and keys must be verifiable. Contractor will install final cores under the supervision of a DMV representative.

3. For construction keyed locks and cylinders render construction keying inoperable and provide permanent keys to owner. Do not use permanent keys during construction. Failure to follow these instructions will require the replacement of the entire key system including all keys and cylinders or cylinder cores with a complete new and fresh system.

F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or directed. Verify location with Architect.

1. Configuration: Provide quantities specified in Hardware Sets, least number of power supplies required to adequately serve doors with electrified door hardware.

H. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

3.04 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Contractor will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements and requirements of authorities having jurisdiction.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.

2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. After Substantial Completion Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant and installer shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.06 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Acceptance of the Work.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.08 Hardware Schedule: Quantities listed are per door opening. Model numbers establish basic function. Contractor shall provide hardware with all the necessary accessories to make a complete system. Manufacturers are listed to establish a basis for design. Lock cylinders shall be provided as indicated above. All exterior doors and roof hatch shall be provided with a door position switch equal to Sentrol 1078. Coordinate with security contractor.

A. Hardware Group 1
   1. Doors: 102, 103

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Push Plate	8200_6x16	630	IVES
1	Pull Plate	8303_6x16	630	IVES
2	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP_EDA	695	LCN
Set	Head & Jamb Seals	2891	DS	PEMKO
1	Threshold	271	A	PEMKO
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

B. Hardware Group 2
   1. Door: 104

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Lockset	10G04LL	630	SERGEANT
1	Closer	4040XP_CUSH	695	LCN
Set	Head & Jamb Seals	2891	DS	PEMKO
1	Threshold	271	A	PEMKO
2	Kick Plate	8400_32x36	630	IVES

Notes:

C. Hardware Group 3
   1. Door:107

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Lockset	10G54LL	630	SERGEANT
1	Closer	4040XP	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO
1	Threshold	236	A	PEMKO

1	Wall Stop	WS401/402CVX	613	IVES

Notes:

D. Hardware Group 4
1. Doors: 109,118B

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Lockset	KP10G77LL	630	SERGEANT
2	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP_CUSH	695	LCN
Set	Head & Jamb Seals			By Storefront Mfgr
1	Threshold	158	A	PEMKO

Notes:

E. Hardware Group 5
1. Door:110

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Lockset	10G04LL	630	SERGEANT
2	Kick Plate	8400_32x36	630	IVES
1	Closer	4040XP_CUSH	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO
1	Threshold	174A	A	PEMKO
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

F. Hardware Group 6
1. Door:111

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Lockset	10G04LL	630	SERGEANT
1	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO
1	Threshold	174A	A	PEMKO
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

G. Hardware Group 7
1. Door:115

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES

1	Lockset	10G24LL	630	SERGEANT
1	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

H. Hardware Group 8
1. Door:116

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Lockset	10G04LL	630	SERGEANT
1	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

I. Hardware Group 9
1. Door:117

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Latchset	10U15LL	630	SERGEANT
1	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP_CUSN	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO

Notes:

J. Hardware Group 10
1. Door:119

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Lockset	10G37LL	630	SERGEANT
1	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO
1	Threshold	236A	A	PEMKO
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

K. Hardware Group 11

1. Doors: 120, 121

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Push Plate	8200_6x16	630	IVES
1	Pull Plate	8303_6x16	630	IVES
2	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO
1	Threshold	236	A	PEMKO
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

L. Hardware Group 12
1. Doors: 123,124

Quantity	*Description*	Model	Finish	Manufacturer
CONT	*Continuous Hinge*	112XY	643e	IVES
1	*Lockset*	M_AV9204LL	630	SERGEANT
1	*Door Top Drip*	346	D	PEMKO
1	*Door Bottom Drip*	3452	DPK	PEMKO
1	*Closer*	4040XP_CUSH	695	LCN
Set	*Head & Jamb Seals*	2891	DS	PEMKO
1	*Threshold*	158	A	PEMKO

Notes:

M. Hardware Group 13
1. Door:126

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Lockset	KP10G77	630	SERGEANT
1	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO
1	Threshold	236A	A	PEMKO
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

N. Hardware Group 14
1. Door:127

Quantity		Description	Model	Finish	Manufacturer
CONT		Continuous Hinge	112XY	643e	IVES

1		Latchset	10U15LL	630	SERGEANT
1		Kick Plate	8400_32x12	630	IVES
1		Closer	4040XP_CUSN	695	LCN
Set		Head & Jamb Seals	S88	D	PEMKO
1		Wall Stop	WS401/402CVX	613	IVES

Notes:

O. Hardware Group 15
1. Doors:101A, 101B

Quantity		Description	Model	Finish	Manufacturer
All					All by Automatic Door Manufacturer

Notes:Provide lock cylinder.

P. Hardware Group 16
1. Doors:106A, 106B

Quantity	Description	Model	Finish	Manufacturer
1 PR	BUTTS	5BB1	643e	IVES
1 PR	SPRING HINGE	3SP1	643e	IVES
1	Lockset	KP10G77LL	630	SERGEANT
1	Kick Plate	8400_32x12	630	IVES
1	Closer	4040XP	695	LCN
Set	SILENCERS	SR64	GRY	IVES
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

Q. Hardware Group 17
1. Door:106C

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	EXIT DEVICE	99EO	630	VON DUPRIN
1	CLOSER	4040XP_CUSN	695	LCN
Set	SEALS			By Storefront Manufacturer
1	THRESHOLD	158	A	PEMKO

Notes:

R. Hardware Group 18
1. Door:106D

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	EXIT DEVICE	99EO	630	VON DUPRIN
1	CLOSER	4040XP_CUSN	695	LCN
Set	SEALS			By Storefront Manufacturer
1	THRESHOLD	158	A	PEMKO

Notes:

S. Hardware Group 19
1. Door:127

Quantity		Description	Model	Finish	Manufacturer
CONT		Continuous Hinge	112XY	643e	IVES
1		Latchset	10U15LL	630	SERGEANT
1		Kick Plate	8400_32x12	630	IVES
1		Closer	4040XP	695	LCN
Set		Head & Jamb Seals	S88	D	PEMKO
1		Wall Stop	WS401/402CVX	613	IVES

Notes:

T. Hardware Group 20
1. Door:122A

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	Lockset	10G37LL	630	SERGEANT
2	Kick Plate	8400_32x36	630	IVES
1	Closer	4040XP_HCUSH	695	LCN
Set	Head & Jamb Seals	S88	D	PEMKO
1	Threshold	174	A	PEMKO
1	Wall Stop	WS401/402CVX	613	IVES

Notes:

U. Hardware Group 21
1. Door: 122B

Quantity	*Description*	Model	Finish	Manufacturer
2	*Continuous Hinge*	112XY	643e	IVES
1	*Lockset*	KP10G77LL	630	SERGEANT
1	*Door Top Drip*	346	D	PEMKO
2	*Door Bottom Drip*	3452	DPK	PEMKO
1	*Astragal*	356	AV	PEMKO
2	*Closer*	4040XP_HCUSH	695	LCN

Set	*Head & Jamb Seals*	2891	DS	PEMKO
1	*Threshold*	158	A	PEMKO

Notes:

V. Hardware Group 22
1. Doors:125A, 125B

Quantity	Description	Model	Finish	Manufacturer
CONT	Continuous Hinge	112XY	643e	IVES
1	EXIT DEVICE	KP8877LL	630	SARGEANT
1	CLOSER	4040XP	695	LCN
Set	SEALS			By Storefront Manufacturer
1	THRESHOLD	158	A	PEMKO
1	Floor Stop	FS18L	613	IVES

Notes:

W. Hardware Group 23
1. Gate: G101

Quantity	*Description*	Model	Finish	Manufacturer
2	*Hinge*	5BB1HWSH	630	IVES
2	*Spring Hinge*	SPS3	630	IVES
1	*EXIT DEVICE*	KP8877ETL	630	SERGEANT
2	*Door Bottom Drip*	345	A	PEMKO
Set	*Jamb Seals*	2891	DS	PEMKO

Notes:

X. Hardware Group 24
1. Gates: G102, 103

Quantity	*Description*	Model	Finish	Manufacturer
4	*Welded Hinge*	2060	P	Lift Master
1	*Cane Bolt w/ Hasp*	1176001	GALV	Gatemate
1	*Pad Lock*	858		SARGEANT

Notes: Provide (3) additional pad locks for gate operators and roof hatch

Y. Hardware Group 23
1. Gate: G104

Quantity	*Description*	Model	Finish	Manufacturer
2	*Welded Hinge*	2060	P	Lift Master
1	*Lockset*	M_AV9204LL	630	SERGEANT
1	*Welded Lock Mounting Box*		P	By Gate Manufacturer

Notes:

Z. Hardware Group 23

1. Gates: G105, G106

Quantity	*Description*	Model	Finish	Manufacturer
2	*Hinge*	5BB1HWSH	630	IVES
2	*Spring Hinge*	SPS3	630	IVES
1	*EXIT DEVICE*	KP8877ETL	630	SERGEANT
1	*Welded Lock Mounting Box*		P	By Gate Manufacturer

Notes:

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other sections where glazing requirements are specified by reference to this section:

1. Doors.

2. Storefront framing.

3. Interior borrowed lites.

4. Glass-clad polycarbonate security glazing

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual".

2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use".

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Fire Protection Rated Glazing Labeling: Permanently mark fire protection rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose stream test, whether or not glazing has a temperature rise rating of 450 degrees F, and the fire resistance rating in minutes.

D. Insulating Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

E. Glazing shall be tested in accordance with CPSC 16 CFR Part 1201 where used in areas specified in CBC 2406.4. (CBC 2406.2)

1.03 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating glass manufacturer agrees to replace insulating glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Acceptance of the Work.

B. Manufacturer's Special Warranty on Glass-Clad Polycarbonate: Manufacturer's standard form in which glass manufacturer agrees to replace glass units that deteriorate within specified warranty period. Deterioration of glass or polycarbonate is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Acceptance of the Work.

1.04 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Glass Samples: For each type of the following products; 12 inches square.

1. Tinted glass.

2. Coated glass.

3. Wired glass.

4. Fire-resistive glazing products.

5. Laminated glass.

6. Insulating glass.

7. Frosted / Acid Etched glass.

8. Speaker Port

C. Glazing Accessory Samples: For gaskets, sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Installers experience statement indicating experience with similar installations over at least 5 years. List projects and products installed, and month and year of installation.

E. Product Data: For each glass product and glazing material indicated.
   1. Provide available Environmental Product Declarations for LEED documentation.

F. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

G. Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

H. Qualification Data: For installers, manufacturers of insulating-glass units with sputter-coated, low-e coatings, glass testing agency and sealant testing agency.

I. Product Certificates: For glass and glazing products, from manufacturer.

J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass, coated glass, insulating glass, glazing sealants and glazing gaskets.

   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

K. Preconstruction adhesion and compatibility test report.

L. Warranties: Sample of special warranties.

M. LEED Documentation: Provide Environmental Product Declarations and Health Product Declarations meeting LEED requirements.

PART 2 - PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thickness as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat treated float glass, or Kind FT heat treated float glass. Where fully tempered glass is indicated, provide Kind FT heat treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center of glazing values, according to NFRC 100 and based on LBL's (Lawrence Berkeley National Laboratory) WINDOW (latest edition) computer program, expressed as Btu/sq. ft. x h x degrees F.

2. Solar Heat Gain Coefficient and Visible Transmittance: Center of glazing values, according to NFRC 200 and based on LBL's WINDOW (latest edition) computer program.

3. Visible Reflectance: Center of glazing values, according to NFRC 300.

2.02 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type 1, Quality-Q3, Class I, clear unless otherwise indicated.

B. Heat Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I, clear unless otherwise indicated; of kind and condition indicated.

C. Low-e coatings shall be magnetron sputtered vacuum deposition (MSVD) or approved equal.

D. Wired Glass: ANSI Z97.1.

2.03 INSULATED GLASS – LOW-E

A. Insulating Glass Units: Factory assembled units consisting of sealed lites of glass separated by an argon filled interspace, qualified according to ASTM E2190, and complying with other requirements specified.

1. Sealing System: Dual Seal.

2. Spacer: Manufacturer's standard spacer material and construction.

3. Glazing Performance:
   a. Visible Light Transmittance 64% minimum
   b. Solar Het Gain Coefficient - 0.26
   c. Winter Nighttime U value 0.24
   d. Light to solar Heat Gain – 2.37

2.04 FROSTED / ACID ETCHED GLAZING

A. Frosted Glazing shall be acid etched clear glazing
   1. Glazing Performance:
      a. Visible Light Transmittance – 91%
      b. Diffusion Haze- 90.73%

B. Acid Etched Satin Glazing shall be lightly acid etched clear glazing.
   1. Glazing Performance:

a. Visible Light Transmittance – 88%
b. Diffusion Haze – 12.9%

2.05 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C864.

2. Or approved equal

2.06 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.

B. Glazing Sealant: Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

C. Glazing Sealants for Fire Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire resistant glazing products with which they are used for applications and fire protection ratings indicated.

2.07 GLAZING TAPES

A. Back Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100% solids elastomeric tape; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.08 SPEAKER PORT

A. Size: 5” Diameter

B. Material: 11 GA #4 brushed slotted stainless steel both sides with cork gaskets

C. Equal to C.R. Lawrence – SST5

D. Matching Screws on secure side.

2.09 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Perimeter Insulation for Fire Resistive Glazing: Product that is approved by testing agency that listed and labeled fire resistant glazing product with which it is used for application and fire protection rating indicated.

F. C-Channel Glazing Trim – 1/4-inch x ¼-inch x ¼-inch x .020-inch thick 430 stainless steel

G. EXECUTION

2.10 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep systems.

3. Minimum required face and edge clearances.

4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

2.11 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

2.12 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

2.13 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

2.14 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

2.15 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

2.16 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

2.17 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

2.18 GLAZING SCHEDULE

A. GL1 – 1/2 -inch laminated mirrored glass. Unit shall consist of ¼-inch reflective glass (42% minimum reflectance out, and 12% maximum in) coating on #2 surface, .060-inch PVB layer, and 1/4"-inch clear inner layer.

B. GL2 – 1-inch Insulating clear low-e glass (low-e on 2nd surface) with frosted glass on 3rd surface.

C. GL3 – 1- inch Insulating low-e clear glass (low-e on 2nd surface)

D. GL4 – 1-inch Insulating clear low-e glass (low-e on 2nd surface). Both panes tempered.

E. GL5 – ¼-inch clear tempered glass.

F. GL6 - 1-inch Insulating clear low-e glass (low-e on 2nd surface) with acid etched satin finish on 3rd surface.

G. GL7 -1-inch Insulating clear low-e glass (low-e on 2nd surface) with acid etched satin finish on 3rd surface. Both panes tempered

H. GL8 – 1-inch Insulating clear glazing with low-e coating on the 2nd surface and opaque silicone based ceramic frit deposited on the #4 surface. Both lites shall be heat strengthened.

END OF SECTION

SECTION 08 91 19

FIXED LOUVERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvers

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

D. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.03 SUBMITTALS

A. Samples: For each type of metal finish required.

B. Submit under the provisions of Section 01 33 00.

C. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

2. Provide available Environmental Product Declarations for LEED documentation.

D. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

2. Show mullion profiles and locations.

E. Submittal: For louvers indicated to comply with structural and seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

G. Windborne-debris-impact-resistance test reports.

1.04 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.05 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.02 PERFORMANCE REQUIREMENTS

A. Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft., acting inward or outward.

C. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5.

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F ambient; material surfaces.

F. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Wind-Driven-Rain-Resistant Louver:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Airolite Company, LLC (The).

b. Greenheck Fan Corporation.

c. Nystrom, Inc.

d. Or approved equal.

2. Louver Depth: 5 inches minimum.

3. Frame and Blade Nominal Thickness: Not less than 0.080 inch for blades and 0.080 inch for frames].

4. Louver Performance Ratings:

a. Free Area: Not less than 6.0 sq. ft. for 48-inch wide by 48-inch high louver.

b. Air Performance: Not more than 0.10-inch wg static pressure drop at 600-fpm free-area intake velocity.

c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 8 inches per hour and a wind speed of 50 mph at a core-area intake velocity of 400 fpm.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.04 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.

2. Screening Type: Bird screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached.

2. Finish: Same finish as louver frames to which louver screens are attached.

3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch square mesh, 0.063-inch wire.

2.05 BLANK-OFF PANELS

A. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.

1. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness.

2. Panel Finish: Same finish type applied to louvers, but black color.

3. Attach blank-off panels with sheet metal screws.

2.06 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use hex-head or Phillips pan-head tamper-resistant screws for exposed fastener.

2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.

4. For fastening stainless steel, use 300 series stainless-steel fasteners.

5. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.07 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.

2. Horizontal Mullions: Provide horizontal mullions at joints.

C. Maintain equal louver blade spacing to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacing indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

2. Semi-recessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.

3. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

4. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.

G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.08 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. High-Performance Organic Finish: Three coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by the State from manufacturer's full range.

2.09 GALVANIZED-STEEL SHEET FINISHES

A. Finish louvers after assembly.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A 780.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.04 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by State, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.

2. Exterior gypsum board.

3. Tile backing panels.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product.

1. Provide available Environmental Product Declarations and Health Product Declarations meeting LEED requirements.

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch long length for each trim accessory indicated.

2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

3. Wall protection corner guard product data.

PART 2 - PRODUCTS

2.01 RECYCLED CONTENT OF GYPSUM PANELS

A. Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 7 percent by weight.

2.02 MANUFACTURERS

A. Gypsum Wall Board Products and Accessories: Listed products establish standard of quality and shall be manufactured by a single manufacturer from the following:

1. Georgia–Pacific Gypsum, LLC, Gypsum Wallboard Products (GP), DENS product line.

2. United States Gypsum Co. (USG)

3. Or Approved Equal

2.03 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X:

1. Thickness: 5/8 inch.

2. Long Edges: Tapered.

C. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch, Type X where applicable.

2. Long Edges: Tapered.

D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 5/8 inch, Type X.

2. Long Edges: Tapered.

E. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch, Type X.

2. Long Edges: Tapered.

3. Product shall meet the requirements of ASTM C1629 Level 3

F. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.

2. Long Edges: Tapered.

G. Acoustical Type: With sound damping layer of resin.

1. Thickness: 5/8 inch, Type X

2. STC Rating, with application one side over metal studs: STC 55.

2.04 EXTERIOR GYPSUM BOARD

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Core: 1/2 inch, regular type.

2.05 METAL-BACKED EXTERIOR GYPSUM BOARD

A. Glass-Mat Gypsum Sheathing Board bonded to sheet metal backing: ASTM C 1177/C 1177M.

1. Core: ½”, Type X
2. Metal backing: 22 gauge sheet steel factory bonded to gypsum board.
3. Shall have an ICC ES Report.

2.06 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.1.

1. Thickness: 1/2 inch.

2.07 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

2. Shapes:

a. Cornerbead.

b. Bullnose bead.

c. LC-Bead: J-shaped; exposed long flange receives joint compound.

d. L-Bead: L-shaped; exposed long flange receives joint compound.

e. U-Bead: J-shaped; exposed short flange does not receive joint compound.

f. Expansion (control) joint.

g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.

2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.08 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.

2. Exterior Gypsum Soffit Board: Paper.

3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.

4. Finish Coat: For third coat, use drying-type, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:

1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.09 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

3. Use Type 302 or Type 304 stainless steel screws for fastening aluminum trim pieces.

C. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

2.10 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Finish: Smooth wall.

2.11 GYPSUM BOARD FINISH LEVELS

A. Gypsum Board Finish Levels: Finish panels to levels indicated below:

1. Level 1: Ceiling plenum areas and concealed areas from occupancy.

a. All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

2. Level 2: Panels that are substrate for tile.

a. All joints shall be treated as required by TCNA standard.

3. Level 3: Areas to receive medium texture finishes before final painting with an eggshell paint: Storage rooms, electrical and communications rooms.

a. All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes.

4. Level 4: All locations within the building where finished wall is gypsum board and paint.
   a. All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife or trowel, leaving a thin coating of joint compound over all joints and interior angles. In addition, two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compounds shall be smooth and free of tool marks and ridges. The prepared surface shall be covered with a drywall primer prior to the application of the final decoration.

5. Level 5: Not Used.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite

sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.

2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8 inch wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4 to 1/2 inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at restroom and shower walls.

B. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.04 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by the State for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.

2. LC-Bead: Use at exposed panel edges.

3. U-Bead: Use at exposed panel edges.

3.05 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.06 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment to produce a uniform texture of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.07 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged includes, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 00

CERAMIC TILING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Ceramic Tile.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Pre-Installation Conference: Conduct conference at project site

Review methods and procedures related to ceramic tile installation including, but not limited to, the following:

1. Tile pattern and layout.

2. Control and expansion joint locations.

3. Finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.

2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12

inches but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.

3. Full-size units of each type of trim and accessory for each color and finish required.

4. Stone thresholds in 6-inch lengths.

5. Metal edge strips in 6-inch lengths.

E. Product Data: For each type of product indicated.

1. Provide available Environmental Product Declarations for LEED documentation.

F. Qualification Data: For qualified Installer.

G. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

H. Product Certificates: For each type of product, signed by product manufacturer.

I. Material Test Reports: For each tile-setting and grouting product and special purpose tile.

J. Maintenance Data.

1.04 ADDITIONAL MATERIALS

A. Provide an additional 5% of each tile product but no less than 1 box used in the project for attic stock.

PART 2 - PRODUCTS

2.01 TILE PRODUCTS

A. Manufacturers

1. Daltile

2. Or approved equal

B. ANSI Ceramic Tile Standard: Provide standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

C. Tile Type: Ceramic tile.

1. Composition: Porcelain.

2. Thickness: 3/8 inch.

3. Sizes as shown on drawings.

4. Finish and Color as shown on drawings.

5. Face: Plain with cushion edges.

6. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

   a. Base Cove: Cove.

   b. Base Cap: Surface bullnose.

   c. Wainscot Cap: Surface bullnose.

   d. External Corners: Surface bullnose.

   e. Internal Corners: Cove.

2.02 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

B. Latex-Portland Cement Mortar (Thin set): ANSI A118.4.

   1. Pre-packaged, dry mortar mix to which only water must be added.

   2. For wall applications, provide non-sagging mortar.

C. Water Cleanable, Tile Setting Epoxy: ANSI A118.3 [with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].

2.03 GROUT MATERIALS

A. Sand Portland Cement Grout: ANSI A108.10.

B. Polymer Modified Tile Grout: ANSI A118.7.

   1. Polymer Type: Dry, re-dispersible form, prepackaged with other dry ingredients.

C. Water Cleanable Epoxy Grout: ANSI A118.3

2.04 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex modified, Portland cement based formulation provided or approved by manufacturer of tile setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, stainless steel, ASTM A666, 300 Series, exposed edge material. Provide metal cove and corner trim equal to Schluter.

C. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.

    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.03 TILE INSTALLATION SCHEDULE

A. Showers walls and floors shall be installed per TCNA # B420-13 including waterproof wall membrane

B. other walls shall be installed per TCNA # W2021-13 at CMU and TCNA # W244C-13

C. other floors shall be installed per TCNA # F131-13

3.04 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

a. Tile floors in wet areas.

b. Tile floors composed of tiles 8 by 8 inches or larger.

c. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Floor Tile: 1/8 inch.

2. Glazed Wall Tile: 1/8 inch.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

I. Metal Edge Strips: Install where exposed edge of tile flooring meets concrete, carpet, or other flooring that finishes flush with top of tile. Install coved brushed stainless steel edge trim between floor and wall tile. Provide ¼-round brushed stainless steel trim between tile at outside wall corners.

J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.05 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.06 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.07 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.12 and manufacturer's written Instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.08 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic on tile floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

SECTION 09 30 50

TILE SETTING MATERIALS AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finishing and edge-protection profiles for walls and countertops.

B. Movement joint and cove-shaped profiles.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 05 55 00 - Metal Stair Treads and Nosings.

C. Section 05 40 00 - Cold Formed Metal Framing.

D. Section 07 92 00 - Joint Sealant.

E. Section 09 29 00 - Gypsum Board.

F. Section 09 30 00 - Tiling.

G. Not used

H. Section 10 26 00 - Wall and Door Protection.

I. Section 22 42 13 - Commercial Plumbing Equipment.

J. Not used

1.3 REFERENCES

A. CSA B79-08: Floor, Area, and Shower Drains, and Cleanouts for Residential Construction.

B. IAPMO IGC 195: Interim Guide Criteria for Floor Drain with Integrated Bonding Flange.

C. Tile Council of North America (TCNA) Handbook for Ceramic Tile Installation.

D. Terrazzo, Tile and Marble Association of Canada (TTMAC) Specification Guide 09300 Tile Installation Manual.

E. American National Standard Specifications for the installation of ceramic tile A108 / A118 / A136.1.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and finish.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience.

B. Source Limitations for Setting Materials and Accessories: Obtain product of a uniform quality for each application condition from a single manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

D. Preinstallation Conference: Conduct conference at the Project site.
1. Convene one week prior to commencing work of this section.
2. Require attendance of installation material manufacturer, tile supplier, tile installer and installers of related work. Review installation procedures and coordination required with related work.
3. Meeting agenda includes but is not limited to:
   a. Surface preparation.
   b. Tile and installation material compatibility.
   c. Edge protection, transition and pre-fabricated movement joint profiles.
   d. Waterproofing techniques.
   e. Crack isolation techniques.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 COORDINATION

A. Coordinate Work with other operations and installation of floor finish materials to avoid damage to installed materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841. ASD. Tel: (800) 472-4588. Fax (800) 477-9783. E-mail:specassist@schluter.com. Web:www.schluter.com.

B. Acceptable Manufacturer: Schluter Systems (Canada) Inc., 21100 Chemin Ste-Marie, Ste-Anne-de-Bellevue, QC H9X 3Y8. Tel: (800) 667-8746. Fax (514) 336-2410. E-mail:specassist@schluter.com. Web:www.schluter.ca.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 FINISHING AND EDGE-PROTECTION PROFILES FOR WALLS AND COUNTERTOPS

A. Schluter-SCHIENE
1. Description: L-shaped profile with 1/8 inch (3.2) wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
2. Anchoring Leg:
a. Provide with straight anchoring leg.
3. Material and Finish:
a. AE - Satin Anodized Aluminum.
1) Height as required to coordinate with tile selection and setting system selected.

2.3 MOVEMENT JOINTS AND COVE-SHAPED PROFILES

A. Schluter-DILEX-AHK
1. Description: anodized aluminum profile with integrated trapezoid-perforated anchoring legs, connected at a 90-degree angle by a cove-shaped section with 3/8 inch (10 mm) radius that forms the visible surface.
2. Corners:
a. Provide with matching inside corners.
b. Provide with matching outside corners.
3. Material and Finish:
a. ACG - Polished Chrome Anodized Aluminum.
1) Height as required to coordinate with tile selection and setting system selected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes acoustical panels, eggcrate and exposed suspension systems for ceilings.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLP accredited laboratory.

B. Seismic Standard: Comply with the following:

1. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct Hung Suspended Ceiling Assemblies" for IBC Category D, E, and F.

2. CBC / ESA Requirements: The following requirements are based on a typical installation with standard commercial products. Contractor is responsible for complying with the essential services criteria and upgrading articles in this section to conform to the ESA regulation. System shall be installed to meet the requirements of the Division of the State Architect IR 25-2.13

1.03 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch square samples of each type, color, pattern, and texture.

2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch long Samples of each type, finish, and color.

E. Product Data: For each type of product. Evaluation report must meet the requirements of the Division of the State Architect IR A-5.
   1. Provide available Environmental Product Declarations and Health Product Declarations meeting LEED requirements.

F. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Suspended ceiling components.

   2. Structural members to which suspension systems will be attached.

   3. Size and location of initial access modules for acoustical panels.

   4. Items penetrating finished ceiling includes, but not limited to the following:

      a. Lighting fixtures.

      b. Air outlets and inlets.

      c. Speakers.

      d. Sprinklers.

      e. Access panels.

      f. Video monitors.

      g. Security cameras.

   5. Perimeter moldings.

G. Qualification Data: For testing agency.

H. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

I. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

J. Field quality-control reports.

K. Closeout Submittals

   1. Maintenance Data: For finishes to include in maintenance manuals.

L. Maintenance Material Submittals

   1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

a. Acoustical Ceiling Panels: Full-size panels equal to 1 percent of quantity installed (a minimum of 1 unopened package).

b. Suspension-System Components: Quantity of each exposed component equal to 1 percent of quantity installed (a minimum of 1 unopened package).

c. Hold-Down Clips: Equal to 1 percent of quantity installed (a minimum of 1 unopened package).

d. Impact Clips: Equal to 1 percent of quantity installed (a minimum of 1 unopened package).

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Acoustical Panel Standard: comply with ASTM E1264.

1. Recycled Content: Provide acoustical panels with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 35% by weight.

B. Metal Suspension System Standard: Comply with ASTM C635.

1. Recycled Content: Provide products made from steel sheet with average recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 12%.

C. Attachment Devices: Size for five times the design load indicated in ASTM C635, Table 1, “Direct Hung”, unless otherwise indicated. Comply with seismic design requirements for Essential Services Buildings.

1. Deck Inserts and Hanger Clips: From hot dipped galvanized steel.

D. Wire Hangers, Braces, and Ties: Zinc coated carbon steel wire; ASTM A641/A641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C635, Table 1, “Direct Hung”) will be less than yield stress of wire, but provide not less than 0.106 inch diameter wire.

E. Seismic perimeter clips.

F. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer’s standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. 2” inch seismic engineered wall molding approved with an ICC report.

2. Product:
   a. USG – 2” wall angle with ACM7 clips
   b. Armstrong - 2” wall angle with BERC2 clips
   c. Chicago Metallic -- 2“ wall angle with 1496 clips

G. Ceiling system shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less when tested in accordance with ASTM E 84.

2.02 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (Typical)

A. Classification: Provide panels complying with ASTM E1264 for type and form as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 1.

B. Color: White.

C. LR: Not less than 0.84.

D. NRC: Not less than 0.9, Type E-400 mounting per ASTM E795.

E. CAC: Not less than 35.

F. Edge/Joint Detail: Square tegular edge.

G. Thickness: 1-inch.

H. Recycled Contedt 40% minimum

I. Modular Size: 24 by 48 inches with 2 x 2 look at Public area and Work Area and 24-inch by 48-inch scored to look like 24” x 24” at all other areas.

1. Products:
   a. USG - Halcyon
   b. Armstrong – Calla High NRC
   c. Or equal by Chicago Metallic / Certainteed.

2.03 EGGCRATE PANELS

A. Basis of Design: Global Industries.com; American Louver

1. ½” White Aluminum 30” x 60”

2.04 ACRYLIC PANELS

A. Basis of Design: ePlastics

1. 1/8” Frosted Acrylic Panel

2.05 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Double-Web, Steel Suspension System: Main and cross runners roll formed from cold rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A653/A653M, not less than G30 coating designation, with pre-finished metal caps on flanges.

1. Structural Classification: Heavy duty system.

2. End Condition of Cross Runners: Override (stepped) type.

3. Cap Material: Steel cold rolled sheet.

4. Cap Finish: Painted white throughout.

5. Grid shall be 24 by 24 or 24 by 48 inches (location per drawings).
   a. Grid Products:
      1) USG – Prelude 15/16” Ceiling Grid
      2) Armstrong – Prelude 15/16” Ceiling Grid
      3) Chicago Metallic / Certainteed - Seismic 1200 Ceiling Grid

2.06 CEILING RETENTION CLIPS

A. At all slopped ceilings install all panels with retention clips.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with location of hangers at spacing required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

8. Do not attach hangers to steel deck tabs.

9. Do not attach hangers to steel roof deck. Attach hangers to structural members.

10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Compliance of seismic design.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.

a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and post-installed anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two post-installed anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.

b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.05 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Resilient base.

2. Resilient molding accessories.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 (latest edition) by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

D. Product Data: For each type of product indicated.

E. Provide Environmental Product Declarations and Health Product Declarations meeting LEED requirements.

PART 2 - PRODUCTS

2.01 RESILIENT BASE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Burker Mercer Flooring Products; Division of Burke Industries, Inc.

2. Johnsonite

3. Roppe Corporation, USA

4. Or approved equal

B. Resilient Base Standard: ASTM F 1861.

C. Minimum Thickness: 0.125 inch

D. Height: 6 inches

E. Toe: Standard (Cove Base)

F. Lengths: Cut lengths, 48 inches long.

G. Outside Corners: Job formed.

H. Inside Corners: Job formed.

2.02 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

B. Description: Nosing for carpet, Transition strips.

C. Material: Thermoset Rubber.TS

2.03 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.

b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Coordinate requirements specified in other Sections for substrate construction and tolerances to ensure that they are appropriate for resilient products selected.

B. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

C. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.

4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

a. Follow manufacturer's requirements for moisture testing.

b. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

c. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

F. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible.

3.04 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet that would otherwise be exposed.

3.05 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Protect resilient products until Acceptance of the Work. Replace any damaged product prior to acceptance.

END OF SECTION

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Luxury Vinyl Tile

2. Description of Work: Provide and install all modular resilient flooring as required by contract documents and their specifications.

1.02 SUBMITTALS

A. Submit each of the following:

1. Manufacturer's Data - Two (2) copies of resilient manufacturer's construction specifications, performance specifications, installation instructions, maintenance instructions, and warranty for resilient flooring and related items specified.

2. LEED v4 applicable Data, including Environmental Product Declaration.

3. Samples: Customary (standard) size samples of each type of LVT, in each specified pattern, color, and construction.

B. Qualification Data for Installer:

1. The installation provider shall be directly responsible for the quality of the completed floorcovering installation, including the quality of both the materials and labor used in the installation.

2. The installation provider shall directly warrant to the end use all products, materials and services related to the floorcovering installation (including any floorcovering(s), or other products or materials used in the installation) meeting specifications set forth herein.

3. Installation provider shall warrant all installation services will be free from defects in workmanship for a period of at least one (1) year following their completion, and that in the event of defective services, the installation provider will re-perform the effected services and, as necessary, supply new products of the same or similar grade sufficient to repair or replace products adversely affected.

4. The installation provider shall have successful resilient flooring installation experience on work similar to the work of this Section.

5. The installation provider shall employ workers for this Project who are competent in techniques required by the manufacturer (trained or certified by the manufacturer) for resilient flooring installation.

6. Installation provider's proof of insurance, copy of contractor's license, and worker's compensation certificate.

7. Five (5) current project references for installation provider, with scope, date, and customer contact with phone number in compliance letter.

C. Qualification Data for Manufacturer:

1. Commitment to sustainability - resilient provider shall demonstrate through programs of source reduction, recycling, reuse, water conservation and conservation of raw material usage its commitment to sustainability.

2. Response to RFQ shall be accompanied by a letter confirming compliance with listed performance specifications signed off by an Officer of the Company.

3. Manufacturer shall make available a list of qualified minority, disabled, women and veteran owned LVT contractors capable of installation per manufacturer's installation instructions and provide contact information for each name supplied.

4. All products offered by the manufacturer shall be "standard running line" products and shall be available with no minimum order (single box availability).

5. Manufacturer shall guarantee availability of fully recyclable resilient flooring product.

6. The product warranty required herein shall be provided directly by the resilient flooring provider.

D. All applicable product warranties provided by manufacturer.

1. Provide the following manufacturer's written warranty for a period of fifteen years from date of product invoice.

a. Resilient flooring products are warranted against excessive wear defined as complete removal of pattern and/or color due to normal foot traffic and assuming proper installation and maintenance according to manufacturer's guidelines.

b. Resilient flooring products are warranted against manufacturing defects.

E. Any alternatives to specified product(s) or approved manufacturers, to be considered, shall be submitted for approval at least ten (10) working days prior to bid or proposal to be considered. No custom alternatives will be accepted.

F. Maintenance Instructions - Two (2) copies of the manufacturer's resilient flooring maintenance instructions.

G. Submit manufacturer's National Voluntary Laboratory Accreditation Program (NVLAP) certified test results to show that resilient flooring product(s) meets or exceeds product performance specification criteria for resilient flooring testing requirements under Section 2.01 hereof.

H. Submit manufacturer's National Voluntary Laboratory Accreditation Program (NVLAP) certified test results to show that resilient flooring product(s) meets or exceeds product performance specification criteria for resilient flooring testing requirements under Section 2.01 hereof.

I. Submit certification of compliance confirming 80 percent of floor area receiving resilient flooring meets one of the following:

   a. Certified under the Resilient Floor Covering Institute (RFCI) Floor Score program;

   b. Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for the Testing and Evaluation Chambers, Version 1.1, February 2010;

   c. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria and listed in the CHPS High Performance Product Database; or

   d. Products certified under UL GREENGUARD Gold (formerly the Greenguard Children's & Schools Program).

J. Submit documentation verifying that resilient flooring materials meet the pollutant emission limits.

PART 2 – PRODUCTS

2.01 LUXURY VINYL TILE : PERFORMANCE REQUIREMENTS

A. Luxury Vinyl Tile (LVT) Performance Standards. Resilient flooring shall meet the following performance standards:

0.1	Radiant Flux (ASTM E648)	$\geq$ 0.45 watts/cm^2, Class 1
0.2	Smoke Density (ASTM E662)	$\leq$ 450
0.3	Size & Squareness (ASTM F2055)	Passes, +/- 0.016 inch per linear foot
0.4	Thickness (ASTM F386)	Passes
0.5	IIC Sound Rating (ASTM E492-09)	57 IIC
0.6	Slip Resistance (ASTM D2047)	>0.55 wet/dry, ADA compliant
0.7	Static Load Limit (ASTM F970)	1000 psi

0.8	Flexibility (ASTM F137)	Passes
0.9	Resistance to heat (ASTM F1514)	Passes
0.10	Resistance to light (ASTM F1515)	Passes
0.11	Dimensional Stability (ASTM F2199)	Passes
0.12	Residual Indentation (ASTM F1914)	Passes
0.13	Resistance to Chemicals (ASTM F925)	Passes
0.14	Indoor Air Quality	FloorScore®/CDPH 01350 Certified for Low-VOC emissions
0.15	Material Composition	Free of Ortho Phthalates, Added Formaldehyde and Heavy Metal Stabilizers
0.16	Ingredients and Life Cycle Impacts	Environmental Product Declaration
0.17	Sustainability Assessment	NSF/ANSI 332 Silver
0.18	LEED v4	Contributes to IEQ: Low emitting materials; M&R: EPD and EPR
0.19	End of Life	Fully recyclable LVT to Carpet Tile Backing Recycling

B. Product Construction Specification. LVT shall meet the following construction specifications:

1. Construction: High performance luxury vinyl tile
2. Class / ASTM F1700: Class III Printed Vinyl Tile
3. Wear Layer Thickness: 22 mil
4. Total Thickness: 4.5 mm
5. Finish: UV urethane
6. Nominal Dimensions: [23 cm x 91.5 cm (9 in x 36 in)] ;when flooring design installation includes modular carpet, modular resilient dimensions must match modular carpet dimensions.
7. Installation Recommendation: Direct glue with a full spread of MM800 and/or 4151 adhesives with the specified 1/16” x 1/32” x 1/32” U notched trowel.

8. Installation Method: All product shall be designed for monolithic installation.

9. Edge profile: square

2.02 MANUFACTURERS

A. Basis of Design is Shaw Industries Group, Inc. Specification based on Shaw Contract, shift + tilt collection, style no. 0709V commercial luxury vinyl tile with fiberglass. Provide the above or an approved equal.

2.03 RELATED MATERIAL

A. Glue - Installation shall be free of the application of wet adhesive. Provide recommended adhesive per the construction specification above in 2.01/B.

PART 3 - EXECUTION

3.01 PRE-INSTALLATION REQUIREMENTS

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposit is that might interfere with the proper installation of the resilient flooring.

2. All substrates to receive moisture sensitive floor coverings must be tested for moisture prior to installation. An internal RH test must be performed per ASTM F 2170 and shall not exceed 90%. New and existing concrete subfloors shall meet the guidelines of ASTM F 710. PH reading must be between 7 and 10.

3. Do not install resilient flooring until the work area can be temperature controlled. Minimum temperature installation is 65°F with a maximum temperature of 85°F.

4. All substrates to receive resilient flooring shall be dry, clean, smooth and structurally sound.

5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General

1. Comply with manufacturer’s instructions and recommendations. All product shall be installed as per manufacturer’s installation guidelines.

2. A direct glue method of installation is preferred using materials described in 2.01/B above, additionally refer to the manufacturer's installation guidelines.

3. Comply with manufacturer's instructions for subfloor evaluation for moisture and alkalinity.

4. Install resilient under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.

5. Run resilient under open bottom items such as heating convectors, and install tight against walls, columns and cabinets so the entire floor area is covered with resilient.

6. Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the resilient being installed.

7. Use cementitious patching and leveling compounds where necessary. These compounds shall meet or exceed the manufacturer's moisture requirements. Use of gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement shall meet or exceed the compressive strength of 3,000 psi.

3.03 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient.

B. On completion of the installation in each area, all dirt, resilient scraps, etc. shall be removed from the surface of the floor.

C. Remove debris, and sort pieces to be saved from scraps to be recycled.

D. Construction manager shall protect resilient flooring against damage during remainder of construction period.

E. At the completion of the work and when directed by the construction manager, clean resilient floor as per the maintenance recommendations of the resilient manufacturer.

3.04 INSPECTION

A. Upon completion of the installation, manufacturer and installer shall verify and certify by means of an affidavit of compliance that work is complete, properly installed and meets all specifications herein.

END OF SECTION

SECTION 09 66 13

PORTLAND CEMENT TERRAZZO FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Poured-in-place portland cement terrazzo flooring and base, bonded installation with dividers and accessory strips.

B. Related Requirements:

1. Section 03 30 00 Cast-in-Place Concrete, for concrete subfloor.

2. Section 07 92 00 "Joint Sealants" for sealants installed with terrazzo.

3. Section 22 13 19 Sanitary Waste Piping Specialties

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to terrazzo including, but not limited to, the following:

a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
c. Review special terrazzo designs and patterns.

1.04 SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Provide Certificates for Recycled Content
2. Provide available Environmental Product Declarations
3. Provide Data on Sealer and Adhesive VOC content.

C. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work. Show layout of the following:

1. Divider strips.
2. Control-joint strips.
3. Expansion-joint strips.
4. Accessory strips.
5. Terrazzo patterns.

D. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

E. Samples for Initial Selection: NTMA's "Terrazzo Color Palette" showing the full range of colors and patterns available for each terrazzo type.

F. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo Sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in sizes indicated below:

1. Terrazzo: 6-inch- square Samples.
2. Accessories: 6-inch- long Samples of each exposed strip item required.

G. Qualification Data: For Installer.

H. Material Certificates: For each type of terrazzo material or product.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is a contractor member of NTMA.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for each type of terrazzo including accessories.

a. Size: Minimum 100 sq. ft. of typical poured-in-place flooring condition for each color and pattern in locations directed by Architect.
b. Include base.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.08 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.

B. Maintain ambient temperatures in the area to receive terrazzo at not less than 50 deg. F.

C. Maintain adequate ventilation in the area to receive terrazzo.

D. Provide permanent interior lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

E. Close spaces to traffic during terrazzo installation and for not less than 24 hours after installation unless manufacturer recommends a longer period.

F. Control and collect water and dust produced by portland cement terrazzo grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

1. Top End Terrazzo
2. Or Approved Equal

2.02 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.03 PORTLAND CEMENT TERRAZZO

A. Portland Cement Terrazzo System: BONDED.

1. Underbed Thickness: As indicated on Drawings.
2. Terrazzo Topping Thickness: As indicated on Drawings.

B. Materials:

1. Portland Cement: ASTM C150/C150M, Type 1.
   a. Color for Terrazzo Matrix: See Finish Schedule
2. Water: Potable
3. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
   a. 24-Hour Absorption Rate: Less than 0.75 percent.
   b. Dust Content: Less than 1.0 percent by weight. for mix indicated and
4. Recycled content shall equal the glass and shell content indicated in the Finish Schedule.
5. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight, and compatible with terrazzo matrix.
6. Underbed Bonding Agent: Neat portland cement paste.

C. Mixes:

1. Underbed Mix: One part portland cement to four parts sand and sufficient water to provide workability at as low a slump as possible.
2. Terrazzo Topping Mix: One 94-lb bag of portland cement per 200 lb of aggregate, matrix pigment if required by mix color, and sufficient water to produce a workable mix.

   a. Mix Color and Pattern: Match Architect's sample.

2.04 STRIP MATERIALS

A. Standard Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in substrate.

1. Material: Zinc alloy
2. Depth: As indicated.
3. Width: As indicated

B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.

C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Base-bead strips for exposed top edge of terrazzo base.
2. Edge-bead strips for exposed edges of terrazzo.

2.05 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: Recommended by manufacturer for this use.

1. Must meet LEED VOC content restrictions.

B. Anchoring Devices:

1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and as required for secure attachment to substrate.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Isolation and Expansion-Joint Material: Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, and non-outgassing in unruptured state; butyl rubber; rubber; or cork; minimum 1/2 inch (12.7 mm) wide.

E. Portland Cement Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; is recommended by sealer manufacturer; and complies with NTMA's written recommendations for terrazzo type indicated.

1. Surface Friction: Not less than 0.6 according to ASTM D2047.
2. Acid-Base Properties: With pH factor between 7 and 10.
3. Sealer must met the VOC limitations required for LEED certification.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.02 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

1. Roughen concrete substrates before installing terrazzo system according to NTMA's written recommendations.

B. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.03 INSTALLATION, GENERAL

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.

C. Underbed:

1. Comply with NTMA's written recommendations for underbed installation.

2. Bonded Portland Cement Terrazzo:

a. Saturate structural concrete substrate with water, and slush and broom with underbed bonding agent.

3. Place underbed and screed to elevation indicated below finished floor elevation.

D. Strip Materials:

1. Divider and Control-Joint Strips:

a Locate divider strips directly over breaks and control joints in concrete slabs.

b. Install control-joint strips [back to back and directly above concrete-slab control joints in locations in locations indicated on drawings.

1) Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.

c. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

2. Accessory Strips: Install as required to provide a complete installation.

3.04 POURED-IN-PLACE TERRAZZO INSTALLATION

A. Underbed Preparation:
1. Bonded Portland Cement Terrazzo: Dampen underbed with water.

B. Place terrazzo mixture in panels formed by divider strips and trowel mixture to top of strips. Seed additional aggregates in matrix to uniformly distribute granular material and produce a surface with a minimum of 70 percent aggregate exposure. Roll and compact surface until excess cement and water have been extracted.

1. Portland Cement Terrazzo: Trowel to a dense, uniform, flat surface disclosing lines of divider strips.

C. Portland Cement Terrazzo Base: Install and finish base at the same time that adjacent flooring is installed.

D. Portland Cement Terrazzo Finishing: Cover terrazzo topping with moisture-retaining cover and cure until topping develops sufficient strength to prevent lifting or pulling of aggregate during grinding.

1. Rough Grinding: Grind with 24-grit or finer stones or with comparable diamond plates.
2. Grouting: After rough grinding, clean terrazzo topping with water and rinse away residue. Remove excess rinse water, apply matrix mix to grout surface, and fill voids. After grouting, cover surface with moisture-retaining cover to cure grout until ready for fine grinding.
3. Fine Grinding and Polishing: Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted. Grind with 80-grit stones or with comparable diamond abrasives until grout is removed from surface.

3.05 REPAIR

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate or underbed, including areas that emit a "hollow" sound if tapped. Cut out terrazzo areas

in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.06 CLEANING AND PROTECTION

A. Terrazzo Cleaning:

1. Remove grinding dust from installation and adjacent areas.
2. Wash surfaces with cleaner immediately after final cleaning of terrazzo flooring according to both NTMA's and manufacturer's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes modular, tufted carpet tile.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 PERFORMANCE REQUIREMENTS

A. Carpet Tile: All carpet purchased for the State of California agencies shall be certified to meet the NSF/ANSI 140-(latest edition) Standard at its Platinum level.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.04 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, and delamination.

1. Warranty Period: 10 years from date of Acceptance of the Work.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

1. Samples of carpet tile, pattern and color.

2. Product Data

3. Warranty.

4. Maintenance Data.

5. Provide Environmental Product Declarations and Health Product Declarations meeting LEED Requirements.

6. Other as specified.

1.06 ADDITIONAL MATERIALS

A. Provide 5% of each type of carpet tile product in unopened boxes, but no more than 100 s.f. of each.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Interface Detours w/GlasBac backing

B. Or approved equal

2.02 CARPET TILE

A. Installation method: monolithic

B. Fiber Content: Solution dyed 100 percent nylon 6, 6 or 100 percent nylon 6.

C. Pile Characteristic: Tufted textured loop pile.

D. Density: 7,636 oz./cu. yd. minimum.

E. Applied Soil-Resistance Treatment: Manufacturer’s standard.

F. Antimicrobial Treatment: Manufacturer's standard material.

G. Performance Characteristics, As follows:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.

2. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.

2.03 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.

2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving carpet tile.

3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For raised access flooring systems, verify the following:

1. Access floor substrate is compatible with carpet tile and adhesive if any.

2. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than 1/8 inch, protrusions more than 1/32 inch, and substances that may interfere with adhesive bond or show through surface.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.03 INSTALLATION

A. General: Comply with CRI 104, Section 18, "Modular Carpet," and with carpet tile manufacturer's written installation instructions.

B. Complete floor moisture test per manufacturer’s instructions. Bead blast and seal as necessary to comply with manufacturer’s warranty guidelines.

C. Installation Method: As recommended in writing by carpet tile manufacturer.

D. Maintain dye lot integrity. Do not mix dye lots in same area.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.

H. Install pattern parallel to walls and borders.

I. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.

2. Remove yarns that protrude from carpet tile surface.

3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 20, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 09 69 00

ACCESS FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Access-flooring panels.

2. Understructure.

3. Floor panel coverings (See 09 68 13 for carpet tiles).

B. The General Requirements Division 1 Specifications apply to this section.

1.02 COORDINATION

A. Coordinate location of mechanical and electrical work in under floor cavity to prevent interference with access-flooring pedestals.

B. Mark pedestal locations on subfloor using a grid to enable mechanical and electrical work to proceed without interfering with access-flooring pedestals.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Product Data: For each type of product.

C. Shop Drawings: Include layout of access-flooring system and relationship to adjoining Work based on field-verified dimensions.

1. Details and sections with descriptive notes indicating materials, finishes, fasteners, typical and special edge conditions, accessories, and understructures.

D. Samples:

1. Exposed Metal Accessories: Approximately 10 inches in length.
2. One complete full-size floor panel, pedestal, and understructure unit for each type of access-flooring system required.

E. Samples for Initial Selection: For each type of product and exposed finish. Samples for Verification: For the following products:

1. Exposed Metal Accessories: Approximately 10 inches in length.
2. One complete full-size floor panel, pedestal, and understructure unit for each type of access-flooring system required.

F. Qualification Data: For Installer.

G. Product Certificates: For each type of access-flooring system.

H. Product Test Reports: For each type of flooring material and exposed finish, for tests performed by a qualified testing agency.

I. Seismic Design Calculations: For seismic design of access-flooring systems including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

J. Preconstruction Test Reports: For preconstruction anchor bolt field test.

K. Provide Environmental Product Declarations and Health Product Declarations meeting LEED Requirements.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Do not install access flooring until spaces are enclosed, subfloor has been sealed, ambient temperature is between 50 and 90 degrees F, and relative humidity is not less than 20 and not more than 70 percent.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Access flooring shall withstand the effects of earthquake motions determined according to ASCE/SEI 16.

B. Structural Performance: Provide access-flooring systems capable of complying with the following performance requirements according to testing procedures in CISCA's "Recommended Test Procedures for Access Floors":

1. Concentrated Loads: 1250 lbf with the following deflection and permanent set:

   a. Top-Surface Deflection: 0.10 inch.
   b. Permanent Set: 0.010 inch.

2. Rolling Loads: Panel supported on actual understructure system shall be able to withstand the following rolling loads at any location in the panel without developing a local and overall surface deformation greater than 0.040 inches when tested in accordance with CISCA A/F, Section 3, "Rolling Loads". Note:

wheel 1 and wheel 2 tests shall be performed on two separate panels. CISCA Wheel 1: Size 3" dia x 1-13/16" wide; Load: 1000 lbs.; Passes: 10 CISCA Wheel 1: Size (A) 6" dia x 2" wide; Load: 800 lbs.; Passes: 10,000 (B) 10" dia. x 4"wide *Note: For loads up to 1500 lbs., specify Wheel 2 (A). For loads greater than 1500 lbs., Specify Wheel 2 (B).

3. Stringer Load Test: 450 lbf at center of span with a permanent set not to exceed 0.010 inch.
4. Pedestal Axial Load Test: 6000 lbf.
5. Pedestal Overturning Moment Test: 1000 lbf x inches.
6. Uniform Load Test: 250 lbf/sq. ft. with a maximum top-surface deflection not to exceed 0.040 inch and a permanent set not to exceed 0.010 inch.

2.02 MANUFACTURERS

A. Source Limitations: Basis of Design is Tate Access Floors, Inc. Specification based on Concore 1250 supported on a bolted understructure system. Provide the above or equal by Global IFS, or ASM.

2.03 FLOOR PANELS

A. Floor Panels, General: Provide modular panels interchangeable with other field panels without disturbing adjacent panels or understructure.

1. Size: Nominal 24 by 24 inches.
2. Attachment to Understructure: Bolted.

B. Cementitious-Core Steel Panels: Fabricated from cold-rolled steel sheet, with the die-cut flat top sheet and die-formed and stiffened bottom pan welded together, and with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish. Fully grout internal spaces of completed units with manufacturer's standard cementitious fill.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Tate Access Floors, Inc. or equal by Global IFS, or ASM.

2.04 UNDERSTRUCTURE

A. Pedestals: Assembly consisting of base, column with provisions for height adjustment, and head (cap); made of steel.

1. Provide pedestals designed for use in seismic applications.
2. Base: Square or circular base with not less than 16 sq. in. of bearing area.
3. Column: Of height required to bring finished floor to elevations indicated. Weld to base plate.
4. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2 inches and for locking at a selected height, so deliberate action is required to change height setting and prevent vibratory displacement.
5. Head: Designed to support the panel system indicated.
   a. Provide sound-deadening pads or gaskets at contact points between

heads and panels.

b. Bolted Assemblies: Provide head with four holes aligned with holes in floor panels for bolting of panels to pedestals.

B. Stringer Systems: Modular steel stringer systems designed to bolt to pedestal heads and form a grid pattern. Protect steel components with manufacturer's standard galvanized or corrosion-resistant paint finish.

1. Continuous Gaskets: At contact surfaces between panel and stringers to deaden sound, seal off the under-floor cavity from above, and maintain panel alignment and position.
2. Steel Stringers shall have conductive galvanized coating. Zinc electroplating shall be prohibited on stringer and stringer fasteners.
3. Stringer grid shall be 4' stringer in a basket-weave configuration ensuring maximum lateral stability in all directions

2.05 FLOOR PANEL COVERINGS

1. See specification 09 68 13 Tile Carpeting.
2. Ramps shall be covered in slip resistant vinyl composition tile – Basis of design Armstrong “Safety Zone”, or equal by Tarkett or Mannington.
   a. Color: as selected by Architect from the manufacturers full line.

2.06 FABRICATION

A. Fabrication Tolerances:

1. Size: Plus or minus 0.020 inch of required size.
2. Squareness: Plus or minus 0.015 inch between diagonal measurements across top of panel.
3. Flatness: Plus or minus 0.035 inch, measured on a diagonal on top of panel.

B. Panel Markings: Clearly and permanently mark floor panels on their underside with panel type and concentrated-load rating.

C. Bolted Panels: Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.
   1. Captive Fasteners: Provide fasteners held captive to panels.

D. Cutouts: Fabricate cutouts in floor panels for cable penetrations and service outlets. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with structural performance requirements.
   1. Grommets: Where indicated, fit cutouts with manufacturer's standard grommets; or, if size of cutouts exceeds maximum grommet size available, trim edge of cutouts with manufacturer's standard plastic molding with tapered top flange. Furnish removable covers for grommets.
   2. Provide foam-rubber pads for sealing annular space formed in cutouts by cables.

2.07 ACCESSORIES

A. Post-Installed Anchors: For anchoring pedestal bases to subfloor, provide four post-installed expansion anchors made from carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 (Mild), with the capability to sustain, without failure, a load equal to 1.5 times the loads imposed by pedestal overturning moment on fasteners, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

B. Cavity Dividers: Provide manufacturer's standard metal dividers located where indicated to divide under floor cavities.

C. Closures: Where under floor cavity is not enclosed by abutting walls or other construction, provide metal-closure plates with manufacturer's standard finish.

D. Panel Lifting Device: Panel manufacturer's standard portable lifting device for each type of panel required.

E. Perimeter Support: Where indicated, provide manufacturer's standard method for supporting panel edge and forming transition between access flooring and adjoining floor coverings at same level as access flooring.

F. Ramps shall include access floor, ramp shoe assembly (tapered threshold at the bottom of the ramp,), and top threshold. See floor covering above.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, foreign deposits, and debris that might interfere with attachment of pedestals.
2. Verify that concrete floor sealer and finish have been applied and cured.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Lay out floor panel installation to keep the number of cut panels at floor perimeter to a minimum. Avoid using panels cut to less than 6 inches.

B. Locate each pedestal, complete any necessary subfloor preparation, and vacuum subfloor to remove dust, dirt, and construction debris before beginning installation.

3.03 INSTALLATION

A. Install access-flooring system and accessories under supervision of access-flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of instability, rocking, rattles, and squeaks.

B. Mechanical Attachment of Pedestals: Attach pedestals to subfloor with post-installed mechanical anchors.

C. Adjust pedestals to permit top of installed panels to be set flat, level, and to proper height.

D. Stringer Systems: Secure stringers to pedestal heads according to access-flooring manufacturer's written instructions.

E. Install flooring panels securely in place, properly seated with panel edges flush. Do not force panels into place.

F. Scribe perimeter panels to provide a close fit with adjoining construction with no voids greater than 1/8 inch where panels abut vertical surfaces.
   1. To prevent dusting, seal cut edges of steel-encapsulated, wood-core panels with sealer recommended in writing by panel manufacturer.

G. Cut and trim access flooring and perform other dirt-or-debris-producing activities at a remote location or as required to prevent contamination of subfloor under already-installed access flooring.

H. Grounded Flooring Access Panel Systems: Ground flooring system as recommended by manufacturer and as needed to comply with performance requirements for electrical resistance of floor coverings.
   1. Panel-to-Understructure Resistance: Not more than 10 ohms as measured without floor coverings.

I. Under floor Dividers: Scribe and install under floor-cavity dividers to closely fit against subfloor surfaces, and seal with mastic.

J. Closures: Scribe closures to closely fit against subfloor and adjacent finished-floor surfaces. Set in mastic and seal to maintain plenum effect within under floor cavity.

K. Clean dust, dirt, and construction debris caused by floor installation, and vacuum subfloor area as installation of floor panels proceeds.

L. Seal under floor air cavities at construction seams, penetrations, and perimeter to control air leakage, according to manufacturer's written instructions.

N. Install access flooring without change in elevation between adjacent panels and within the following tolerances:
   1. Plus or minus 1/16 inch in any 10-foot distance.
   2. Plus or minus 1/8 inch from a level plane over entire access-flooring area.

3.04 PROTECTION

A. Prohibit traffic on access flooring for 24 hours and removal of floor panels for 72 hours after installation to allow pedestal adhesive to set.

B. After completing installation, vacuum access flooring and cover with continuous sheets

of reinforced paper or plastic. Maintain protective covering until time of Acceptance of the Work.

C. Replace access-flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

END OF SECTION

SECTION 09 77 00

INTERIOR WALL PANEL SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall Protection Panels – Fiber Reinforced Laminate (FRL).

B. Trim and accessories for attaching wall panels, including fastenings, accessory features, connections to the building structure, and other items not mentioned specifically herein, and which are necessary to make a complete installation.

1.02 RELATED SECTIONS

A. Documents affecting work in this section includes but is not limited to:
1. 09 29 00 - Gypsum Board.
2. 04 22 00 - Concrete Masonry Units
3. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 QUALITY ASSURANCE

A. Work Quality: All work of this Section to be manufactured and constructed, assembled and installed by skilled craft persons in finish carpentry. All such work to be accurately fabricated, assembled, joined and expertly finished in accordance with measurements taken on the job- site.

B. Defective Work: All work, work not true to line, not in satisfactory operating condition, improperly installed, damaged or marred will not be accepted. Remedy, remove or replace defective work as directed by the State.

C. Standards: All applicable Sections of the "Manual of Millwork" and current supplements published by the Woodwork Institute for the construction types and grades hereinafter specified. All modifications to such standards shown on the Contract Drawings and approved Shop Drawings or specified shall govern.

D. Manufacturer: Provide wall panels produced by one manufacturer whose published product literature clearly indicates compliance with specifications.

E. Manufacturer Qualifications: All primary panel products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.

F. Installer Qualifications: All products listed in this section are to be installed by a single installer trained and approved by the manufacturer or representative.

G. Mock-Up: Provide a mock-up for evaluation of the product and application workmanship.
   1. Do not proceed with remaining work until workmanship, color, and sheen are approved by the State.

H. Pre-installation Meetings: Conduct pre-installation conference to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.04 SUBMITTALS

A. Submit in accordance with Division 1 Submittal Procedures.

B. Submit four samples, 3 1/2”x 3 1/2”, of each color, and texture of specified products.

D. Shop Drawings: Submit plan, section, elevation and perspective drawings necessary to describe and convey the layout, profiles and product components, including edge conditions, panel joints, fixture location, anchorage, accessories, finish colors, patterns and textures.
   1. Include configuration and layout of panel trim system and order of panel installation.

E. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

F. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

G. Special Warranty.

H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.

I. Submit the following Quality Assurance Submittals:
   1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
   2. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver and store materials in the manufacturer's original protective packaging. Store materials in an enclosed shelter providing protection from damage and exposure to the elements.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 COORDINATION

A. Do work of this Section in a fully coordinated and cooperative manner with work of other trades to provide complete and proper installation and to expedite the job without delays.

B. Secure field measurements before preparation of shop drawings and fabrication where possible, for proper and adequate fabrication and installation of the work.

C. Priming and back-painting of all carpentry and millwork is specified in Section 09 91 23 – Interior Painting. Do not set items until priming and back-painting have been completed.

D. Where wall panels are clad around outside corners of a room, the drywall installer should avoid installing drywall corner beads, as this makes shimming the phenolic panels very difficult. (See Section 09 29 00).

E. Protect all work against damage of any kind until final acceptance of the building. Repair or replace damaged work to the satisfaction of the State without additional cost to the Owner.

F. Provide adequate ventilation and acclimate panels per Woodwork Institute Manual of Millwork.

1.08 WARRANTY

A. Special Warranty: Wall panel to be warranted against delamination for 10 years. The factory authorized fabricator, product installer and material manufacturer must sign and date the Warranty documents and submit a copy to the Contractor for the warranty to be valid.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Panolam Industries International, Inc.

B. Or Approved Equal

2.02 MATERIALS

A. Provide a wall protection panel system with metal trim meeting the performance criteria below.

2.03 PERFORMANCE CRITERIA

A. Panels system shall meet the following criteria.

B. Flame spread (ASTM E-84): Panels to be UL registered and labeled for quality consistency.
1. Class 1 or Class A.
2. Class 2 or Class B.
3. Note: If Class A Fire Rating is not required, then use Class B.

C. Performance requirements:
1. Flexural strength: 10,000 psi minimum per ASTM D 790
2. Water Absorbtion: 0.90% maximum per ASTM D570
3. Barcol Hardness: 55 minimum per ASTM D 2583
4. Izod Impact Resistance: 5 lb. minimum per ASTM D 256

D. Panel Tolerance:
1. Thickness; 1/32” max.
2. Length; 1/4” maximum.
3. Width; 1/4” maximum.

F. Optical Properties:
1. As different materials have different testing criteria, provide test results showing that color variation is at most slight when subjected to an industry accepted Light Resistance test.

2.04 PANEL: TRIM

A. Aluminum “Z” clips and trim to be manufactured specifically to meet the following requirements:
1. Handle the weight of the panels.
2. Fasteners for panel assembly to be designed to keep panels consistently flat at each joint.
3. System to allow interchanging of components at a later date without damage to the wall substrate.

B. Trim and Clip Material
1. Where not seen: Al 6061-T6.
2. Where visible: Al 6063-T5.
3. Trim to be rounded to avoid catching on clothing or gear.

C. Fasteners to be as recommended by manufacturer.

D. Panel trim for joints, edges and corners to be from Wall Panel Systems; Shadowline, Captured, or Open Reveal System (ORS) options as shown on the drawings.
   1. Finish:
      a. Clear Satin Anodized

2.04 ADHESIVES

A. Adhesives, if required shall be a release type, which allows replacement of panels without damaging wall substrate. Adhesive shall be as recommended by the manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Panels will be installed to minimize panel joints and provide a regular panel spacing.

B. Do not begin installation until substrates have been properly prepared.

C. Surfaces to receive panels shall be even, smooth, dry, and free from defects detrimental to the installation of the panel system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the work.

D. Install panels and fixing system as per shop drawings and specifications.

E. Install aluminum trim to support the panel assembly.

F. The installation of the panel trim shall be true and plumb.

3.02 PROTECTION

A. After installation, the General Contractor shall protect the panels from damage. The panels shall be kept free from paint, plaster, cement scratches, or any other destructive forces.

3.03 CLEANING

A. Panels to be cleaned as recommended by panel manufacturer.

B. Repair or replace all damaged material to the satisfaction of the State.

END OF SECTION

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete.

2. Galvanized metal.

3. Aluminum (not anodized or otherwise coated).

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

B. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.

1. Furnish certification that all paint coatings furnished for the location of the project comply with the EPA clean air act for permissible levels of volatile organic content for architectural coatings applied in California as designated by California Air Resources Board (CARB).

2. Furnish certification that any aerosol paints and coatings shall meet the Product-Weighted MIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances (CCR, Title 17, Section 94520, et seq.).

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00. Samples for Initial Selection: For each type of topcoat product.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.

2. Step coats on Samples to show each coat required for system.

3. Label each coat of each Sample.

4. Label each Sample for location and application area.

C. Product Data: For each type of product, include preparation requirements and application instructions.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

3. VOC content.

E. Maintenance Data.

1.04 ADDITIONAL MATERIALS

A. Provide an additional 1 gallon of each paint product/color used in the project for attic stock. Color of mix shall be identified on the container.

PART 2 - PRODUCTS

2.01 GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Dunn-Edwards Corporation is the standard of quality against which the State will judge equivalency. The quantity of titanium dioxide (prime pigments), the use of clays, aluminum silicate, talc and the purity of acrylic materials are the criteria which will be used by the State in determining equivalency of materials.

2.02 PRIMERS/SEALERS

A. Alkali-Resistant Primer:

1. 100% Acrylic.

2. Minimum 34% Volume Solids.

3. Minimum 9% Prime Pigment.

2.03 METAL PRIMERS

A. Waterborne Galvanized-Metal Primer:

1. 100% Acrylic.

2. Minimum 37% Volume Solids.

3. Minimum 13% Prime Pigment.

B. Quick-Drying Primer for Aluminum:

1. Epoxy Ester.

2. Minimum 47% Volume Solids.

3. Minimum 22% Prime Pigment.

2.04 EXTERIOR LATEX PAINTS

A. Exterior Latex (Flat):

1. 100% Acrylic.

2. Minimum 39% Volume Solids.

3. Minimum 21% Prime Pigment.

B. Exterior Latex (Semigloss):

1. Acrylic.

2. Minimum 36% Volume Solids.

3. Minimum 20% Prime Pigment.

2.05 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex Over Alkali-Resistant Primer System:

a. Prime Coat: Alkali-resistant primer.

b. Intermediate Coat: Exterior latex matching topcoat.

c. Topcoat: Exterior latex (flat).

B. Galvanized-Metal Substrates:

1. Latex Over Water-Based Primer System:

a. Prime Coat: Waterborne galvanized-metal primer.

b. Intermediate Coat: Exterior latex matching topcoat.

c. Topcoat: Exterior latex (semigloss).

C. Aluminum Substrates:

1. Latex System:

a. Prime Coat: Quick-drying primer for aluminum.

b. Intermediate Coat: Exterior latex matching topcoat.

c. Topcoat: Exterior latex (semigloss).

D. Plastic Trim Fabrication Substrates:

1. Latex System:

a. Prime Coat: Bonding primer (water based).

b. Intermediate Coat: Exterior latex matching topcoat.

c. Topcoat: Exterior latex (flat).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.

2. Wood: 15 percent.

3. Masonry (Clay and CMU): 12 percent

4. Portland Cement Plaster: 12 percent

5. Gypsum Board: 12 percent

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer’s specifications

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."

2. SSPC-SP 3, "Power Tool Cleaning."

3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.

2. Sand surfaces that will be exposed to view, and dust off.

3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.

2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.

4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Uninsulated metal piping.

b. Uninsulated plastic piping.

c. Pipe hangers and supports.

d. Metal conduit.

e. Plastic conduit.

f. Tanks that do not have factory-applied final finishes

g. Other items as directed by the State

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: State may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by the State, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Galvanized metal.
3. Aluminum (not anodized or otherwise coated).
4. Concrete masonry units (CMU).
5. Steel.
6. Gypsum Board.
7. Wood
8. Plaster
9. Spray textured ceilings

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

B. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.

1. Furnish certification that all paint coatings furnished for the location of the project comply with the EPA clean air act for permissible levels of volatile organic content for architectural coatings applied in California as designated by California Air Resources Board (CARB).

2. Furnish certification that any aerosol paints and coatings shall meet the Product-Weighted MIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances (CCR, Title 17, Section 94520, et seq.).

1.03 SUBMITTALS

A. Submit under the provision of Section 01 33 00.

B. Samples for Initial Selection: For each type of top coat.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.

2. Step coats on Samples to show each coat required for system.

3. Label each coat of each Sample.

4. Label each Sample for location and application area.

D. Product Data: For each type of product, include preparation requirements and application instructions.

1. Include Environmental Product Declaration and MSDS sheets for each product.

E. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

3. VOC content.

F. Maintenance Data.

1.04 ADDITIONAL MATERIALS

A. Provide an additional 1 gallon of each paint product/color used in the project for attic stock. Color of mix shall be identified on the container.

PART 2 - PRODUCTS

2.01 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Dunn-Edwards Corporation is the standard of quality against which the State will judge equivalency. The quantity of titanium dioxide (prime pigments), the use of clays, aluminum silicate, talc and the purity of acrylic materials are the criteria which will be used by the State in determining equivalency of materials.

2.02 BLOCK FILLERS

A. Interior / Exterior Latex Block Filler.

1. Acrylic copolymer.

2. Minimum 50% Volume Solids.

2.03 PRIMER / SEALERS

A. Interior Latex Primer / Sealer.

1. Acrylic copolymer.

2. Minimum 28% Volume Solids.

3. Minimum 13% Prime Pigment.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.04 METAL PRIMERS

A. Alkyd Anti-Corrosive Metal Primer.

1. Alkyd.

2. Minimum 53% Volume Solids.

3. Minimum 7% Rust Inhibitive Pigments.

4. Minimum 15% Prime Pigment.

B. Waterborne Galvanized Metal Primer.

1. 100% Acrylic.

2. Minimum 37% Volume Solids.

3. Minimum 13% Prime Pigment.

C. Quick Drying Primer for Aluminum.

1. Epoxy ester.
2. Minimum 47% Volume Solids.
3. Minimum 22% Prime Pigments.

2.05 WOOD PRIMERS

A. Interior Latex-Based Wood Primer:

1. 100% Acrylic
2. Minimum 37% Volume Solids
3. Minimum 13% Prime Pigments

2.06 LATEX PAINTS

A. Institutional Low Odor/VOC Latex

1. Modified copolymer.
2. Minimum 37% Volume Solids.
3. Minimum 27% Prime Pigments.
4. Less than 11 g/L VOC as supplied.

B. Institutional Low Odor/VOC Latex

1. 100% Acrylic.
2. Minimum 36% Volume Solids.
3. Minimum 27% Prime Pigments.
4. Less than 8 g/L VOC as supplied.

C. High Performance Architectural Latex

1. 100% Acrylic.
2. Minimum 34% Volume Solids.
3. Minimum 22% Prime Pigments.
4. Non-Blocking.

2.07 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Non-traffic Surfaces.

1. Institutional Low Odor/VOC Latex System:

a. Prime Coat: Institutional low odor/VOC interior latex matching topcoat.

b. Intermediate Coat: Institutional low odor/VOC interior latex matching topcoat.

c. Topcoat: Institutional low odor/VOC interior latex

B. CMU Substrates.

1. Institutional Low Odor/VOC Latex System:

a. Prime Coat: Interior/exterior latex block filler.

b. Intermediate Coat: Institutional low odor/VOC interior latex matching topcoat.

c. Topcoat: Institutional low odor/VOC interior latex

C. Steel Substrates.

1. High Performance Architectural Latex System:

a. Prime Coat: Alkyd anti-corrosive metal primer.

b. Intermediate Coat: High performance architectural latex matching topcoat.

c. Topcoat: High performance architectural latex

D. Galvanized Metal Substrates.

1. High Performance Architectural Latex System:

a. Prime Coat: Waterborne galvanized metal primer.

b. Intermediate Coat: High performance architectural latex matching topcoat.

c. Topcoat: High performance architectural latex.

E. Aluminum (Not Anodized or Otherwise Coated) Substrates.

1. High Performance Architectural Latex System:

a. Prime Coat: Quick drying primer for aluminum.

b. Intermediate Coat: High performance architectural latex matching topcoat.

c. Topcoat: High performance architectural latex

F. Dressed Lumber Substrates: Including architectural woodwork.

1. High Performance Architectural Latex System:

a. Prime Coat: Interior latex-based wood primer.

b. Intermediate Coat: High performance architectural latex matching topcoat.

c. Topcoat: High performance architectural latex.

G. Wood Panel Substrates: Including painted plywood, medium density fiberboard.

1. Institutional Low Odor/VOC Latex System:

a. Prime Coat: Interior latex based wood primer.

b. Intermediate Coat: Institutional low odor/VOC interior latex matching topcoat.

c. Topcoat: Institutional low odor/VOC interior latex.

H. Dimension Lumber Substrates, Non-traffic surfaces: Including exposed beams.

1. Institutional low-odor/VOC latex System.

a. Prime Coat: Interior latex-based wood primer.

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.

c. Topcoat: Institutional low-odor/VOC interior latex.

I. Gypsum Board Substrates.

1. Institutional Low Odor/VOC Latex System:

a. Prime Coat: Interior latex primer/sealer.

b. Intermediate Coat: Institutional low odor/VOC interior latex matching topcoat.

c. Topcoat: Institutional low odor/VOC interior latex.

2. High Performance Polyurethane System:

a. Prime Coat: Interior latex primer/sealer.

b. Intermediate Coat: High performance polyurethane matching field color of topcoat.

c. Topcoat: Multiple color high performance polyurethane pattern coat.

J. Plaster Substrates.

1. Institutional low-odor/VOC Latex System.
    a. Prime Coat; Interior latex primer/sealer.
    b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
    c. Topcoat: Institutional low-odor/VOC interior latex.

K. Spray Textured Ceiling Substrates.
1. Latex (Flat) System: spray applied.
    a. Prime Coat: Interior latex primer/sealer.
    b. Topcoat: Interior latex.

L. Clear Wood Finish @ Doors and Wood Trim.
1. Water-Bourne Polyurethane.
    a. (2) coats

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."

2. SSPC-SP 3, "Power Tool Cleaning."

3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.

2. Sand surfaces that will be exposed to view, and dust off.

3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.

2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

1. Paint the following work where exposed in e unoccupied rooms:

a. Un-insulated metal piping.

b. Un-insulated plastic piping.

c. Pipe hangers and supports.

d. Metal conduit.

e. Plastic conduit.

f. Tanks that do not have factory-applied final finishes.

g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

h. Other items as directed by the State.

2. Paint the following work where exposed in occupied rooms:

a. Un-insulated metal piping.

b. Un-insulated plastic piping.

c. Pipe hangers and supports.

d. Metal conduit.

e. Plastic conduit.

f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

g. Other items as directed by the State.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: State may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 09 96 23

GRAFFITI-RESISTANT COATINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Application of Graffiti-Resistant coatings on exposed sides of concrete, stone and concrete masonry surfaces accessible to the public.

1.02 RELATED SECTIONS

A. Not used

1.03 SUBMITTALS

A. Product Data: Manufacturer's product literature.
   a. Include available Environmental Product Declaration Sheets and MSDS Sheets.

B. Samples: Minimum 8-inch square samples of each color of coating for verification purposes after initial color selection has been made.

C. Certification: Duplicate copies of manufacturer's affidavit with each shipment of materials delivered to the Project site certifying that materials furnished comply with specified requirements.

D. Sample Panel: Apply specified finish on approximately 10-square feet of wall area where directed by the Architect. Obtain Architect's approval before proceeding with coating application. Approved sample shall be used as a standard for the Project.

E. Maintenance Materials and Instructions:

   1. Furnish one identified unopened 5-gallon container of coating used, and one 5-gallon container of solvent to be used for graffiti removal.

   2. Coating and solvent shall not be used for recoating of touching-up damaged surfaces before final acceptance of the work.

   3. Furnish Owner with instructions for graffiti removal and maintenance instructions.

F. Compatibility Statement: Manufacturers statement on Company letterhead indicating the product’s compatibility with the integral water repellant of the substrate.

1.04 JOB CONDITIONS

A. Environmental Requirements: Comply with coating manufacturer's recommendations for environmental conditions regarding coating application. Do not apply coating in areas where dust is being generated.

B. Provide drop cloths, shields, barricades and other protection necessary to safeguard adjacent surfaces not to be painted. Post signs immediately after coating application.

C. Provide and maintain protection as required to protect finished work from damage until final acceptance.

D. Protect landscape items and adjacent surfaces not scheduled to receive graffiti-resistant coating. Contractor shall repair or replace areas damaged by work at no additional cost to Owner.

E. Remove, mask or otherwise protect murals and signage indicated on the Drawings as not to receive graffiti-resistant coating.

PART 2 – PRODUCTS

2.01 ANTI-GRAFFITI COATING

A. Non-sacrificial siloxane base anti-graffiti system.
B. Approved Manufacturers:
   a. Sherwin Williams Company, Anti-Graffiti Coating;
   b. Weatherman Products Inc., VandlGuard
   c. Or State approved equal.
C. System to include manufacturer recommended surface preparation and base coating.
D. Color: Non-yellowing clear, flat sheen.
E. Coatings shall meet LEED and Local Air Quality Management District VOC limitations.

PART 3 – EXECUTION

3.01 PREPARATION

A. Power wash all existing untreated surfaces with medium pressure hot water and mild tri-sodium phosphate solution or other approved cleaning agent. Hand scrub areas of hardened dirt. Allow surfaces to completely dry prior to application of product.

B. Surfaces shall be clean, free of dust, dirt, oils, scale, and rust.

C. Treat or clean alkali or efflorescence on the surfaces to be coated with a neutralizing agent recommended by coating manufacturer.

3.02 APPLICATION

A. Apply coating by brush, roller or sprayer set at normal painting pressures, tip size as recommended by coating manufacturer.

B. Apply sealer and coating system in accordance with manufacturer's instructions, allowing for drying between each coat as recommended by coating manufacturer.

3.03 CLEAN-UP

A. As work proceeds, promptly remove coating where spilled, splashed, or spattered. Contractor will be responsible for cleaning, repairing or replacing areas damaged by overspray, drips or spills at no cost to the Owner.

B. During progress of work, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

C. Upon completion of the work of this section, remove all surplus material and related debris from the site.

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Marker Boards.

2. Tack Boards.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 450 or less.

1.03 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.

b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 10 years from date of Acceptance of the Work.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product indicated, include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

C. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:

1. Actual sections of porcelain-enamel face sheet, visual display surface, tackboard assembly, visual display wall panel, and display rail.

2. Fabric swatches of polyester fabric-faced tack assemblies.

3. Include accessory Samples to verify color selected.

D. Samples for Verification: For each type of visual display surface indicated.

1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.

2. Trim: 6-inch long sections of each trim profile.

3. Display Rail: 6-inch long sections.

4. Rail Support System: 6-inch long sections.

5. Accessories: Full-size Sample of each type of accessory.

E. Product Schedule: For visual display surfaces.

F. Qualification Data: For qualified Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

H. I. Warranties: Sample of special warranties.

I. Closeout Submittals

1. Operation and Maintenance Data: For visual display surfaces and power-operated units to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Claridge

B. Egan

C. Or approved equal

2.02 MARKERBOARDS

A. Porcelain-Enamel Markerboards: Aluminum trim, balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and porcelain-enamel face sheet with low-gloss finish.

1. Face Sheet: ASTM A 424, enameling grade steel, uncoated thickness of 24 gauge, with exposed face and edges coated with primer. Face sheet shall be fused bonded using continuous coil process. Porcelain-enamel coating 0.21 inch thick.

2. Core Material: Particleboard 3/8 inch thick.

3. Backing Material: 0.005 inch thick aluminum foil.

4. Metal Trim and Accessories: 6063 aluminum allow with a T5 temper.

5. Laminating Adhesive: Manufacturer's standard, moisture resistant thermoplastic type.

B. Marker Board Accessories:

1. Provide Marker Boards with metal trim and accessories.

a. Aluminum extrusions with clear satin anodized finish.

1) Chalk tray: Standard continuous solid chalk tray with ribbed section and smoothly curved ends. Maximum projection from wall 4 inches.

2) Frame: Standard channel frame with 1-1/2” face and integrated hanger bar system.

3) Hanger Bar: Standard hanger bar for concealed mounting to wall.

b. Markers: 4-assorted LCS markers and erasers for each markerboard unit.

2.03 TACK BOARDS

A. Aluminum trimmed fabric covered cork laminated to a hardboard backing.

1. Face Material: Polyester fabric nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd.; with surface-burning characteristics indicated.

2. Core Material: Natural cork 0.25 inch thick laminated to 0.25 inch hard board.

3. Metal trim: Aluminum extrusions with clear satin anodized finish frame.

a. Standard channel frame with 1-1/2” face and integrated hanger bar system.

b. Hanger Bar: Standard hanger bar for concealed mounting to wall.

2.04 FABRICATION

A. Marker Boards: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Tack Boards: Factory assemble boards.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to boards at manufacturer's factory before shipment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.

C. Examine walls and partitions for proper preparation and backing for visual display surfaces.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

3.03 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.04 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.

    a. Attach chalk trays to boards with fasteners at not more than 12 inches o.c.

3.05 INSTALLATION OF VISUAL DISPLAY RAILS

A. Display Rails: Install rails in locations and at mounting heights indicated on Drawings. Attach to wall surface with fasteners at not more than 16 inches o.c.

3.06 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas. If results of restoration are unsuccessful, as determined by State, remove damaged units and replace with new units.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Monument and applicable LEED Plaques.
2. Dimensional characters.
3. Panel signs.
4. Eye Charts
5. Storefront and Entrance Decals
6. Signage for Disabled Accessibility.
7. Interior Signs and toilet room signage.
8. Dimensional Letters, numbers and Braille.
9. Conform to Title 24 and to ADA.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in Americans with Disabilities Act Accessibility Guidelines (ADAAG) and CBC Chapter 11B.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: for each type of product.

C. Coordinate room signage with DMV.

D. Shop Drawings: For Signage.

1. Include fabrication and installation details and attachments to other work.

2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.

3. Show message list, typestyles, graphic elements, and layout for each sign at least half size (coordinate with State for message list).

4. Show locations of electrical service connections.

5. Include diagrams for power, signal, and control wiring.

E. Samples for Final Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

F. Samples for Verification: For each type of sign assembly, showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Post and Panel Signs: Not less than 12 inches square, including corner and post.

2. Variable Component Materials: 8 inch sample of each base material, character or graphic element, in each exposed color and finish not included in other samples.

3. Exposed Accessories: Half size sample of each accessory type.

G. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

H. Qualification Data: For installer and manufacturer.

I. Sample Warranty: For special warranty.

J. Maintenance Data.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

C. Bronze Castings: ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).

D. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

2.02 PLAQUES

A. Cast Plaques: Provide castings free of pits, scale, sand holes, and other defects, as follows:

1. Plaque Material: Bronze.

2. Background Texture: Manufacturer's standard stipple texture.

3. Border Style: Projected bevel.

4. Mounting: Rosettes and fasteners matching plaque finish for substrates encountered.

5. Thickness: 0.250 inch thick.

2.03 DIMENSIONAL CHARACTERS

A. Cast Characters: Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.

1. Character Material: Aluminum.

2. Thickness: 1-inch.

3. Mounting: Concealed studs, non-corroding for substrates encountered.

2.04 PANEL SIGNS

A. Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:

1. Laminated, Etched Photopolymer: Raised graphics with Braille 1/32 inch above surface with contrasting colors and laminated to acrylic back.

2. Edge Condition: Beveled.

3. Corner Condition: Rounded.

4. Mounting: Aluminum Framed.

5. Manufacturer's standard anchors for substrates encountered.

6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.

B. Panel Sign Frames:

1. Extruded-Aluminum Frames: Mitered and welded.

    a. Corner Condition: Rounded to ½" radius.

    b. Depth: 1/2-inch.

    c. Profile: Square.

C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with Americans With Disabilities Act Accessibility Guidelines (ADAAG) and CBC Chapter 11B-703. Text shall be accompanied by Grade 2 (Contracted) Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

1. Panel Material: Photopolymer.

2. Copy: Raised not less than 1/32 inch.

3. Braille: Raised not less than 1/40 inch.

2.05 EYE CHARTS

A. Material and content per DMV standard Eye Chart specification

1. Panel Material:
    a. Background: Plexiglass, 1/4" thick, black: Rohm & Hass #2418.
    b. Chart: acrylic or other approved material, white with black lettering. Attach to background with hook & loop fasteners

2. Copy: letter size and viewing distance per Construction Documents.

3. Mounting: ¼" holes with "S" hooks at top corners, chain or wire attachment to ceiling with backing. Height A.F.F. to be field verified by owner.

2.06 STOREFRONT AND ENTRANCE DECALS

A. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing. Apply copy to glass.

2.07 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.08 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.

2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.09 ALUMINUM FINISHES

A. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.

B. Baked-Enamel Finish: AA-C12C42R1x (Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils, medium gloss.

2.10 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Verify that electrical service is correctly sized and located to accommodate signs.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Install signs so they do not protrude or obstruct according to the accessibility standard.

3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.

3. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or

components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until Acceptance of the Work.

END OF SECTION

SECTION 10 14 26

POST AND PANEL SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Exterior non-illuminated post and panel signs.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in Americans with Disabilities Act Accessibility Guidelines (ADAAG) and CBC Chapter 11B.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product.

C. Shop Drawings: For post and panel/pylon signage.

1. Include fabrication and installation details and attachments to other work.

2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.

3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

D. Samples for Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

E. Samples for Verification: For each type of sign assembly, showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Post and Panel Signs: Not less than 12 inches square, including corner and post.

2. Variable Component Materials: 8-inch Sample of each base material, character or graphic element, in each exposed color and finish not included in other Samples.

3. Exposed Accessories: Half-size Sample of each accessory type.

F. Qualification Data: For Installer and manufacturer.

G. Sample Warranty: For special warranty.

H. Maintenance Data.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

C. Steel:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial or forming steel.

2. Hot-Rolled Structural-Steel Shapes: ASTM A 36/A 36M or ASTM A 529/A 529M.

3. Steel Tubing or Pipe: ASTM A 500, Grade B.

4. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, 42,000-psi minimum yield strength.

5. Bolts for Steel Framing: ASTM A 307 or ASTM A 325 as necessary for design loads and connection details.

6. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

2.02 PANEL SIGNS

A. Sign Message Panels: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

1. Continuously weld joints and seams unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

B. Message Panel Materials:

1. Aluminum Sheet: 0.125 inch thick.

    a. Panel Finish: Baked enamel.

C. Hollow-Box-Type Panel Signs: Frame message panel with formed aluminum sheet or extruded hollow-box-type frame with ends flanged to engage slots in posts or attached to posts with extruded-aluminum fittings. Close top and bottom edges of panels with manufacturer's standard welded seams or extrusions.

1. Message Panel Materials:

    a. Aluminum Sheet: 0.125 inch thick.

        1) Panel Finish: Baked enamel.

2. Hollow-Box Depth: 2 inches.

    a. Corner Condition: Square.

    b. Finish: Match sign panel face.

3. Mounting: Between posts.

    a. Manufacturer's standard noncorroding anchors for substrates encountered.

2.03 POSTS

A. General: Fabricate posts to lengths required for mounting method indicated.

1. Direct-Burial Method: Provide posts 36 inches longer than height of sign to permit direct embedment in concrete foundations.

B. Aluminum Posts: Manufacturer's standard 0.125-inch- thick, extruded-aluminum tubing, with vertical slots to engage sign panels. Provide stop blocks in slots to hold panels in position. Include post caps, fillers, spacers, junction boxes, access panels, and related accessories required for complete installation.

1. Square Posts: 2 inches square.

2. Post Finish: Match sign panel face.

3. Color: As selected by Architect from manufacturer's full range.

2.04 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

B. Panel Tape: High performance double coated pressure sensitive acrylic foam closed cell tape used to attach architectural panels to metal frames in storefront systems, curtain wall systems and commercial windows replacing commonly using structural silicone sealants or mechanical fasteners and gaskets, complying with specified, and third-party verified, test results for performance, durability, UV and temperature resistance of acrylic foam chemistry.
   1. 3M™ VHB™ Architectural Panel Tape G11F, as manufactured by 3M.
   2. Composition: Conformable acrylic closed cell foam
   3. Color: Gray (G).
   4. Peel Adhesion (ASTM D3330, Stainless Steel): Minimum 20 lbs per Thickness: 0.045 inches (1.1 mm) ±10 percentage
   5. Width: 1 inch (25 mm)
   6. Density: 45 pcf (720 kg per cubic meter)
   7. Volatile Organic Compound (VOC) Content: Less than 5 grams per liter.
   8. Product Shelf Life: 24 months from Date of Manufacture when stored in original cartons at 70°F (21°C) and 50% relative humidity.
   9. Performance Capacities: Tests performed at 70 degrees F (21 degrees C).
      a. Peel Adhesion (ASTM D3330, Stainless Steel): Minimum 20 lbs per inch of width (350 N/100 mm) and cohesive failure mode.
      b. Tensile Strength (ASTM D897, Aluminum T-Block): Minimum @ 2 inches (50 mm) per minute.
         1) Tape Type G11F: Minimum 85 psi (585 kPa).
      c. Dynamic Overlap Shear Strength (ASTM D1002, Stainless Steel): Minimum 70 psi @ 0.5 inches per minute.(480 kPa @ 12.7 mm per minute).
      d. Static Shear Adhesion (ASTM D3654, Stainless Steel): 2.2 lbs per 0.5 sq. inch (1000 g per 3.2 sq. cm).
      e. Temperature Resistances
         1) Short Term: 300 degrees F (149 degrees C).
         2) Long Term: 200 degrees F (93 degrees C)

2.05 FABRICATION

A. General: Provide manufacturer's standard post and panel signs of configurations indicated.

   1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.

   2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

   3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.06 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, **Class I, 0.018 mm** or thicker.

B. Color Anodic Finish: AAMA 611, **Class I, 0.018 mm** or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.07 GALVANIZED STEEL FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

C. Color-Coated Finish: Apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Verify that electrical service is correctly sized and located to accommodate signs.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Install signs so they do not protrude or obstruct according to accessibility standard.

3. Before installation, verify that sign components are clean and free of materials or debris that would impair installation.

4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.03 INSTALLING POSTS

A. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet.

B. Direct-Burial Method:

1. Excavation: Excavate posthole to dimensions indicated. Reconstruct subgrade that is not firm, undisturbed, or compacted soil, or that is damaged by freezing temperatures, frost, rain, accumulated water, or construction activities by excavating an additional 12 inches, backfilling with satisfactory soil or well-graded aggregate, and compacting to original subgrade elevation.

2. Setting in Earth: Set post in position, support to prevent movement, and backfill with satisfactory soil or well-graded aggregate as recommended in writing by manufacturer. Place and compact backfill in 6-inch lifts, compacting each lift.

3. Setting in Cast-in-Place Concrete: Set post in position, support to prevent movement, and place concrete in posthole or for concrete foundation.

4. Setting in Preformed Hole in Concrete Foundation: Form or core drill holes in concrete foundation not less than 3/4 inch larger than outside dimension of post for installing posts in concrete. Set post in position, shim to prevent movement, and fill annular space between post and hole with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with manufacturer's written instructions.

a. Cover anchorage joint in concrete foundations with flange of same metal and finish as post, welded to post after placing anchoring material.

b. Leave anchorage joint exposed with 1/8-inch anchoring material sloped away from post.

3.04 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until Acceptance of the work.

END OF SECTION

SECTION 10 21 13.19

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Solid-plastic, polymer resin toilet partitions, floor supported, overhead braced.

B. Related Requirements:

   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

   2. Section 07 92 00 – Joint Sealants

   3. Section 10 28 00 - Toilet, Bath, and Janitorial Accessories.

1.03 REGULATORY REQUIREMENTS

A. Provisions for accessibility:
   1. Conform to CCR Title 24 - California Code of Regulations Title 24, California Building Code (CBC), Chapter 11B.

1.1 CONFORM TO REQUIREMENTS OF THE FEDERAL AMERICANS WITH DISABILITIES ACT (ADA), ACCESSIBILITY GUIDELINES.

1.04 PERFORMANCE REQUIREMENTS

A. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with ASTM E84-09c - Standard Test Method for Surface Burning Characteristics of Building Materials.

   1. Smoke Developed Index: Not to exceed 450.

   2. Flame Spread Index: Not to exceed 75.

3. Material Fire Ratings:

   a. National Fire Protection Association (NFPA): Class B.

   b. International Code Council (ICC): Class B.

1.04 SUBMITTALS

A. Samples

1. Sample of panel showing manufacturer's standard finish. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.

2. Security fasteners proposed for use.

B. Product Data

C. Shop Drawings: Indicate partition layout dimensions, panel and door sizes, door swings, elevations, anchorage and mounting details.

1.05 PRODUCT STORAGE AND HANDLING

A. Store and handle products in such a manner as to prevent twisting, bending, or other damage.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify field measurements are as indicated on Drawings.

B. Show locations of cutouts for compartment-mounted toilet accessories.

C. Show locations of centerlines of toilet fixtures.

D. Show locations of floor drains.

E. Show overhead support or bracing locations.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

A. A.Basis-of-Design Product: Subject to compliance with requirements, provide toilet partitions by Bradley or comparable product by one of the following:

1. Scranton Products (Santana-Comtec)

2.

3.

4.

5. PERFORMANCE REQUIREMENTS

2.02 SOLID-PLASTIC TOILET COMPARTMENTS

A. Manufacturers:

1. Bobrick

2. General Partitions Mfg. Corp.

3. American Sanitary Partition Corp.

4. Or approved equal

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

B. Solid-Plastic, Polymer Resin: High-density polyethylene (HDPE) with homogenous color throughout. Doors, panels and pilasters shall be of material not less than 1-inch thick with seamless construction and eased edges machined to a radius of 1/4-inch.

C. Pilaster Shoes and Sleeves (Caps): ASTM A167, Type 304 stainless steel, not less than 0.0312-inch thick and 3-inch high, finished to match hardware.

D. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls of the following material: Stainless Steel: ASTM A167, Type 304.

E. Tension Hooks: Invisible manufacturer's standard design for rigidly interlocking panels and screens to pilasters.

1. Hardware and Accessories: Manufacturer's standard design heavy-duty operating hardware and accessories of the following material: Stainless Steel: ASTM A167, Type 304.

a. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.

b. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors[and entrance-screen doors].

c. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

F. Overhead Bracing: Manufacturer's standard continuous, heavy-duty extruded-6463-T5 alloy and temper aluminum head rail with anti-grip profile in manufacturer's standard finish, bolted or screwed to pilasters from the inside. No visible screws from outside.

G. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless-steel, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.04 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware and accessories as indicated.

B. Solid-Plastic, Polymer-Resin Compartments and Screens: Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.

C. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

D. Floor-Anchored Screens: Provide pilasters and panels of same construction and finish as toilet compartments. Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Doors: Unless otherwise indicated, provide 24-inch wide in-swinging doors for standard toilet compartments and for compartments indicated to be accessible, 36-inch wide out-swinging doors with a minimum 34-inch wide clear opening for doors located at the side of the compartment and 32-inch wide clear opening for doors located at the end of the compartment. Provide 18-inch minimum strike side clearance at the pull side of the door at compartments indicated to be accessible.

1. Hinges: Manufacturer's standard heavy-duty, self-closing type that can be adjusted to hold door open at any angle up to 90-degrees.

2. Latch and Keeper: Recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper through-bolted to pilaster. Provide units that comply with accessibility requirements at accessible compartments.

3. Door Pull: Manufacturer's standard unit that complies with accessibility requirements. Provide units on both sides of doors at accessible compartments.

F. Fasteners: Stainless steel; tamper proof.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and openings are ready to receive work.

B. Verify field measurements are as shown on shop drawings.

C. Verify correct spacing of plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

E. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.02 PREPARATION

A. Protect elements surrounding the work of this Section from damage or disfiguration.

3.03 INSTALLATION

A. Install partitions and screens, hardware, fittings, and accessories in accordance with the manufacturer's printed instructions.

B. Provide fasteners suitable for attaching to adjacent construction.

C. Conceal evidence of drilling in finished Work.

D. Components attached to walls and floors which may leave gap of 1/32-inch or greater shall be bedded in sealant under provisions of Section 07 92 00, pressure applied to fill gap. Finish smooth and flush.

3.04 ADJUSTMENT

A. Adjust brackets to provide uniform clearances not exceeding the following:

1. Pilaster and Wall: 1-inch.

2. Panels and Wall: 1-inch.

3. Pilasters and Panels: 1/2-inch.

4. Pilasters and Doors: 3/16-inch.

B. Adjust pilaster shoes to fit flush with adjacent surface.

C. Adjust hardware for proper operation.

D. Set hinges to hold door ajar when not latched.

E. When complete, each compartment assembly shall be set square, plumb and level, accurately aligned, and securely anchored to prevent movement.

F. Doors shall remain plumb in all positions of swing, and doors and hardware shall operate smoothly, quietly, and free from binding.

G. Adjust and service operating elements as necessary to operate smoothly, quietly, and free from binding.

3.05 CLEANING

A. After completion of installation, clean and polish compartments, hardware, fittings, and accessories, leaving exposed surfaces free from damage, dents, tool marks, stains, discoloration, and other defects and damage.

B. Field touch-up of finish surfaces will not be permitted. Replace damaged components.

END OF SECTION 10 21 13

SECTION 10 26 00

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 07 92 00 - Joint Sealants.

C. Section 09 91 23 - Interior Painting.

1.2 SUMMARY

A. Section Includes:

1. Corner guards.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s information on corner guards, wall guards, and fasteners.

B. Installation instructions.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1. Include Samples of accent strips and accessories to verify color selection.

D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
1. Corner Guards: 12 inches long. Include example top caps.

E. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration during shipment, handling and storage.

B. Deliver and store corner guards, wall guards and fasteners in manufacturer's original packaging, identified with manufacturer's name, brand name and type of product, and size.

C. Store indoors, protected from moisture and other sources of damage.

D. Follow manufacturer's instructions for additional storage and handling requirements.

1.6 COORDINATION

A. Coordinate the Work of this Section with other Sections to ensure that required internal wall reinforcement is accurately located.

PART 2 - PRODUCTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide wall and corner guards by Construction Specialties or comparable product by one of the following:
   1. Pawling Corp

   2. InPro Corporation

   3. PERFORMANCE REQUIREMENTS

2.2 CORNER GUARDS

A. Corner Guards: Surface-Mounted, Metal Corner Guards (Height as indicated on drawings). Fabricated from 1-piece, formed or extruded metal with formed edges; with turn to match wall condition.

   1. Material: Stainless steel, Type 304 or 430.

      a. Thickness: Minimum 0.0781 inch.

      b. Finish: Directional satin, No. 4.

2. Wing Size: Nominal 3-1/2” by 3-1/2” inches.

3. Corner Radius: 1/8 inch.

4. Gauge: 16.

5. Flush Mounting: Mastic or peel and stick.

B. Lengths: Maximum available lengths to minimize joints.

2.3 ACCESSORIES

A. Attachment Hardware:
1. Size and Type: Appropriate to component and substrate; stainless steel. Unless otherwise shown on the Drawings, provide:

2. Concealment: Provide concealed fastenings wherever possible. Where exposed fastenings are unavoidable, use security fasteners.

2.4 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces to receive corner guards are satisfactory for installation.

B. Verify application of wall base and wall finish has been completed, and finish is dry, prior to installation of wall and corner guards.

C. Verify internal reinforcement is accurately placed in stud walls.

D. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected.

3.2 PREPARATION

A. Prior to application, clean side of corner guards that will be in contact with wall surfaces.

3.3 INSTALLATION

A. Install corner guards in accordance with manufacturer's written instructions, using attachment hardware of type specified herein.

B. Install corner guards with bottom edge at top of wall base, extending to full height of wall.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Required Height: 1/4 inch.

B. Maximum Variation from Level for Visible Length: 1/4 inch.

3.5 CLEANING

A. Clean wall and corner guards in accordance with manufacturer's instructions in manner to avoid damage to guards and adjacent surfaces.

END OF SECTION 102600

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.01 Section Includes:

1. Public-use & Staff-use washroom accessories.
2. Childcare accessories.
3. Custodial accessories.

1.02 Related sections

A. Section 05 40 00 - Cold formed metal framing.

1.03 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets for each product specified, including the following:

1. Installation instructions and recommendations.
2. Storage and handling requirements and recommendations.

3. Cleaning and maintenance instructions.
4. Replacement parts information.
5. Include electrical characteristics.

B. USGBC LEED Submittals, Recycled Content: Materials and Resource Credits MR4.1 and MR4.2 - Recycled Content: Submit manufacturer's calculation of value of recycled content for specified products, calculated in accordance with USGBC LEED certification requirements.

C. Country of Origin: Manufacturer must supply, with first submittal, Country of Origin information for each type of washroom accessory for this project.

D. Samples: Full size, for each exposed product and for each finish specified.
1. Approved full-size Samples will be returned and may be used in the Work.

E. Sample Warranty: For manufacturer's special warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.07 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.

2. Warranty Period: 15 years from date of Substantial Completion.

B. Manufacturer's Warranty for Electric Hand Dryers: Manufacturer's standard 5 year warranty on parts, except 3 year warranty on motor brushes from date of purchase.
1.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 PUBLIC-USE AND EMPLOYEE-USE WASHROOM ACCESSORIES

A. Paper Towel Dispenser with Waste Receptacle:
1. Minimum Towel-Dispenser Capacity: 800 multifold paper towels
2. Minimum Waste-Receptacle Capacity: 12 gal.
3. Material and Finish: Stainless steel, No. 4 finish (satin).
4. Liner: Reusable, vinyl waste-receptacle liner.
5. Lockset: Tumbler type--all accessories keyed alike

B. Surface-Mounted Automatic Paper Towel Dispenser:
1. Towels: universal standard-core, non-perforated rolls 8" (205mm) wide, 8" (205mm) diameter. 800 ft (244 m) long
2. Material and Finish: Stainless steel, No. 4 finish (satin).
3. Power: (4) "D" size alkaline batteries (not furnished) or an external 6-volt AC to DC switching power supply
4. Lockset: Tumbler type--all accessories keyed alike

C. Toilet Tissue (Roll) Dispenser:
1. Surface mounted
2. Vandal/theft-resistant

3. Multi-roll dispenser (two rolls min.),
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type—all accessories keyed alike

D. Liquid-Soap Dispenser:

1. Description: Designed for manually dispensing commercially marketed all-purpose soaps.
2. Mounting: Vertically oriented, surface mounted.
3. Capacity: 40 oz.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type—all accessories keyed alike

E. Grab Bar:

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 18 gauge.

    a. Finish: Smooth, No. 4 finish (satin).

3. Outside Diameter: 1-1/2 inches.
4. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit:

1. Mounting: Surface mounted.
2. Door or Cover: Self-closing, disposal-opening cover
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, No. 4 finish (satin)

G. Seat-Cover Dispenser:

1. Mounting: Recessed mount.
2. Minimum Capacity: 500 seat covers.
3. Exposed Material and Finish: Stainless steel, No. 4 finish (satin)

4. Lockset: Tumbler type.

H. Mirror Unit -- Full-Length (Employee Restroom only):

1. Frame: Stainless-steel angle, 0.05 inch thick

a. Corners: Manufacturer's standard

2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

a. One-piece, galvanized-steel, wall-hanger device hold mirror unit in position with no exposed screws or bolts.

3. Size: 24” W X 72” H

I. Employee Restroom Mirror Unit:

1. Frame: Stainless-steel angle, 0.05 inch thick

a. Corners: Manufacturer's standard

2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

a. One-piece, galvanized-steel, wall-hanger device hold mirror unit in position with no exposed screws or bolts.

3. Size: 18” W X 36” H

J. Public Restroom Mirror Unit:

1. Material: 18-8, type-304, 20 gauge (0.9mm) stainless steel polished to a No. 8 mirror finish.

2. Frame: none

a. Corners: Manufacturer's standard

3. Mounting: Four corner countersunk holes provide flush fit of tamper-resistant mounting screws with mirror surface.

4. Size: 18” W X 30” H

K. Folding Utility Shelf

1. Material: 18-8, type-304, 18-gauge (1.2mm) stainless steel. All-welded construction. Exposed surfaces have satin finish. Equipped with heavy-duty internal spring.
2. Mounting: Bracket per manufacturer instructions. 18-8 S, type-304, 18-gauge (1.2mm) stainless steel with satin finish

L. Stainless Steel Shelf:

1. Shelf – 18-8, type 304, 18 gauge (1.2mm) stainless steel with asatin finish. ¾” (19mm) return edges for maximum rigidity. Front edge is hemmed for safe handling.

2. Mounting Brackets — 18-8, type-304, 16-gauge (1.6mm) stainless steel with satin finish. Welded to back return of shelf and secured inside front hem of shelf.

3. Mounting: (4) tamper-resistant screws

M. Recessed Waste Receptacle:

1. Cabinet — 18-8, type-304, heavy-gauge stainless steel. All-welded construction. Exposed surfaces have satin-finish.
2. Flange — 18-8, type-304, 22-gauge (0.8mm) stainless steel with satin-finish. Drawn and beveled, one-piece, seamless construction.
3. Waste Receptacle — 18-8, type-304, 22-gauge (0.8mm) stainless steel with satin-finish. Front and side edges of bottom and all top edges are hemmed for safe handling. Secured to cabinet with a tumbler lock keyed like other Bobrick washroom accessories. Capacity: 12-gal. (45.4-L).
4. Mounting: (4) tamper-resistant screws

N. Coat Hook

1. Description: Single-prong unit with bumper.
2. Material and Finish: Solid cast aluminum with matte finish.
3. Mounting: (4) tamper-resistant screws

2.03 WARM-AIR DRYERS

A. Warm-Air Dryer:

1. Basis of Design: Bobrick B-7128 Hand Dryer (or approved equal).
2. Description: Standard-speed, warm-air hand dryer.
3. Mounting: Wall mounted
4. Operation: Electronic sensor activated with timed power cut-off switch.
5. Cover Material and Finish: Chrome

2.04 CHILDCARE ACCESSORIES

A. Baby-Changing Station:

1. Basis of Design: Koala Kare Products KB100-00ST
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
    a. Engineered to conform to ASTM F 2285-04 Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use
3. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE in manufacturer's standard color
6. Liner Dispenser: Built in

2.05 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder <Insert drawing designation>:

1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf
2. Length: 36 inches
3. Hooks: Three
4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.

5. Material and Finish: Stainless steel, No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
    b. Rod: Approximately 1/4-inch- diameter stainless steel.

B. Janitor Room Paper Towel (Folded) Dispenser”

1. Mounting: Surface mounted.
2. Minimum Capacity: 200 multifold towels.
3. Material and Finish: Stainless steel, No. 4 finish (satin).
4. Lockset: none.
5. Refill Indicator: Pierced slots at sides or front.

2.06 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install products in strict compliance with manufacturer’s written instructions and recommendations, including the following:
    1. Verify blocking has been installed properly.
    2. Verify location does not interfere with door swings or use of fixtures.
    3. Comply with manufacturer’s recommendations for backing and proper support.
    4. Use fasteners and anchors suitable for substrate and project conditions
    5. Install units rigid, straight, plumb, and level, in accordance with manufacturer’s installation instructions and approved shop drawings.

6. Conceal evidence of drilling, cutting, and fitting to room finish.
7. Test for proper operation.

3.02 CLEANING AND PROTECTION

A. Clean exposed surfaces of compartments, hardware, and fittings using methods acceptable to the manufacturer.

B. Touch-up, repair or replace damaged products until Substantial Completion.

3.03 ACCESSORY SCHEDULE

Item	**Description**	**Manufacturer**	**Model #**
BC	Baby Changing Station	Koala Kare Products	KB200-00
HD	Hand Dryer	Bobrick	B-7128
GB	Grab Bar	Bobrick	B-6806 series
MR	Mop Rack, 36 inches long	Bobrick	B-224
PTD	Paper Towel Dispenser & Waste Re-ceptacle	Bradley	237-10
JPTD	Janitor Room Paper Towel Dispenser	Bobrick	B-2621
SD-W	Soap Dispenser (wall mounted)	Bobrick	B-4112
TPD	Toilet Paper Dispenser	Bobrick	B-2888
SND	Sanitary Napkin Disposal	Bobrick	B-270
TSCD	Toilet Seat Cover Dispenser	Bobrick	B-301
ERM	Employee Restroom Mirror	Bobrick	B-290 1836
PRM	Public Restroom Mirror	Bobrick	B-1556 1830
FUS	Folding Utility Shelf	Bobrick	B-287
CH	Clothes Hook	Bobrick	B-212
FLM	Employee Full-length Mirror	Bobrick	B-290 2472
SSS	Stainless Steel Shelf 16” long	Bobrick	B-296x16
RWR	Recessed Waste Receptacle	Bobrick	B-3644

END OF SECTION

SECTION 10 44 13

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes fire protection cabinets for fire extinguishers.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

C. Samples for Initial Selection: For each type of fire protection cabinet indicated.

D. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

E. Maintenance Data.

F. Samples for Verification: (Included Color Charts) For each type of exposed finish required, prepared on Samples of size indicated below:

1. Size: 6 by 6 inches square.

G. Closeout Submittals

1. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide fire extinguisher cabinets by Potter Roemer or comparable product by one of the following:
Note: Potter Roemer Semi-recessed Model DC 1734 F-RR is available from manufacture upon request and is not listed in the product literature (phone: 1-800-366-3474)

1. Larsen's Manufacturing

2. JL Industries, Inc.; a division of the Activar Construction Products Group.

3. Or approved equal.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Stainless-Steel Sheet: ASTM A 666, Type 304.

C. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, 3 mm thick.

D. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

E. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 1.5 mm thick, with Finish 1 (smooth or polished).

2.03 FIRE PROTECTION CABINET

B. Cabinet Construction: Semi-recessed or Fully-recessed.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material. Provide factory-drilled mounting holes.

B. Cabinet Material: Steel sheet.

C. Semi-recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.

1. Rolled-Edge Trim: 2-1/2- backbend depth.

C. Cabinet Trim Material: Same material and finish as door.

D. Door Material: Steel sheet.

E. Door Style: Center glass panel.

F. Door Glazing: Tempered float glass, clear.

G. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

H. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.

3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.

2) Application Process: Silk-screened.

3) Lettering Color: Red.

4) Orientation: Vertical.

b. Wall mount V shape directional signage. “FIRE EXTINGUISHER” and arrow indicating housing location.

I. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:

a. Interior of cabinet.

2.04 FABRICATION

J. Fire Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Miter and weld joints and grind smooth.

PART 3 - EXECUTION

3.01 EXAMINATION

K. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

L. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

M. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

N. General: Install fire protection cabinets in locations and at mounting heights acceptable to authorities having jurisdiction. Verify locations with State Fire Inspector prior to installation.

O. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semi-recessed fire protection cabinets.

2. Provide inside latch and lock for break-glass panels.

3. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

3.04 ADJUSTING AND CLEANING

P. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed, unless otherwise indicated in manufacturer's written installation instructions.

Q. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

R. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

S. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

T. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 44 16

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

A. Code Compliance: Fabricate and label fire extinguishers to comply with:

1. ANSI/UL Standard 711 (latest edition).
2. ANSI/UL Standard 299 (latest edition).
3. CCR, Title 19, Division 1, Chapter 3.
4. California State Fire Marshal.

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

C. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.

D. Warranty: Sample of special warranty.

E. Closeout Submittals

1. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.04 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of hydrostatic test according to ANSI/UL Standard 711, (latest edition) and CCR, Title 19.
   b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Acceptance of the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide fire extinguishers by Potter Roemer or comparable product by one of the following:

1. Larsen’s Manufacturing
2. JL Industries, Inc.; a division of the Activar Construction Products Group.
3. Or approved equal.

2.02 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Instruction Labels: Include pictorial marking system complying with 19 CCR § 563.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install fire extinguishers in fire protection cabinet in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION

SECTION 10 51 13

METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard lockers.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.

C. Samples: For each color specified, in manufacturer's standard size.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

E. Samples for Verification: For the following products, in manufacturer's standard size:

1. Lockers.

F. Warranty: Manufacturer’s Steel Locker warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Prime, high grade Class 1 mild annealed, cold-rolled steel free from surface imperfections. A.S.T.M.-A1008. Galvannealed steel available for high humidity atmospheres. A.S.T.M.-A653. Bolts to be zinc plated or subjected to other rust-retardant treatment.

2.2 PERFORMANCE REQUIREMENTS

A. Locker(s) indicated on plans and drawings to be accessible, and to comply with applicable provisions in 2019 California Building Code

2.3 WELDED CORRIDOR LOCKERS

A. Manufacturers:

1. Basis of Design: Lyon Standard Duty Lockers 5712 Lyon Workspace Products, LLC. 420 N. Main Street Montgomery, IL 60538 P.O. Box 671 Aurora, IL 60507-0671 lyonworkspace.com
2. Penco Products, Inc.
3. Or Approved Equal

B. Doors: One-piece, 16-gauge steel on single, triple tier with both vertical edges formed into channel-shaped formation; top and bottom shall be flanged at 90 degree angle. On multiple tier lockers, hinge side shall be formed into channel shaped formation with other three sides flanged at 90 degree angle.

1. Door Style: Vented panel as follows:

a. Louvered Vents: Triple tier lockers – Over 9"w:Two 6" louvers top and bottom

C. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
1. 24-gauge steel, flanged to give double thickness of metal at back vertical corners.
2. Shelves: Flanged on all four sides for strength with the front flange turned 45 degrees for safety and attached at no less than two points through each side flange.

D. Frames: triple tier lockers shall have two jambs welded to side of door frames to engage locking device. Design and gauge of jamb shall prevent freeing of locking device by prying.

E. Each jamb shall have easily replaceable soft rubber bumper.

F. Hinges: Shall not be less than 2" high, .050" steel, 5 knuckle,
1. Design: full loop forming double thickness on each leaf.
2. Hinges to be set in slot in door and frame and projection welded to frame and securely attached to door;
3. Hinge pin to be spun over at ends to resist removal.
4. 3-teir lockers to have two hinges – all on right hand side of door

G. Recessed Door Handle:
1. On single, double and triple tier lockers, handles shall be recessed.

2. No moving parts are to operate against outside surface of locker.
3. The recessed handle shall be 4-1⁄8"w x 6-1⁄16"h x 1-1⁄4"d.

H. Latching:
1. Triple tier locking device shall engage frame at two points.
2. Channel shaped locking device with full length reinforcing ribs shall be a quiet design utilizing nylon guide inserts to reduce metal-to-metal contact.
3. The locking device shall include a latch finger that engages the 12-gauge door jamb.
4. Lock bar shall be enclosed on three sides and operate within the channel formation of the door.
5. Locking device shall be prelocking so mechanism can be locked in open position – door locking automatically when closed.
6. Doors also to be provided with lock hole filler to permit use of built in lock.

I. Coat rods:
1. Triple tier lockers shall have one 5⁄8" diameter double prong hook and three single prong wall hooks.
2. All hooks to be zinc plated or subjected to a comparable rust retardant treatment and attached with two bolts.

J. Legs/Base:
1. Lockers shall be furnished with 6" legs and optional front and end closed bases.

K. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

L. Finish:
1. Exposed steel parts shall be thoroughly cleaned, given a bonding and rust inhibitive phosphate treatment and then electrostatically sprayed with powder coat.
2. Color: As selected by Architect from manufacturer's full range

2.4 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

D. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

E. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

2.5 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls[, and elsewhere as indicated,] for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.

B. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.[Verify that integral locking devices operate properly.]

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

SECTION 10 56 13

METAL STORAGE SHELVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal storage shelving.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete.

B. Section 05 40 00 - Cold formed metal framing..

1.3 SUBMITTALS

A. Submit product data under provisions of Division 01.

B. Submit product data for sizes, types, and methods of construction, and attachment details.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Division 01.

B. Protect metal shelving from damage by other trades. Store in dry protected areas. Replace any damaged items at no cost to Owner.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Heavy Duty Solid Shelving SPC-028:
1. Basis of Design: Penco
2. Model: Rivet Rite, or equal by Republic.
3. Units: 16 gauge galvanized flat steel shelves, 1-5/8 inch diameter steel posts with shelf adjust-ability in 2 inch increments. Each shelving unit shall be 18 inches deep x 36 inches long x 84 inches high.
4. Finish/Color: As selected by Architect.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install shelving per manufacturer’s recommendations.

B. Fasten shelving to walls and floor as indicated on Drawings.

C. Install metal shelving units in locations as designated on the Drawings. Units shall be set plumb and level.

END OF SECTION

SECTION 10 75 16

GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes ground-set flagpoles made from aluminum.

B. Owner-Furnished Material: 5 ft x 8 ft Flags.

1.03 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001.
2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.03 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Entasis-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm).
1. American Flagpole
2. L. Ph. Bolander and Sons
3. U.S. Flag and Flagpole Supply
4. Or approved Equal

B. Exposed Height: 30 feet

C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Shoe Base: Cast aluminum shoe base will be anchored using four galvanized steel anchor bolts (55,000 PSI minimum yield) conforming to AASHTO M314-90 Grade 55. Threaded end of bolt will be galvanized 10” per ASTM A153. Kits will contain (4) hex nuts, (4) lock washers and (4) flat washers, with all components being galvanized steel. Anchor bolts will be secured in foundation utilizing 3000 psi concrete.

E. Flashing Collar: Same material and finish as flagpole.

2.04 FITTINGSA. Finial (Ornament): Finial sized as indicated or, if not indicated, to match pole butt diameter.

2.05 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

2.06 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

B. Powder Coated Finish: Thermo-set Polyester Powder Coated Finish, with a minimum thickness of 1-½ mils. Application shall be in a closed loop automated powder coating system to insure uniformity and quality of finish.

PART 3 - EXECUTION

3.01 PREPARATION

A. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

B. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

C. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.

D. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.02 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION

SECTION 11 20 00

COMMERCIAL EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes:

1. Defibrillator (AED)
2. Brochure Rack
3. Assisted Listening Device

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUBMITTALS

A. Submit under the provisions of Section 01 33 00.

B. Product Data: For each type of product indicated. Include the following:

1. Manufacturer's model number.
2. Accessories and components that will be included for Project.
3. Clearance requirements for access and maintenance.
4. Utility service connections for water, drainage, and power; include roughing-in dimensions.

C. Samples for Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each factory-applied color finish required, in manufacturer's standard sizes.

E. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.

F. Coordination Drawings:

1. Indicate locations of commercial equipment and connections to utilities.
2. Key equipment using same designations.
3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.
4. Include details of seismic bracing for equipment.

G. Closeout Submittals

1. Operation and Maintenance Data: For commercial equipment to include in emergency, operation, and maintenance manuals.

a. Product Schedule: For each commercial equipment item, include the following:

1. Manufacturer's name and model number.

2. List of factory-authorized service agencies including addresses and telephone numbers.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.06 AIDS TO USE

A. All record documentation, Operation and Maintenance Data and training shall be provided in accordance with Division 1 – General Requirements.

B. Upon completion, the Contractor shall provide:

1. Manuals of operating and maintenance literature, pursuant to the requirements of the General Conditions.

2. Contractor to provide training for the CHP personnel in the operation, upkeep and basic maintenance of the system, pursuant to the requirements of the General Conditions.

PART 2 - PRODUCTS

2.01 The Basis of Design products listed are for reference only. CONTRACTOR shall have the option to submit an equal product that provides similar quality. Other manufacturers exist that can be priced during the proposal period that the CONTRACTOR finds to be equal.

2.02 EQUIPMENT

A. DEFIBRILLATOR

1. Automated external defibrillator, Cardiac Science G3 Plus 9390A-1001, or approved equal.
2. CPR kit.
3. Wall cabinet.
4. Carry case.
5. AED signage.

6. 2-pair adult electrode pads.
7. Battery.
8. Users Manual.
9. Quantity:
   a. Per Drawings

B. BROCHURE RACK

1. Literature holder, floor standing; Model BDI1224BLK, or approved equal.
   a. 12/24 Adjustable Pockets with removable Dividers
   b. Melamine with wire pockets, Black

C. ASSISTED LISTENING DEVICE

1. ALS System: Listen Technologies LT-84-01 Transmitters/Radiator Combo; LA-141 Expansion Radiator, Advanced Intelligent DSP IR Receiver 6-Pack, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install commercial equipment level and plumb, according to manufacturer's written instructions.

1. Connect equipment to utilities.
2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

B. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.

3.02 CLEANING AND PROTECTING

A. After completing installation of equipment, repair damaged finishes.

B. Clean and adjust equipment as required to produce ready-for-use condition.

C. Protect equipment from damage during remainder of the construction period.

END OF SECTION

SECTION 12 21 13

HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Horizontal louver blinds with aluminum slats.

1.03 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For horizontal louver blinds, include fabrication and installation details.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

D. Samples for Initial Selection: For each type and color of horizontal louver blind.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type and color of horizontal louver blind indicated.

1. Slat: Not less than 12 inches long.
2. Tapes: Full width, not less than 6 inches long.
3. Horizontal Louver Blind: Full-size unit, not less than 16 inches wide by 24 inches long.
4. Valance: Full-size unit, not less than 12 inches wide.

F. Product Test Reports: For each type of horizontal louver blind, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Horizontal Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.02 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

A. Manufacturers:
1. Levolor Inc., Riviera
2. SWF Contracts

3. Or Approved Equal

B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.

1. Width: 1 inches
2. Thickness: .008 inch
3. Spacing: Manufacturer's standard
4. Finish: Ionized antistatic, dust-repellent, baked polyester finish
5. Reflective Coating: Manufacturer’s special coating enhancing the reflection of solar energy on the outside facing slat surface.

C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrails fully enclose operating mechanisms on three sides.

1. Ends: Capped or plugged

D. Manual Lift Mechanism:

a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within blind full operating range
b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.

2. Manual Tilt Mechanism:
   a. Tilt: Two-direction
   b. Operator: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
   c. Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over rotation of gear.
   d. Designed for eliminating all visible light gaps if slats are tilted closed and with minimal sized rout holes for ladders hidden and placed near back edge for maximum slat overlap; with headrail and bottom rail extended and formed for light tight joints between rail and adjacent slats or construction.

E. Bottom Rail: Formed-steel or extruded-aluminum tube that secures and protects ends of ladders and lift cords and has plastic- or metal-capped ends.

F. Lift Cords: Manufacturer's standard braided cord.

G. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.

1. Type: Braided cord

H. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.

1. Type: Overhead

2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.

I. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.

J. Colors, Textures, Patterns, and Gloss:

1. Slats: As selected by Architect from manufacturer's full range
2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated

2.03 HORIZONTAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch, plus or minus 1/8 inch.

C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish:

1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so exterior slat edges are not closer than 1 inch from interior faces of glass and not closer than 1/2 inch from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting and intermediate brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.03 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.04 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION

SECTION 12 48 16

ENTRANCE FLOOR GRILLES

PART 1 - GENERAL

1.01 Summary

A. This section includes the following:
   1. Entrance floor mats and frames
   2. Entrance floor grids and frames

1.02 Related Work

A. Related work that is specified elsewhere
   1. Section 03 10 00 Concrete Formwork and Accessories
   2. Section 03 30 00 Cast-In-Place Concrete

1.03 SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for entrance floor grilles, foot grilles and frames.

B. Samples: For the following products, in manufacturer's standard sizes:

   1. Floor Grille: Assembled section of floor grille.
   2. Frame Members: Sample of each type and color.

1.04 Coordination

A. Submittals shall be completed and approved prior to fabrication and shipment of material to jobsite.

B. Subcontract for the work of this section shall be planned to allow sufficient time for manufacturer’s production and delivery scheduling.

C. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

D. Verify field conditions affecting entrance floor mats, entrance floor grids, and frames fabrication and installation. Show field measurements on submittal drawings. Coordinate field measurement schedule to avoid delay.

1.05 Delivery, Storage, and Handling

A. Provide temporary protective cover on anodized aluminum finished surfaces.

B. Deliver entrance floor mats, entrance floor grids, and frames to jobsite in clean, unopened crates of sufficient size and strength to protect materials during transit.

C. Store components in original containers in a clean, dry location.

1.06 Warranty

A. Submit manufacturer's warranty that materials furnished will perform as specified for a period of not less than two (2) years when installed in accordance with manufacturer's recommendations.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor grilles and frames to include in maintenance manuals.

1.08 FIELD CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.09 1.05 Quality Assurance

A. Manufacturer: Obtain entrance floor mats, entrance floor grids, and frame assemblies through one source from a single manufacturer.

B. Installer: All products listed in this section shall be installed by a single installer with demonstrated experience in installing products of the same type and scope as specified. Installer shall be insured and licensed as required by agencies within the project's jurisdiction and acceptable to the manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Balco, Inc., Basis of Design: FM2R-C

B. Construction Specialties, Inc.

C. J.L. Industries

D. Or approved Equal

2.02 ENTRANCE FLOOR GRILLES, GENERAL

A. Structural Performance: Provide floor grilles and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:

1. Uniform floor load of 300 lbf/sq. ft.
2. Wheel load of 350 lb per wheel.

B. Accessibility Standard: In addition to requirements of authorities having jurisdiction, provide installed foot grilles that comply with “Americans with Disabilities Act” (ADA).

2.03 FLOOR GRILLES

A. General: Provide manufacturer's standard floor-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.

2.04 FRAMES

A. Provide manufacturer's standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

2.05 Materials

A. Aluminum extrusions: ASTM B221, alloy 6063-T5, alloy 6005-T5, alloy 6061-T6

B. Leading edge fillers and hinges: Flexible PVC.

C. Liners:
1. Galvanized steel: ASTM A653, G90, 20 gauge
2. Aluminum: ASTM B209, alloy 5052-H32, 0.063” thick
3. Stainless Steel: ASTM A666, type 304, 22 gauge

D. Abrasive: Two (2) part Epoxy combined with aluminum oxide grit

E. Heavy-Duty Carpet: Carpet strips with extruded polypropylene backing. Solution dyed polypropylene yarns, 50/50 blend of 600/12 denier multifilament and 595/D1 denier monofilament. Total denier 6975. 13 Picks per inch. Minimum weight 28 oz. /sq. yd.

F. Standard fasteners required for assembly and installation shall be included

G. All surfaces in contact with masonry or concrete shall be protected by a factory-applied coating.

2.06 Finishes

A. Aluminum Extrusions: Mill finish, AA-M10 (As fabricated, unspecified) standard. Optional finishes: [Clear Anodized] [Color anodized – Select color from manufacturer's standard colors]

B. Carpet: [Select color from manufacturer's standard colors]

C. Abrasive: [Select color from manufacturer's standard colors]

D. PVC Hinges: [Select color from manufacturer's standard colors]

2.07 Fabrication

A. Fabricate entrance floor mats and frames as detailed.
   1. Fabricate entrance floor mats and frames of width and length as shown on shop drawings.
   2. Fabricate entrance floor mats and frame pans of width, length, and depth as shown on shop drawings.
   3. Standard fasteners required for assembly and installation shall be included.

B. Provide components in single size where possible; minimize site splicing.
   1. Maximum single mat width shall be 12' (3.6m) wide for mats with carpet or heavy-duty carpet inserts, 10' (3.0m) for mats with abrasive inserts. Larger sizes shall be fabricated in modular sections.
   2. Provide minimal number of pieces possible for frames that exceed maximum length.
   3. Provide frames with hairline joints, equally spaced, complete with corner pins, splice plates, and installation anchors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, size, minimum recess depth, and other conditions affecting installation of floor grilles and frames.

B. Examine roughing-in for drainage piping systems to verify actual locations of piping connections before floor grille and frame and drain pan installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install recessed floor grilles and frames to comply with manufacturer's written instructions at locations indicated and with top of floor grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set floor-grille tops at height for most effective cleaning action. Coordinate top of floor-grille surfaces with adjacent doors provide clearance under door.

3.03 PROTECTION

A. After completing frame installations, provide temporary filler of plywood or fiberboard in floor-grille recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes the following:
   1. Benches
   2. Trash receptacles
   3. Ash receptacles
   4. Bike racks
   5. Cluster seating
   6. Umbrellas

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 DESCRIPTION

A. Work includes but is not limited to the following:

   1. Furnish all labor, materials, tools, equipment, operation or methods listed, mentioned or scheduled on Drawings and/or herein specified in this Section.

   2. Although such Work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

   3. Completely coordinate with Work of all other trades.

1.04 QUALITY ASSURANCE

A. All products or items described herein shall be new, unless otherwise specified, and shall be from the specified manufacturer or approved equal. Products shall be complete in all respects, properly installed, and in perfect working order.

1.05 QUALIFICATION OF INSTALLER

A. Installer shall be thoroughly trained and experienced in the skills required, and shall be completely familiar with the products and their installation as specified on Landscape Concept Plan and in this Section. Installer shall be present at all times during progress of Work of this Section and shall direct all Work performed.

1.06 COORDINATION

A. Contractor shall be charged with the responsibility of making arrangements for the coordination of his construction operations with those of all others on the job, and he shall permit other forces so engaged to accomplish their portion of the Work without undue interference or delay.

B. Contractor shall place order for all site furnishings and equipment immediately after award of bid to ensure adequate time for manufacturing, shipping and installation. If any materials or equipment are not ordered in time, additional costs made by equipment manufacturer's to their equipment in time to meet construction schedule together with any special handling costs, shall be borne by the Contractor. NO project extension shall be granted due to improper lead time in ordering.

1.07 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Samples of each type of product with color charts.

C. Submit six (6) copies of manufacturer's catalog cuts off all products for State approval. Catalog cuts shall clearly identify product, finishes, color, schedule and installation.

D. Manufactures' specifications and other data needed to prove compliance with the specified products.

E. Maintenance Data.

PART 2 - PRODUCTS

2.01 BENCHES

A. Concrete Bench with back.

1. Products: Subject to compliance with requirements, provide benches from one of the following:

a. Outdoor Creations, Inc.: #419SKB Contour Bench 90”

b. Or equal.

2. Description: Standard seven foot six inch long bench with back and anti skateboard system.

a. Material: Concrete

b. Color: Color shall be match with trash receptacles and ash receptacles.

2.02 TRASH AND RECYCLING RECEPTACLES

A. Products: Subject to compliance with requirements, provide all trash receptacles from one of the following:

1. Outdoor Creations Inc.: #512 Concrete Trash Receptacle-Square

2. Or equal.

B. Description: Standard 40 gallon trash receptacle. Includes concrete dome lid for rain protection.

1. Material: Concrete

2. 14 ga steel powder coated door. Color to be selected by architect.

3. Concrete Color: Color shall be match with bench and ash receptacles.

4. Engrave sides with appropriate waste designation.

2.03 ASH RECEPTACLES

A. Products: Subject to compliance with requirements, provide all ash receptacles from one of the following:

1. Outdoor Creations Inc.: #600 Concrete Ashtray-Square

2. Or equal.

B. Description: Standard Ash Receptacles.

1. Material: Concrete

2. Deep well for sand pit.

3. Concrete Color: Color shall be match with bench and trash receptacles.

2.04 BIKE RACK

A. Products: Subject to compliance with requirements, provide all bike racks from one of the following:

1. Dura Bike Racks, a division of Hannan Specialties, Inc.: Model DBR5
   a. Color to be chosen by Architect from Manufacturer’s full range.

2. Or approved Equal.

2.05 BIKE LOCKER

A. Products: Subject to compliance with requirements, provide all bike racks from one of the following:

1. Dura Bike Racks, a division of Hannan Specialties, Inc.: Model DLSP
   a. Color to be chosen by Architect from Manufacturer's full range.

2. Or approved Equal.

2.06 CLUSTER SEATING

A. Products: Subject to compliance with requirements, provide all cluster seating from one of the following:

1. Anova Furnishings 211 North Lindbergh Blvd, Suite 200 St. Louis, Missouri 63141-7809 (800)231-1327 (314)754-0835 fax anovafurnishings.com: Cosmopolitan L1740 Cluster Table

2. Or approved equal.

2.07 UMBRELLAS

A. Products: Subject to compliance with requirements, provide all umbrellas from one of the following:

1. Kay Park Recreation Corp., which is located at: 1301 Pine St.; Janesville, IA 50647; Toll Free Tel: 800-553-2476; Tel: 319-987-2313; Fax: 319-987-2900; Email:request info (sales@kaypark.com); Web:www.kaypark.com: UHM7OC, 6 Rib Hexagon Patio Wind-resistant Umbrella, 7 1/2 feet.
2.
3. Or approved equal

PART 3 - EXECUTION

3.01 GENERAL

A. Adequately protect all work from damage by subsequent construction operations. Damaged work shall be replaced by Contractor and at Contractor's expense.

B. Work shall be set true to line and shall present a neat and finished appearance. Include setting each item in its correct place, securely fastening it, connecting it, or incorporating it into other portions of the work, as each item my require; and testing and operating equipment to assure proper functioning. Furnish anchors and adhesives required for securely installing and attaching the equipment specified herein.

C. Install per manufacturers drawings, details and specifications.

END OF SECTION

SECTION 12 93 13

BICYCLE LOCKERS

PART 1 PRODUCTS

1.1 SECTION INCLUDES

A. Bicycle Lockers:
   1. Single bicycle capacity locker. (BV-1).

1.2 RELATED SECTIONS

A. Section 31 20 00 - Earth Moving.

B Not used.

C. Section 32 13 13 - Concrete Paving.

D. Section 03 30 00 - Cast-in-Place Concrete.

E. Section 05 50 00 - Metal Fabrications.

1.3 REFERENCES

A. American International (ASTM):
   1. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   2. ASTM A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A 312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
   4. ASTM A 314 - Standard Specification for Stainless Steel Billets and Bars for Forging.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including full range of standard color selections.

C. Shop Drawings: Indicate materials, dimensions, tolerances, welding, fasteners, hardware, mounting, finish, and accessories.

D. Quality Assurance Submittals:
   1. Qualifications: Proof of manufacturer qualifications.
   2. Manufacturer's Installation Instructions.

E. Selection Samples: Color charts illustrating full range of colors and patterns.

F. Verification Samples: Sample of actual color chip selected.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product.

B. Do not store products in location with conditions outside manufacturer's absolute limits.

C. Materials delivered to the site shall be examined for concealed damage or defects in shipping. Defects shall be noted and reported to the Owner's Representative in writing.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

A. Warranty: Manufacturer's standard warranty.
1. Seller warranties to replace, or at seller's option, repair any product or part thereof which is found to be defective in material or workmanship for a period of one year from date buyer accepts products. All parts and labor required under warranty provisions shall be supplied free of charge.
2. Transportation costs of returning the products to and from repair facility or costs involved with contractor personnel traveling to buyer's facility for the purpose of repairing products on site shall be borne by seller during 1 year warranty period.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Huntco Site Furnishings, which is located at: P. O. Box 10385; Portland, OR 97296; Toll Free Tel: 800-547-5909; Tel: 503-224-8700; Fax: 503-274-2055; Email: request info (sales@huntco.com); Web: www.huntco.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 BIKE LOCKERS

A. Bike Lockers:
1. Basis of Design: Model: BV-1 as manufactured by Huntco Site Furnishings.
a. Capacity: 1 bicycle.
b. Hinges: Stainless steel piano style hinges.
c. Materials: Stainless steel, # satin finish.
d. Materials: Steel.
1) Finishes: Single coating of Tiger Drylac triglycidyl isocyanurate (TGIC) polyester powder coatings, 3-4 mils thick.
1) Colors: As indicated on Drawings.

e. Construction: No exposed fasteners.
1) Doors: 14 gauge.
2) Door Frames: 12 gauge.
3) Sidewall Panels: 14 gauge sidewall panels.
4) Roof Panels: 14 gauge sidewall panels.
f. Perforations: None.
g. Hardware: Stainless steel pistol-grip style handle with "U" lock Box
h. Mounting: Surface mount vertically adjusting stainless steel feet for leveling and bolting to concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which bicycle racks will be installed. Verify that surfaces are clean, flat and level within manufacturer's recommended installation tolerances.

B. If preparation is the responsibility of another installer, notify Architect of deviations from manufacturer's recommended installation tolerances and conditions.

C. Do not proceed with installation until substrates have been properly prepared and deviations are corrected.

D. Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

A. Install bicycle racks/lockers in accordance with manufacturer's installation instructions.

B. Install bicycle racks/lockers level, plumb, square, accurately aligned, correctly located per drawings, and without warp.

C. Mounting: Hardware and fasteners in accordance with manufacturer's instructions
1. For Surface Flange Mounted Bicycle Racks: Anchor bicycle racks securely in place with galvanized 1/2 inch HILTI-KB-TZ anchor bolts through flange holes with 3-1/4” embedment into 4” min. concrete slab..

3.3 CLEANING AND PROTECTION

A. Clean in accordance with manufacturer's recommendations.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products and finishes in accordance with manufacturer's instructions before Substantial Completion.

END OF SECTION

SECTION 13 34 20

STEEL CANOPY

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

A. Provide all materials, labor and accessories as required and specified for complete steel canopy installation.

1.03 RELATED DOCUMENTS

A. Cast-In-Place Concrete: Section 03 30 00.

B. Reinforcing Steel: Section 03 21 00.

C. Not used.

D. Structural Steel: Section 05 12 00.

E. Metal Decking: Section 05 30 00.

1.04 SUMMARY

A. This section includes the following:

1. Furnishing and installation of structural steel canopies including structure, footing and all other items specified hereunder.

2. Fabrication and installation of steel canopies for Parking Canopies with photovoltaics.

3. Fabrication and installation of steel canopies for Waiting Canopies without photovoltaics.

1.05 CANOPY DESIGN

A. Canopies shall be full cantilever design per DSA requirements.

B. Design Criteria:

1. Parking Canopies:

a. Design of structure shall include Photovoltaic panel installations.

C. Basic Design Criteria: AISC “Specifications for Design, Fabrication and Erection of Structural Steel for Buildings”.

D. Canopies shall be designed and fabricated in conformance with the requirements of the American Iron and Steel Institute and the American Institute of Steel Construction.

E. Design shall conform to requirements of the California Building Code (CBC) and the following:

1. Soil bearing values shall be taken from the site specific geotechnical and geological hazard report.

2. Design for not less than 20 lbs./sq. ft. roof live load.

3. Concrete footing 28-day compressive strength shall be f’c = 4000 psi Minimum.

4. Wind and seismic design loads shall be as specified in CBC, Chapter 16A. Importance factor = 1.0.

F. Design shall include loads imposed upon the canopies of a complete photovoltaic system.

G. Canopies shall be designed by a California licensed civil or structural engineer.

H. Canopies shall be coordinated with top of concrete footings.

1.06 SUBMITTALS

A. Submit Design Calculations signed and stamped by a California Licensed Civil or Structural Engineer.

B. Shop Drawings shall include the following individual detail sheets:

1. Cover Sheet

2. Column/Post Plan

3. Column Anchoring Details

4. Framing Details

5. Roof Details

6. Elevations

7. Gutter and Drainage Details

C. Product Data

D. Submit 2 samples of color palette for State's selection and approval of color.

1.07 QUALITY ASSURANCE

A. For DSA requirements, refer to pertinent sections of Division 01 and CBC Chapter 22A.

B. All tests shall be performed by a DSA approved laboratory as specified in pertinent sections of Division 01 and CBC Chapters 17A and 22A.

C. Testing and Inspection:

1. DSA statement of structural tests and special inspections (DSA-103) shall be prepared by the registered design professional in responsible charge.

D. The DSA approved laboratory shall review all submittals and testing of materials per Chapters 17A and 22A of the CBC.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials shall conform to the specifications and standard practices of the latest editions of the AISC Manual of Steel Construction, AISI Specifications for Design of Cold Formed Members, ASTM A6 Standard Specifications for General Requirements for Rolled Steel Plates, Shapes, Sheets and Bars of Structural Use, and AWSD1.1 for welded connections.

2.02 ROOF DECKING (At Waiting Canopies Only)

A. Deck panels shall conform to ASTM A653 Grade 50 steel with minimum yield strength of 50 ksi, with a G60 galvanized surface per ASTM A924. Panels shall have a minimum thickness of 24 gauge and shall not be spliced.

B. Panels shall have a finish side coated with a full coat of premium silicon polyester paint baked on over an epoxy primer. Color to be selected by State and match the canopy. A white wash coat baked on over an epoxy primer shall protect the interior side of the panel.

C. Panels shall have a minimum 20 year manufacturer's finish warranty against cracking, checking and fading.

D. Roof shall have a minimum slope of 0.5:12.

2.03 STEEL TUBE COLUMNS

A. Columns shall conform to ASTM A500 Grade B steel tubing with a minimum yield strength of 46 ksi with welded brackets and plates of ASTM A36 structural steel plate with a minimum yield strength of 36 ksi. Plates shall be sized for required loads.

Gussets shall be used as required. Columns shall be provided with electrical access openings, cover plates, conduits and drains.

1. Engineered by a California Licensed Civil or Structural engineer.

2. Approximate size: HSS 16” x 16” square tubing.

3. Columns shall be shot blasted, and galvanized after fabrication.

2.04 STEEL BEAMS

A. Roof beams shall be ASTM A500 Grade B steel tubing HSS shapes and have minimum yield strength of 46 ksi.

1. Engineered by a California Licensed Civil or Structural engineer.

2. Approximate size: HSS 14x10x1/2”, W24 or equal.

3. Provide 1/4” plates caps at open ends.

4. Provide full zinc base organic coating applied to the interior surface for corrosion protection.

5. Provide full zinc base organic coating applied to the interior surface for corrosion protection.

6. The exterior surface shall be galvanized after fabrication.

2.05 STEEL PURLINS

A. Purlins shall be ASTM A500 Grade B steel tubing HSS shape and have minimum yield strength of 46 ksi.

1. Engineered by a California Licensed Civil or Structural engineer.

2. Approximate size: HSS 5x5x1/2” or equal.

3. Provide 1/4” plates caps at open ends.

4. The exterior surface shall be galvanized after fabrication.

2.06 FASTENERS AND BOLTS

A. Roof fasteners shall be self tapping/self drilling type and shall be designed to withstand specified design loads. Neoprene washers shall be supplied for all roof fasteners.

B. Structural bolts shall conform to ASTM A325 Specification for High Strength Bolts for Structural Steel Joints. All structural steel framing members shall be shop fabricated for field assembly, unless otherwise specified.

C. Anchor bolts shall conform to ASTM A36 with minimum yield strength of 36 ksi. Standard anchor bolt size shall be 1-1/4 inch diameter by 44 inch long with minimum 7 inch, 90-degree bend. Anchor bolts shall be placed with a minimum projection of 8 inches above top of footer. Double nuts and washers shall be provided with each anchor bolt, with one set to be used for leveling column. Galvanized sheet metal templates for setting anchor bolts shall be provided. Templates shall be removed prior to setting columns on anchor bolts.

D. All fasteners, anchor bolts and bolts, shall be zinc plated and provided with a factory applied coating in a color to match metal panels.

2.07 ROOF DRAINS AND DOWNSPOUTS (At Waiting Canopies Only)

A. Gutter shall have an epoxy primer and provided with a power coated paint finish. A white wash coat baked on over an epoxy primer shall protect the interior side of the gutter. Gutter leaders to column drain shall be 20 gauge steel and 8 inch wide x 6 inch deep.

B. External downspouts shall be 4 inch x 3 inch rolled formed 26 gauged steel with watertight locked seams. Exterior paint with one full coat of polyester paint baked on over epoxy primer. Downspouts to be of one contiguous length up to 15 feet. Larger drains shall be used where required for proper drainage.

C. Downspouts shall be located so as to direct water away from the driveway.

PART 3 - EXECUTION

3.01 GENERAL

A. Install canopy frames plumb, level and true to line in accordance with the manufacturer's instructions and the approved shop drawings.

3.02 SEALANT

A. Provide and apply a synthetic rubber sealant between metal base channel and concrete and elsewhere as necessary for weatherproofing. Handle and apply sealant and back-up per sealant manufacturer's recommendations. Sealant shall be approved by the canopy’s manufacturer.

B. Touch-Up: At the completion of the work, all scratched, abraded, or other areas where the finish on the frame, beams, columns, or other parts of the assembly are damaged, shall be touched-up with paint furnished by the manufacturer, which matches the original finish. Contractor shall submit one gallon of touch-up paint furnished by the manufacturer to the State for future touch-ups.

END OF SECTION

SECTION 21 05 17

SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.02 STACK-SLEEVE FITTINGS

A. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.03 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig (137 kPa) minimum.
3. Sealing Elements: EPDM-rubber High-temperature-silicone Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

2.04 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.05 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.06 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 84 13 "Penetration Firestopping."

3.02 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Use silicone sealant to seal around the outside of stack-sleeve fittings.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.03 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.04 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use grout or silicone sealant, to seal the space around outside of sleeve-seal fittings.

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.06 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6 (DN 150): Cast-iron pipe sleeves, Steel pipe sleeves, Sleeve-seal fittings.
b. Piping NPS 6 (DN 150) and Larger: Cast-iron pipe sleeves, Steel pipe sleeves, Sleeve-seal fittings.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6 (DN 150): Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, Sleeve-seal fittings.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 (DN 150) and Larger: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6 (DN 150): Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, Sleeve-seal fittings.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 (DN 150) and Larger: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, Sleeve-seal fittings.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6 (DN 150): Steel pipe sleeves, Sleeve-seal fittings.
   b. Piping NPS 6 (DN 150) and Larger: Steel pipe sleeves.

5. Interior Partitions:

   a. Piping Smaller Than NPS 6 (DN 150): Steel pipe sleeves.
   b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 21 05 17

SECTION 21 05 18

ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.03 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated polished brass finish and setscrew fastener.

2.02 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece steel cast brass or split-plate steel with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated polished brass finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated polished brass finish.
e. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece cast brass with polished, chrome-plated rough-brass finish.
g. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate.
2. Existing Piping: Split floor plate.

3.02 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 21 05 18

SECTION 21 05 23

GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Indicator posts.
9. Trim and drain valves.

1.03 DEFINITIONS

A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. SBR: Styrene-butadiene rubber.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

a. Level 1: HCBZ - Indicator Posts, Gate Valve.
b. Level 1: HLOT - Valves.

1) Level 3: HLUG - Ball Valves, System Control.
2) Level 3: HLXS - Butterfly Valves.
3) Level 3: HMER - Check Valves.
4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

a. Indicator posts.
b. Valves.

1) Gate valves.
2) Check valves.

a) Single check valves.

3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 (DN 50) and smaller.

2.02 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. NIBCO INC.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear or traveling nut.
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 (DN 25) through NPS 2 (DN 50): Threaded ends.
12. End Connections for Valves NPS 2-1/2 (DN 65): Grooved ends.

2.03 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International.
2. Globe Fire Sprinkler Corporation.
3. Kennedy Valve Company; a division of McWane, Inc.
4. NIBCO INC.
5. Tyco Fire Products LP.
6. Victaulic Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Grooved-end connections.

2.04 CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International.
2. Globe Fire Sprinkler Corporation.
3. Kennedy Valve Company; a division of McWane, Inc.
4. Mueller Co.
5. NIBCO INC.
6. Reliable Automatic Sprinkler Co., Inc. (The).
7. Tyco Fire Products LP.
8. Victaulic Company.
9. Viking Corporation.
10. Watts; a Watts Water Technologies company.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.

6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.05 IRON OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kennedy Valve Company; a division of McWane, Inc.
2. Mueller Co.
3. NIBCO INC.
4. Victaulic Company.
5. Watts; a Watts Water Technologies company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged, Grooved, Threaded.

2.06 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-End & Croker Corporation.
b. NIBCO INC.
c. Potter Roemer LLC.
d. Tyco Fire Products LP.
e. Victaulic Company.
f. Watts; a Watts Water Technologies company.

2. Description:

a. Pressure Rating: 175 psig (1200 kPa).
b. Body Design: Two piece.
c. Body Material: Forged brass or bronze.

d. Port size: Full or standard.
e. Seats: PTFE.
f. Stem: Bronze or stainless steel.
g. Ball: Chrome-plated brass.
h. Actuator: Handlever.
i. End Connections for Valves NPS 1 (DN 25) through NPS 2-1/2 (DN 65): Threaded ends.
j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2 (DN 32 and DN 65): Grooved ends.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. NIBCO INC.

2. Description:

a. Pressure Rating: 175 psig (1200 kPa).
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. NIBCO INC.

2. Description:

a. Pressure Rating: 175 psig (1200 kPa).
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

1. Section 21 11 00 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping outside the building.
2. Section 21 13 13 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 21 05 53 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves

are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 21 05 23

SECTION 21 05 29

HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 21 05 48 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for vibration isolation devices and seismic restraints.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.05 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, licensed in the State of California to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

C. NFPA Compliance: Comply with NFPA 13.

D. UL Compliance: Comply with UL 203.

2.02 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.04 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or Stainless steel.
2. Outdoor Applications: Stainless steel.

2.05 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.06 MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M).

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

3.02 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

H. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.06 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 09 91 13 "Exterior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.07 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and attachments for general service applications.

D. Use stainless-steel pipe hangers and corrosion-resistant attachments for hostile environment applications.

E. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

G. Hanger-Rod Attachments: Comply with NFPA requirements.

H. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

I. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

J. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 21 05 29

SECTION 21 05 48

VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Pipe-riser resilient supports.
5. Resilient pipe guides.
6. Elastomeric hangers.
7. Snubbers.
8. Restraint channel bracings.
9. Seismic-restraint accessories.
10. Mechanical anchor bolts.
11. Adhesive anchor bolts.

B. Related Requirements:

1. Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.
2. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.03 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
    d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: B.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.

a. Component Importance Factor: 1.0
b. Component Response Modification Factor: 1.5
c. Component Amplification Factor: 1.0

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): <Insert number>.
4. Design Spectral Response Acceleration at 1.0-Second Period: <Insert number>.
5. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

    a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.02 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads: <Insert drawing designation>.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Novia; A Division of C&P.
    g. Vibration Eliminator Co., Inc.
    h. Vibration Isolation.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth, Ribbed, Waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.

    a. Surface Pattern: Smooth, Ribbed, Waffle pattern.
    b. Infused nonwoven cotton or synthetic fibers.

2.03 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts: <Insert drawing designation>.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.

d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Novia; A Division of C&P.
g. Vibration Eliminator Co., Inc.
h. Vibration Isolation.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.04 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts: <Insert drawing designation>.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Novia; A Division of C&P.
g. Vibration Eliminator Co., Inc.
h. Vibration Isolation.

2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene or other elastomeric material.

2.05 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene <Insert drawing designation>.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.

2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.06 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post-and-sleeve arrangement separated by a minimum 1/2-inch- thick neoprene <Insert drawing designation>.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.07 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: <Insert drawing designation>.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.08 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.

2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.09 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Mason Industries, Inc.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.10 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-line, an Eaton business.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.11 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

2.12 ADHESIVE ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti, Inc.
2. Kinetics Noise Control, Inc.

B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.03 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 07 72 00 "Roof Accessories" for installation of equipment supports and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on fire-suppression equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

J. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 21 13 13 "Wet-Pipe Sprinkler Systems,".

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.

8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

END OF SECTION 21 05 48

SECTION 21 05 53

IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: stainless steel, 0.025 inch (0.64 mm) aluminum, 0.032 inch (0.8 mm) or anodized aluminum, 0.032 inch (0.8 mm) thick, with predrilled holes for attachment hardware.
2. Letter Color: Black.

3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
5. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

E. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.04 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping.
2. Stencil Material: Fiberboard or metal.
3. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.

4. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.05 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping-system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: stainless steel, 0.025 inch (0.64 mm) aluminum, 0.032 inch (0.8 mm) or anodized aluminum, 0.032 inch (0.8 mm) thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain beaded chain or S-hook.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.06 WARNING TAGS

A. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches (100 by 178 mm).
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Piping: Painting of piping is specified in Section 09 91 23 "Interior Painting."

B. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Wet-Pipe Sprinkler System: 2 inches (50 mm), square.
b. Clean-Agent Fire-Extinguishing System: 2 inches (50 mm), square.

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 21 05 53

SECTION 21 08 00

COMMISSIONING OF FIRE SUPPRESSION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes Cx process requirements for the following fire-suppression systems, assemblies, and equipment:

1. Water-based fire-suppression systems.
2. Fire-extinguishing systems.
3. Clean Agent systems.

B. Related Requirements:

1. Section 01 91 13 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
2. For construction checklists, comply with requirements in various Division 21 Sections specifying fire-suppression systems, system components, equipment, and products.

1.03 DEFINITIONS

A. Cx: Commissioning, as defined in Section 01 91 13 "General Commissioning Requirements."

B. CxA: Commissioning Authority, as defined in Section 01 91 13 "General Commissioning Requirements."

C. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fire-suppression testing technician.

B. Construction Checklists: Draft construction checklists will be created by CxA for Contractor review.

C. Construction Checklists: Material, installation, and performance test checklists for systems, assemblies, subsystems, equipment, and components to be part of the Cx process and according to requirements in Section 01 91 13 "General Commissioning Requirements."

1. Facility fire-suppression water distribution piping outside the building, including the following:

    a. Fire-suppression water piping, fittings, and specialties outside the building.
    b. Hydrants and fire-department connections.
    c. Fire-alarm devices.
    d. Meters and meter pits.
    e. Sleeves and sleeve seals.
    f. Meters and gages.
    g. General-duty and specialty valves.
    h. Hangers and supports.
    i. Vibration isolation and seismic restraints.
    j. Identification.

2. Fire-suppression sprinkler systems, including the following:

    a. Wet-pipe sprinkler piping, fittings, sprinklers, and specialties.
    b. Sleeves and sleeve seals.
    c. Meters and gages.
    d. General-duty and specialty valves.
    e. Hangers and supports.
    f. Vibration isolation and seismic restraints.
    g. Identification.

D. Test equipment and instrumentation list, identifying the following:

1. Equipment/instrument identification number.
2. Planned Cx application or use.
3. Manufacturer, make, model, and serial number.
4. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
5. Equipment manufacturers' proprietary instrumentation and tools. For each instrument or tool, identify the following:

    a. Instrument or tool identification number.
    b. Equipment schedule designation of equipment for which the instrument or tool is required.
    c. Manufacturer, make, model, and serial number.
    d. Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

1.05 QUALITY ASSURANCE

A. Fire-Suppression Testing Technician Qualifications: Technicians to perform fire-suppression construction checklist verification tests, construction checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:

1. Journey level or equivalent skill level with knowledge of fire-suppression system, electrical concepts, and building operations.
2. Minimum three years' experience installing, servicing, and operating systems manufactured by approved manufacturer.

B. Testing Equipment and Instrumentation Quality and Calibration:

1. Capable of testing and measuring performance within the specified acceptance criteria.
2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
3. Be maintained in good repair and operating condition throughout duration of use on Project.
4. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

C. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:

a. Be calibrated by manufacturer with current calibration tags permanently affixed.
b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
c. Fire-suppression system proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 CONSTRUCTION CHECKLISTS

A. Prepare detailed construction checklists for fire-suppression systems, subsystems, equipment, and components.

1. Water-based fire-suppression systems, including the following:

a. Facility fire-suppression water-service piping.
b. Wet-pipe sprinkler systems.

3.02 CONSTRUCTION CHECKLIST REVIEW

A. Review and provide written comments on draft construction checklists. CxA will create required draft construction checklists and provide them to Contractor.

B. Return draft construction checklist review comments within 10 days of receipt.

C. When review comments have been resolved, the CxA will provide final construction checklists, marked "Approved for Use, (date)."

D. Use only construction checklists, marked "Approved for Use, (date)."

3.03 Cx TESTING PREPARATION

A. Certify that fire-suppression systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved submittals.

B. Certify that fire-suppression systems instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved submittals, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.04 Cx TEST CONDITIONS

A. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

B. If tests cannot be completed because of a deficiency outside the scope of the fire-suppression system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.

C. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.05 Cx TESTS COMMON TO FIRE-SUPPRESSION SYSTEMS

A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.

B. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response according to acceptance criteria.

C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.

D. Comply with construction checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Division 21 Sections specifying fire-suppression systems and equipment.

E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:

1. Construction checklist verification tests.
2. Construction checklist verification test demonstrations.
3. Cx tests.
4. Cx test demonstrations.

F. Vibration Isolation in Fire-Suppression Systems:

1. Prerequisites: Acceptance of results of construction checklists for vibration and seismic control devices specified in Section 21 05 48 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
2. Components to Be Tested:

    a. Vibration isolation and seismic control devices in water-based fire-suppression systems.
    b. Structural systems.

3. Test Purpose: Evaluate effectiveness of vibration isolation and seismic control devices.
4. Test Conditions: Measure vibration of the facility structure at three locations designated by Owner's witness while the isolated equipment operates.
5. Test Conditions: Measure vibration of the facility structure at three locations designated by Owner's witness at the following operating conditions:

    a. Maximum speed.
    b. Minimum speed.
    c. Critical speed.

6. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.

G. Supervision of Fire-Protection Valves in Water-Based Fire-Suppression Systems:

1. Prerequisites: Acceptance of results of construction checklists for valves specified in the Sections listed below:

   a. Section 21 05 23 "General-Duty Valves for Water-Based Fire Protection Piping."
   b. Section 21 11 00 "Facility Fire-Suppression Water-Service Piping."
   c. Section 21 13 13 "Wet-Pipe Sprinkler Systems."
   d. Section 28 46 21.11 "Addressable Fire-Alarm Systems."

2. Equipment and Systems to Be Tested:

   a. Supervised valves in water-based fire-suppression systems.
   b. Division 28 fire-detection and -alarm systems.

3. Test Purpose: Verify generation of supervisory alarm at the fire-alarm control panel in response to activation of valve supervision device or tamper switch.
4. Test Conditions:

   a. Fire-alarm system operating in normal, automatic mode.
   b. Activate valve supervision devices and tamper switches, one at a time.

5. Acceptance Criteria: Activation of valve supervision device or tamper switch generates supervisory alarm at fire-alarm control panel.

END OF SECTION 21 08 00

SECTION 21 11 00

FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes fire-suppression water-service piping and related components outside the building and service entrance piping through floor into the building and service entrance piping through wall into the building and the following:

1. Pipes, fittings, and specialties.
2. Fire-suppression specialty valves.
3. Concrete vaults.
4. Protective enclosures.
5. Alarm devices.

B. Utility-furnished products include water meters that are furnished to the site, ready for installation.

C. Related Requirements:

1. Section 21 11 16 "Facility Fire Hydrants" for AWWA and UL-listed, dry- and wet-barrel fire hydrants.
2. Section 21 11 19 "Fire-Department Connections" for exposed-, flush-, and yard-type, fire-department connections.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
2. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.07 PROJECT CONDITIONS

A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.01 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.

D. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Grooved-End, Ductile-Iron Fittings: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions matching pipe.
2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.

1. Gaskets: AWWA C111, rubber.

G. Flanges: ASME B16.1, Class 125, cast iron.

2.02 PVC PIPE AND FITTINGS

A. PVC Pipe: AWWA C900 or UL 1285, Class 150 and Class 200, with bell end with gasket, and with spigot end.

B. PVC Fittings: AWWA C900 or UL 1285, Class 150 and Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.03 SPECIAL PIPE FITTINGS

A. Ductile-Iron Flexible Expansion Joints:

1. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
2. Pressure Rating: 250 psig (1725 kPa) minimum.

B. Ductile-Iron Deflection Fittings:

1. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
2. Pressure Rating: 250 psig (1725 kPa) minimum.

2.04 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105.

B. Material: Linear low-density PE film of 0.008-inch (0.20-mm) minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

2.05 JOINING MATERIALS

A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

2.06 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
2. Standard: AWWA C219.
3. Center-Sleeve Material: Manufacturer's standard.
4. Gasket Material: Natural or synthetic rubber.
5. Pressure Rating: 150 psig (1035 kPa) minimum.
6. Metal Component Finish: Corrosion-resistant coating or material.

2.07 DETECTOR CHECK VALVES

A. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

B. Standards: UL 312 and FM Global's "Approval Guide."

C. Pressure Rating: 175 psig (1200 kPa).

D. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

2.08 WATER METERS

A. Water meters are furnished by utility company.

B. Compound-Type Water Meters:

1. Standard: AWWA C702.
2. Registration: Flow in gallons (liters).

C. Remote Registration System:

1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C706.
3. Registration: Flow in gallons (liters).

2.09 DETECTOR-TYPE WATER METERS

A. Fire-Protection, Detector Check Water Meters:

1. Description: Main-line turbine meter with strainer and second meter on bypass.
2. Standards: UL's "Fire Protection Equipment Directory" listing and FM Global's "Approval Guide."
3. Registration: Flow in gallons (liters).
4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Bypass Meter: AWWA C701, turbine-type, bronze case.

    a. Size: At least NPS 2 (DN 50).

B. Remote Registration System:

1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C706.
3. Registration: Flow in gallons (liters).

2.10 BACKFLOW PREVENTERS

A. Double-Check, Backflow-Prevention Assemblies:

1. Standard: ASSE 1015 or AWWA C510.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
4. Body Material: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
6. Configuration: Designed for horizontal, straight through flow.

7. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

B. Backflow Preventer Test Kits:

1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.11 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" on cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" on top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

2.12 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C857, and made according to ASTM C858.

B. Ladder: ASTM A36/A36M, steel ladder

C. Manhole: ASTM A48/A48M, Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.

1. Dimension: 24-inch (610-mm) minimum diameter unless otherwise indicated.

D. Manhole: ASTM A536, Grade 60-40-18, ductile-iron traffic frame and cover.

1. Dimension: 24-inch (610-mm) minimum diameter unless otherwise indicated.

E. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.13 ALARM DEVICES

A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig (1725-kPa) working pressure; designed for horizontal or vertical installation; with two single-pole,

double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Comply with excavating, trenching, and backfilling requirements in Section 31 20 00 "Earth Moving."

3.02 PIPING INSTALLATION

A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company's standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.

6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install encasement for piping according to ASTM A674 or AWWA C105.

G. Install PVC, AWWA pipe according to ASTM F645 and AWWA M23.

H. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:

I. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

J. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.

1. Terminate fire-suppression water-service piping within the building at the floor slab until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.

K. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

L. Comply with requirements for fire-suppression water-service piping inside the building in the following Sections:

1. Section 21 13 13 "Wet-Pipe Sprinkler Systems

M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.03 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in tubing NPS 2 (DN 50) and smaller.

C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of tubes and remove burrs.

E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

F. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

G. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.

H. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.

I. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D2774 or ASTM D3139.

J. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

K. Do not use flanges or unions for underground piping.

3.04 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.05 VALVE INSTALLATION

A. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

B. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.

C. MSS Valves: Install as component of connected piping system.

3.06 DETECTOR CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

3.07 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install compound-type water meters NPS 3 (DN 80) and larger in meter vaults. Include shutoff valves on water meter inlets and outlets, and include valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.08 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.09 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

3.10 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches (50 mm) above surface.

3.11 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C891.

3.12 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches (50 mm) above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.13 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.

B. Install protective pipe bollards on two sides of each freestanding fire-department connection. Pipe bollards are specified in Section 05 50 00 "Metal Fabrications."

3.14 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.

1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:

1. Valves: Install chain and padlock on open OS&Y gate valve.
2. Post Indicators: Install padlock on wrench on indicator post.

D. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

E. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Section 28 46 21.11 "Addressable Fire-Alarm Systems."

3.15 CONNECTIONS

A. Connect fire-suppression water-service piping to utility water main. Use tapping sleeve and tapping valve.

B. Connect fire-suppression water-service piping to interior fire-suppression piping.

3.16 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig (zero kPa). Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare test and inspection reports.

3.17 IDENTIFICATION

A. Install continuous underground warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.18 CLEANING

A. Clean fire-suppression water-service piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in

NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow it to stand for three hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging activities.

3.19 PIPING SCHEDULE

A. Underground fire-suppression water-service piping NPS 3 (DN 80) and larger shall be one of the following:

1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.

B. Underslab fire-suppression water-service piping NPS 3 (DN 80) and larger shall be one of the following:

1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and restrained, gasketed joints.
3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and restrained, gasketed joints.

3.20 VALVE SCHEDULE

A. Underground fire-suppression water-service shutoff valves NPS 2 (DN 50) and smaller shall be corporation valves or curb valves with ends compatible with piping.

B. Meter box fire-suppression water-service shutoff valves NPS 2 (DN 50) and smaller shall be meter valves.

C. Underground fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be one of the following:

1. 200-psig (1380-kPa), AWWA, iron, nonrising-stem, metal resilient-seated gate valves.
2. 250-psig (1725-kPa), AWWA, iron, nonrising-stem, resilient-seated gate valves.
3. [175-psig (1200-kPa)] [250-psig (1725-kPa)], UL-listed or FM Global-approved, iron, nonrising-stem gate valves.

D. Indicator-post underground fire-suppression water-service valves NPS 3 (DN 80) and larger shall be 175-psig (1200-kPa), UL-listed or FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.

E. Standard-pressure, aboveground and vault fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be one of the following:

1. 200-psig (1380-kPa), AWWA, iron, OS&Y, metal resilient-seated gate valves.
2. 250-psig (1725-kPa), AWWA, iron, OS&Y, resilient-seated gate valves.
3. 175-psig (1200-kPa), UL-listed or FM Global-approved, iron, OS&Y gate valves.
4. UL-listed or FM Global-approved butterfly valves.

F. Fire-suppression water-service check valves NPS 3 (DN 80) and larger shall be one of the following:

1. UL-listed or FM Global-approved check valves.
2. UL-listed or FM Global-approved detector check valves.

END OF SECTION 21 11 00

SECTION 21 11 16

FACILITY FIRE HYDRANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. AWWA dry-barrel fire hydrants.

B. Related Requirements:

1. Section 21 11 00 "Facility Fire-Suppression Water-Service Piping" for piping and specialties for facility fire-suppression water-service piping outside the building and for service entrance piping into the building at the floor slab or wall.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire hydrants to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 AWWA DRY-BARREL FIRE HYDRANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American AVK Company.
2. American Cast Iron Pipe Company.
3. American Foundry Group, Inc.
4. Clow Valve Company; a subsidiary of McWane, Inc.
5. EJ.

6. Kennedy Valve Company; a division of McWane, Inc.
7. M & H Valve Company; a division of McWane, Inc.

B. Description: Post type, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets; and with 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body and compression-type valve that opens against pressure and closes with pressure.

C. Standard: AWWA C502.

1. Pressure Rating: 150 psig (1035 kPa) minimum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire hydrants.

B. Examine roughing-in for facility fire-suppression water-service piping to verify actual locations of piping connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA Fire Hydrants: Comply with AWWA M17.

END OF SECTION 21 11 16

SECTION 21 11 19

FIRE DEPARTMENT CONNECTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Yard-type fire-department connections.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2 - PRODUCTS

2.01 YARD-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Elkhart Brass Mfg. Co., Inc.
2. Fire Protection Products, Inc.
3. Fire-End & Croker Corporation.
4. GMR International Equipment Corporation.
5. Guardian Fire Equipment, Inc.
6. Potter Roemer LLC.

B. Standard: UL 405.

C. Type: Exposed, freestanding.

D. Pressure Rating: 175 psig minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, floor type.

I. Outlet: Bottom, with pipe threads.

J. Number of Inlets: Two.

K. Sleeve: Brass.

L. Sleeve Height: 18 inches.

M. Escutcheon Plate Marking: Similar to "AUTO SPKR."

N. Finish, Including Sleeve: Rough brass or bronze.

O. Outlet Size: NPS 4.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 03 30 00 "Cast-in-Place Concrete."

B. Install two protective pipe bollards around each fire-department connection. Comply with requirements for bollards in Section 05 52 00 "Pipe Bollards."

C. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 21 11 19

SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

B. Related Requirements:

1. Section 21 11 19 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 23 05 23 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.03 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig (1200 kPa), but not higher than 250 psig (1725 kPa).

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig (1200-kPa) maximum.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

C. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

D. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling include the following:

a. Lighting fixtures.
b. Air outlets and inlets.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

F. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.08 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.09 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Owner's written permission.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

C. High-Pressure Piping System Component: Listed for 250-psig (1725-kPa) minimum 300-psig (2070-kPa) working pressure.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Available fire-hydrant flow test records indicate the following conditions:

a. Date: 07/23/2018.
b. Performed by: Kern County Fire Department.
c. Location of Residual Fire Hydrant R: Dover South of Morse St. West side of street.
d. Location of Flow Fire Hydrant F: 4.5 port
e. Static Pressure at Residual Fire Hydrant R: 63 psig.
f. Measured Flow at Flow Fire Hydrant F: 3096 gpm.
g. Residual Pressure at Residual Fire Hydrant R: 54 psig.

2. Sprinkler system design shall be approved by authorities having jurisdiction.

a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
b. Sprinkler Occupancy Hazard Classifications:

1) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
2) General Storage Areas: Ordinary Hazard, Group 1.
3) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
4) Office and Public Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m) area.
b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m) area.

4. Maximum Protection Area per Sprinkler: According to UL listing.

5. Maximum Protection Area per Sprinkler:

    a. Office Spaces: 225 sq. ft. (20.9 sq. m).
    b. Storage Areas: 130 sq. ft. (12.1 sq. m).
    c. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
    d. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
    e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.02 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized- and Black-Steel Pipe: ASTM A53/A53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Thinwall Galvanized- and Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.

D. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M thinwall with plain ends and wall thickness less than Schedule 10.

E. Hybrid Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.

F. Galvanized- and Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

G. Galvanized- and Uncoated-Steel Couplings: ASTM A865/A865M, threaded.

H. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

I. Malleable- or Ductile-Iron Unions: UL 860.

J. Cast-Iron Flanges: ASME 16.1, Class 125.

K. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.

    a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.

b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

L. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

M. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International.
b. Corcoran Piping System Co.
c. National Fittings, Inc.
d. Shurjoint Piping Products.
e. Smith-Cooper International.
f. Tyco Fire Products LP.

2. Pressure Rating: 175-psig (1200-kPa) minimum.
3. Galvanized Painted Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

N. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig (1200-kPa) pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

2.03 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig (1200-kPa) minimum.
2. High-Pressure Piping Specialty Valves: 250-psig (1725-kPa) minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Globe Fire Sprinkler Corporation.
    b. Reliable Automatic Sprinkler Co., Inc. (The).
    c. Tyco Fire Products LP.
    d. Victaulic Company.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Reliable Automatic Sprinkler Co., Inc. (The).

2. Standard: UL 1726.
3. Pressure Rating: 175-psig (1200-kPa) minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4 (DN 20).
6. End Connections: Threaded.

2.04 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International.
    b. Tyco Fire Products LP.

2. Standard: UL 213.
3. Pressure Rating: 175-psig (1200-kPa) minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.

7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AGF Manufacturing Inc.
    b. Reliable Automatic Sprinkler Co., Inc. (The).
    c. Tyco Fire Products LP.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig (1200-kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AGF Manufacturing Inc.
    b. Tyco Fire Products LP.
    c. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig (1200-kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Aegis Technologies, Inc.
    b. CECA, LLC.
    c. Corcoran Piping System Co.

2. Standard: UL 1474.
3. Pressure Rating: 250-psig (1725-kPa) minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Fivalco Inc.
    b. FlexHead Industries, Inc.
    c. Gateway Tubing, Inc.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig (1200-kPa) minimum.
5. Size: Same as connected piping, for sprinkler.

2.05 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire Products LP.
4. Victaulic Company.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Automatic Sprinklers: 175-psig (1200-kPa) minimum.

D. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.

2. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

E. Sprinkler Finishes: Chrome plated bronze and painted.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat Chrome-plated steel, two piece, with 1-inch (25-mm) vertical adjustment Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel Plastic, white finish, one piece, flat.

G. Sprinkler Guards:

1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.

2.06 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Globe Fire Sprinkler Corporation.
b. Tyco Fire Products LP.
c. Victaulic Company.

2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 8-1/2-inches (216-mm) diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4 (DN 20).
8. Outlet: NPS 1 (DN 25) drain connection.

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Notifier.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch (150-mm) minimum- diameter.

5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Potter Electric Signal Company, LLC.
   b. System Sensor.
   c. Viking Corporation.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig (1725 kPa).
7. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Kennedy Valve Company; a division of McWane, Inc.
   c. Potter Electric Signal Company, LLC.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.07 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.08 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.

1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

C. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

D. Panels Components:

1. Power supply.
2. Battery charger.
3. Standby batteries.
4. Field-wiring terminal strip.
5. Electrically supervised solenoid valves and polarized fire-alarm bell.
6. Lamp test facility.
7. Single-pole, double-throw auxiliary alarm contacts.
8. Rectifier.

2.09 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AGF Manufacturing Inc.
2. AMETEK, Inc.
3. Ashcroft Inc.
4. Brecco Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

D. Pressure Gage Range: 0- to 250-psig (0- to 1725-kPa) minimum.

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.02 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 21 11 00 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 21 11 00 "Facility Fire-Suppression Water-Service Piping."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.03 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 22 11 13 "Facility Water Distribution Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.04 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 21 05 48 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

N. Fill sprinkler system piping with water.

O. Not used

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 05 18 "Escutcheons for Fire-Suppression Piping."

3.05 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

3.06 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.07 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.08 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.09 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
4. Standard-weight, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 (DN 65) and larger, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
6. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.
3. Wall Mounting: Sidewall sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

4. Residential Sprinklers: Dull chrome.
5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13

SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with

indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

3. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Used)

END OF SECTION 22 05 13

SECTION 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Rubber union connector packless expansion joints.
2. Flexible-hose packless expansion joints.
3. Metal-bellows packless expansion joints.
4. Externally pressurized metal-bellows packless expansion joints.
5. Rubber packless expansion joints.
6. Grooved-joint expansion joints.
7. Alignment guides and anchors.
8. Pipe loops and swing connections.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

2.02 PACKLESS EXPANSION JOINTS

A. Rubber Union Connector Expansion Joints RUEJ-01:

1. Material: Twin reinforced-rubber spheres with external restraining cables.
2. Minimum Pressure Rating: 150 psig at 170 deg F (1035 kPa at 77 deg C), unless otherwise indicated.
3. End Connections for NPS 2 (DN 50) and Smaller: Threaded.

B. Flexible-Hose Packless Expansion Joints FHEJ-01:

1. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
2. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
3. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.

    a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
    b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 500 psig at 450 deg F (3450 kPa at 232 deg C) ratings.

4. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Copper-alloy fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F (2890 kPa at 21 deg C) and 315 psig at 450 deg F (2170 kPa at 232 deg C) ratings.

5. Expansion Joints for Steel Piping NPS 2 (DN 50) and Smaller: Carbon-steel fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 515 psig at 600 deg F (3550 kPa at 315 deg C) ratings.

6. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Carbon-steel fittings with flanged welded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C) ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F (1900 kPa at 21 deg C) and 200 psig at 600 deg F (1380 kPa at 315 deg C) ratings.

7. Expansion Joints for Steel Piping NPS 8 to NPS 12 (DN 200 to DN 300): Carbon-steel fittings with flanged welded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F (860 kPa at 21 deg C) and 90 psig at 600 deg F (625 kPa at 315 deg C) ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.

8. Expansion Joints for Steel Piping NPS 14 (DN 350) and Larger: Carbon-steel fittings with flanged welded end connections.

    a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.

C. Metal-Bellows Packless Expansion Joints MBEJ-01:

1. Standards: ASTM F1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
2. Type: Circular, corrugated bellows with external tie rods.
3. Minimum Pressure Rating: 150 psig (1035 kPa) 175 psig (1200 kPa) 200 psig (1379 kPa), unless otherwise indicated.
4. Configuration: Single joint Single joint with base and double joint with base class(es), unless otherwise indicated.
5. Expansion Joints for Copper Tubing: Single- or multi- ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

    a. End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: Solder joint or threaded.
    b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Solder joint or threaded.
    c. End Connections for Copper Tubing NPS 5 (DN 125) and Larger: Flanged.

6. Expansion Joints for Steel Piping: Single- or multi- ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.

    a. End Connections for Steel Pipe NPS 2 (DN 50) and Smaller: Threaded.
    b. End Connections for Steel Pipe NPS 2-1/2 (DN 65) and Larger: Flanged Welded.

D. Externally Pressurized Metal-Bellows Packless Expansion Joints EPEJ-01:

1. Minimum Pressure Rating: 150 psig (1035 kPa) 200 psig (1379 kPa) 300 psig (2068 kPa), unless otherwise indicated.
2. Description:

    a. Totally enclosed, externally pressurized, multi-ply, stainless-steel bellows isolated from fluid flow by an internal pipe sleeve.
    b. Carbon-steel housing.
    c. Drain plugs and lifting lug for NPS 3 (DN 80) and larger.
    d. Bellows shall have operating clearance between the internal pipe sleeves and the external shrouds.
    e. Joints shall be supplied with a built-in scale to confirm the starting position and operating movement.
    f. Joint Axial Movement: 4 inches (100 mm) 6 inches (150 mm) 8 inches (200 mm) of compression and 0.75 inch (19 mm) 1 inch (25 mm) 2 inches (50 mm) of extension.

3. Permanent Locking Bolts: Set locking bolts to maintain joint lengths during installation. Temporary welding tabs that are removed after installation in lieu of locking bolts are not acceptable.
4. End Connection Configuration: Flanged; one raised, fixed and one floating flange.

E. Rubber Packless Expansion Joints REJ-01:

1. Standards: ASTM F1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
2. Material: Fabric-reinforced rubber complying with FSA-PSJ-703.
3. Arch Type: Single or multiple arches with external control rods.
4. Spherical Type: Single or multiple spheres with external control rods.
5. Minimum Pressure Rating for NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 150 psig (1035 kPa) at 220 deg F (104 deg C).
6. Minimum Pressure Rating for NPS 5 and NPS 6 (DN 125 and DN 150): 140 psig (966 kPa) at 200 deg F (93 deg C).
7. Minimum Pressure Rating for NPS 8 to NPS 12 (DN 200 to DN 300): 140 psig (966 kPa) at 180 deg F (82 deg C).
8. Material for Fluids Containing Acids, Alkalis, or Chemicals: Butyl rubber Chlorosulfonyl-polyethylene rubber Ethylene-propylene-diene terpolymer rubber.
9. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N Chlorosulfonated polyethylene synthetic rubber.
10. Material for Water: Butyl rubber Buna-N Chlorosulfonated polyethylene synthetic rubber Chlorosulfonyl-polyethylene rubber Ethylene-propylene-diene terpolymer rubber Natural rubber.
11. End Connections: Full-faced, integral steel flanges with steel retaining rings.

2.03 GROOVED-JOINT EXPANSION JOINTS

A. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

B. Standard: AWWA C606, for grooved joints.

C. Nipples: Galvanized, ASTM A53/A53M, Schedule 40, Type E or S, steel pipe with grooved ends.

D. Couplings: Five Seven 10 12, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water ethylene-propylene-diene terpolymer rubber gasket suitable for cold and hot water, and bolts and nuts.

2.04 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides AG-01:

1. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A36/A36M.

2. Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.
3. Washers: ASTM F844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Stud: Threaded, zinc-coated carbon steel.
    b. Expansion Plug: Zinc-coated steel.
    c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Bonding Material: ASTM C881/C881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    b. Stud: ASTM A307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.01 EXPANSION JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

C. Install rubber packless expansion joints according to FSA-PSJ-703.

D. Install grooved-joint expansion joints to grooved-end steel piping.

3.02 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.03 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 22 05 16

SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.02 STACK-SLEEVE FITTINGS

A. Description: Manufactured, Dura-coated or Duco-coated cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.03 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig (137 kPa) minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

2.04 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.05 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.06 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 84 13 "Penetration Firestopping."

3.02 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.03 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.04 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.06 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6 (DN 150): Cast-iron pipe sleeves.
b. Piping NPS 6 (DN 150) and Larger: Cast-iron pipe sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6 (DN 150): Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 (DN 150) and Larger: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6 (DN 150): Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 (DN 150) and Larger: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

    a. Piping Smaller Than NPS 6 (DN 150): PVC pipe sleeves.
    b. Piping NPS 6 (DN 150) and Larger: PVC pipe sleeves.

5. Interior Partitions:

    a. Piping Smaller Than NPS 6 (DN 150): PVC pipe sleeves.
    b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 22 05 17

SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.03 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Brass Manufacturing Co.

B. Dearborn Brass

C. Mid-American Fittings, Inc.

D. Or equal.

2.02 ESCUTCHEONS

A. One-Piece, Steel Type: With polished brass finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished brass finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.03 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece cast brass with polished, chrome-plated finish.
c. Insulated Piping: One-piece steel with polished brass finish.
d. Insulated Piping: One-piece stainless steel with polished stainless-steel finish.
e. Insulated Piping: One-piece cast brass with polished brass finish.
f. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
g. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished brass finish.
h. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
i. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished brass finish.
j. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

k. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished brass finish.
l. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
m. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished brass finish.
n. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
o. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
p. Bare Piping in Unfinished Service Spaces: One-piece cast brass with rough-brass finish.
q. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
r. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.
s. Bare Piping in Equipment Rooms: One-piece cast brass with polished, chrome-plated rough-brass finish.
t. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate.
2. Existing Piping: Split floor plate.

3.02 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 22 05 18

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.

B. Related Requirements:

1. Section 22 11 13 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 BIMETALLIC-ACTUATED THERMOMETERS

A. Standard: ASME B40.200.

B. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) nominal diameter.

C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F (deg C).

D. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

E. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.

F. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.

G. Window: Plain glass.

H. Ring: Stainless steel.

I. Element: Bimetal coil.

J. Pointer: Dark-colored metal.

K. Accuracy: Plus or minus 1 percent of scale range.

2.02 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Standard: ASME B40.200.
2. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
3. Element: Bourdon tube or other type of pressure element.
4. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
6. Pointer: Dark-colored metal.
7. Window: Glass.
8. Ring: Metal.
9. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.

11. Accuracy: Plus or minus 1 percent of scale range.

2.03 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch (152-mm) nominal size.
3. Case Form: Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum; 7-inch (178-mm) 9-inch (229-mm) nominal size unless otherwise indicated.
3. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
6. Window: Glass.
7. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.04 LIGHT-ACTIVATED THERMOMETERS

A. Direct-Mounted, Light-Activated Thermometers:

1. Case: Metal; 7-inch (178-mm) nominal size unless otherwise indicated.
2. Scale(s): Deg F (Deg C).
3. Case Form: Adjustable angle.

4. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
5. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

6. Display: Digital.
7. Accuracy: Plus or minus 2 deg F (1 deg C).

2.05 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1 (DN 15, DN 20, or NPS 25), ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.06 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Solid-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 (DN 8) NPS 1/4 or NPS 1/2 (DN 8 or DN 15) NPS 1/2 (DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Metal.
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.07 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8) NPS 1/4 or NPS 1/2 (DN 8 or DN 15) NPS 1/2 (DN 15), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 (DN 8) NPS 1/4 or NPS 1/2 (DN 8 or DN 15) NPS 1/2 (DN 15), ASME B1.20.1 pipe threads.

2.08 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).

E. Core Inserts: EPDM self-sealing rubber.

2.09 TEST-PLUG KITS

A. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-)diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).

E. Carrying Case: Metal or plastic, with formed instrument padding.

2.10 SIGHT FLOW INDICATORS

A. Description: Piping inline-installation device for visual verification of flow.

B. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

C. Minimum Pressure Rating: 125 psig (860 kPa) 150 psig (1034 kPa).

D. Minimum Temperature Rating: 200 deg F (93 deg C).

E. End Connections for NPS 2 (DN 50) and Smaller: Threaded.

F. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.

3.02 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Metal case, industrial-style, liquid-in-glass type.
4. Direct -mounted, light-activated type.
5. Test plug with EPDM self-sealing rubber inserts.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.05 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C)

B. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F (0 to 150 deg C).

C. Scale Range for Domestic Cooled-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C).

3.06 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Solid-front, pressure-relief, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with EPDM self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Solid-front, pressure-relief, direct-mounted, metal case.
2. Sealed, direct -mounted, plastic case.
3. Test plug with EPDM self-sealing rubber inserts.

3.07 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi (0 to 1100 kPa).

B. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa).

END OF SECTION 22 05 19

SECTION 22 05 23.14

CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bronze lift check valves.
2. Bronze swing check valves.
3. Bronze swing check valves, press ends.
4. Iron swing check valves.
5. Iron swing check valves with closure control.
6. Iron, grooved-end swing check valves.
7. Iron, center-guided check valves.
8. Iron, plate-type check valves.
9. CPVC ball check valves.
10. PVC ball check valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 and NSF 372.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE LIFT CHECK VALVES

A. Bronze Lift Check Valves with Bronze Disc, Class 125:

1. Description:

    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Vertical flow.
    d. Body Material: ASTM B61 or ASTM B62, bronze.
    e. Ends: Threaded or soldered. See valve schedule articles.
    f. Disc: Bronze.

B. Bronze Lift Check Valves with Nonmetallic Disc, Class 125:

1. Description:

    a. Standard: MSS SP-80, Type 2.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Vertical flow.
    d. Body Material: ASTM B61 or ASTM B62, bronze.
    e. Ends: Threaded or soldered. See valve schedule articles.
    f. Disc: NBR, PTFE.

2.03 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Bronze Disc, Class 125:

1. Description:

    a. Standard: MSS SP-80, Type 3.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B62, bronze.
    e. Ends: Threaded or soldered. See valve schedule articles.
    f. Disc: Bronze.

B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:

1. Description:

    a. Standard: MSS SP-80, Type 4.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B62, bronze.
    e. Ends: Threaded or soldered. See valve schedule articles.
    f. Disc: PTFE.

C. Bronze Swing Check Valves with Bronze Disc, Class 150:

1. Description:

    a. Standard: MSS SP-80, Type 3.

b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

D. Bronze Swing Check Valves with Nonmetallic Disc, Class 150:

1. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

E. Bronze Swing Check Valves, Press Ends:

1. Description:

a. Standard: MSS SP-80 and MSS SP-139.
b. CWP Rating: Minimum 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B584, bronze.
e. Ends: Press.
f. Press Ends Connection Rating: Minimum 200 psig (1380 kPa).
g. Disc: Brass or bronze.

2.04 IRON SWING CHECK VALVES

A. Iron Swing Check Valves with Metal Seats, Class 125:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.

B. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).

c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Composition.
g. Seat Ring: Bronze.
h. Disc Holder: Bronze.
i. Disc: PTFE.
j. Gasket: Asbestos free.

C. Iron Swing Check Valves with Metal Seats, Class 250:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.05 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed exterior lever and weight.

B. Iron Swing Check Valves with Lever and Weight-Closure Control, Class 125:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed exterior lever and weight.

2.06 IRON, GROOVED-END SWING CHECK VALVES

A. Iron, Grooved-End Swing Check Valves, 300 CWP:

1. Description:

a. CWP Rating: 300 psig (2070 kPa).
b. Body Material: ASTM A536, ductile iron.
c. Seal: EPDM.
d. Disc: Spring operated, ductile iron or stainless steel.

2.07 IRON, CENTER-GUIDED, SPRING-LOADED CHECK VALVES

A. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 125:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

B. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 125:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

C. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 150:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

D. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 150:

1. Description:

a. Standard: MSS SP-125.

b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

E. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 250:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

F. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 250:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

G. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 300:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

H. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 300:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

I. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 125:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: EPDM or NBR.

J. Iron Globe, Center-Guided Check Valves with Resilient Seat, Class 125:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

K. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 150:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Compact wafer, spring loaded.
e. Seat: EPDM or NBR.

L. Iron, Globe, Center-Guided Check Valves with Resilient Seat, Class 150:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

M. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 250:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A126, gray iron.

d. Style: Compact wafer, spring loaded.
e. Seat: EPDM or NBR.

N. Iron Globe, Center-Guided Check Valves with Resilient Seat, Class 250:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

O. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 300:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Compact wafer, spring loaded.
e. Seat: EPDM or NBR.

P. Iron Globe, Center-Guided Check Valves with Resilient Seat, Class 300:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

2.08 IRON, PLATE-TYPE CHECK VALVES

A. Iron, Dual-Plate Check Valves with Metal Seat, Class 125:

1. Standard: API 594.
2. CWP Rating: 200 psig (1380 kPa).
3. Body Design: Wafer, spring-loaded plates.
4. Body Material: ASTM A126, gray iron.
5. Seat: Bronze.

B. Iron, Dual-Plate Check Valves with Metal Seat, Class 150:

1. Standard: API 594.
2. CWP Rating: 300 psig (2070 kPa).

3. Body Design: Wafer, spring-loaded plates.
4. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
5. Seat: Bronze.

C. Iron, Dual-Plate Check Valves with Metal Seat, Class 250:

1. Standard: API 594.
2. CWP Rating: 400 psig (2760 kPa).
3. Body Design: Wafer, spring-loaded plates.
4. Body Material: ASTM A126, gray iron.
5. Seat: Bronze.

D. Iron, Dual-Plate Check Valves with Metal Seat, Class 300:

1. Standard: API 594.
2. CWP Rating: 500 psig (3450 kPa).
3. Body Design: Wafer, spring-loaded plates.
4. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
5. Seat: Bronze.

E. Iron, Single-Plate Check Valves with Resilient Seat, Class 125:

1. Standard: API 594.
2. CWP Rating: 200 psig (1380 kPa).
3. Body Design: Wafer, spring-loaded plate.
4. Body Material: ASTM A126, gray iron.
5. Seat: EPDM or NBR.

F. Iron, Dual-Plate Check Valves with Resilient Seat, Class 125:

1. Standard: API 594.
2. CWP Rating: 200 psig (1380 kPa).
3. Body Design: Wafer, spring-loaded plates.
4. Body Material: ASTM A126, gray iron.
5. Seat: EPDM or NBR.

G. Iron, Dual-Plate Check Valves with Resilient Seat, Class 150:

1. Standard: API 594.
2. CWP Rating: 300 psig (2070 kPa).
3. Body Design: Wafer, spring-loaded plates.
4. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
5. Seat: EPDM or NBR.

H. Iron, Wafer, Single-Plate Check Valves with Resilient Seat, Class 250:

1. Standard: API 594.
2. CWP Rating: 400 psig (2760 kPa).
3. Body Design: Wafer, spring-loaded plate.
4. Body Material: ASTM A126, gray iron.

5. Seat: EPDM or NBR.

I. Iron, Dual-Plate Check Valves with Resilient Seat, Class 250:

1. Standard: API 594.
2. CWP Rating: 400 psig (2760 kPa).
3. Body Design: Wafer, spring-loaded plates.
4. Body Material: ASTM A126, gray iron.
5. Seat: EPDM or NBR.

J. Iron, Dual-Plate Check Valves with Resilient Seat, Class 300:

1. Standard: API 594.
2. CWP Rating: 500 psig (3450 kPa).
3. Body Design: Wafer, spring-loaded plates.
4. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
5. Seat: EPDM or NBR.

2.09 CPVC BALL CHECK VALVES

A. Description:

1. Pressure Rating and Temperature: 125 psig (860 kPa) 150 psig (1035 kPa) at 73 deg F (23 deg C).
2. Body Material: CPVC.
3. Body Design: Union-type ball check.
4. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket or threaded.
5. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket socket or threaded threaded flanged.
6. Ball: CPVC.
7. Seals: EPDM- or FKM-rubber O-rings.

2.10 PVC BALL CHECK VALVES

A. Description:

1. Pressure Rating and Temperature: 150 psig (1035 kPa) at 73 deg F (23 deg C).
2. Body Material: PVC.
3. Body Design: Union-type ball check.
4. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket or threaded.
5. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket or threaded.
6. Ball: PVC.
7. Seals: EPDM- or FKM-rubber O-rings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Check Valves: Install check valves for proper direction of flow.

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, metal-seat or resilient-seat check valves.
c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded or soldered or press-ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged.
7. For Grooved-End Copper Tubing and Steel Piping: Grooved.

3.05 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Vertical, Upflow Applications Only: Bronze lift check valves with bronze disc, Class 125, with soldered or threaded end connections.
2. Horizontal and Vertical Applications: Bronze swing check valves with bronze disc, Class 150, with soldered or threaded end connections.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron swing check valves with metal seats, Class 125 Class 250, with threaded or flanged end connections.
2. Iron, grooved-end swing check valves, 300 CWP.
3. Iron, dual-plate check valves with metal seat, Class 150, with threaded or flanged end connections.
4. Iron, single-plate check valves with resilient seat, Class 250, with threaded or flanged end connections.

3.06 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG (1035 TO 1380 kPa)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Vertical, Upflow Applications Only: Bronze lift check valves with bronze disc, Class 125, with soldered or threaded end connections.
2. Horizontal and Vertical Applications: Bronze swing check valves with bronze disc, Class 150, with soldered or threaded end connections.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron swing check valves with metal seats, Class 250, with threaded or flanged end connections.
2. Iron, grooved-end swing check valves, 300 CWP with threaded or flanged end connections.
3. Iron, dual-plate check valves with metal seat, Class 150, with threaded or flanged end connections.
4. Iron, single-plate check valves with resilient seat, Class 125, with threaded or flanged end connections.

3.07 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze swing check valves with bronze disc, Class 150, with soldered or threaded end connections.
2. Bronze swing check valves with press-end connections.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron swing check valves with metal seats, Class 125, with threaded or flanged end connections.
2. Iron swing check valves with closure control lever and weight, Class 125, with threaded or flanged end connections.
3. Iron, grooved-end swing check valves, 300 CWP.
4. Iron, center-guided check valves with compact wafer, Class 150.
5. Iron, center-guided check valves with globe, metal seat, Class 150, with threaded or flanged end connections.
6. Iron, dual-plate check valves with metal seat, Class 150, with threaded or flanged end connections.
7. Iron, single-plate check valves with resilient seat, Class 125, with threaded or flanged end connections.

C. CPVC Pipe NPS 2 (DN 50) NPS 4 (DN 100) and Smaller: CPVC ball check valve.

D. PVC Pipe NPS 2 (DN 50) NPS 4 (DN 100) and Smaller: PVC ball check valve.

END OF SECTION 22 05 23.14

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal hanger-shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe-positioning systems.
10. Equipment supports.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 22 05 16 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.

4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.05 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in the State of California to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.02 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.04 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1 steel pipe hanger, except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of polyurethane or stainless steel.
3. Flammability: ASTM D635, ASTM E84, UL 94.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10 steel pipe hanger, except hanger is made of fiberglass-reinforced resin.

    a. Flammability: ASTM D635, ASTM E84, UL 94.

2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.05 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted stainless-steel, Type 316 channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7. Metallic Coating: Hot-dip galvanized.
8. Paint Coating: Green epoxy, acrylic, or urethane.
9. Plastic Coating: PVC.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted stainless-steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7. Metallic Coating: Hot-dip galvanized
8. Paint Coating: Green epoxy, acrylic, or urethane.
9. Plastic Coating: PVC.

2.06 FIBERGLASS STRUT SYSTEMS

A. Description: Structural-grade, factory-formed, glass-fiber-resin channels and angles for supporting multiple parallel pipes.

1. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
2. Channels: Continuous slotted fiberglass-reinforced plastic channel with inturned lips.
3. Channel Width: Selected for applicable load criteria.
4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
5. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
6. Rated Strength: Selected to suit applicable load criteria.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.07 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig (688-kPa) or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig (688-kPa) ASTM C552, Type II cellular glass with 100-psig (688-kPa) or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.08 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Stainless steel.

2.09 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand:

1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Hardware: Galvanized steel or polycarbonate.
4. Accessories: Protection pads.

C. Low-Profile, Single-Base, Single-Pipe Stand:

1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Vertical Members: Two stainless-steel, continuous-thread, 1/2-inch (12-mm) rods.
4. Horizontal Member: Adjustable horizontal, stainless-steel pipe support channels.
5. Pipe Supports: Roller.
6. Hardware: Stainless steel.
7. Accessories: Protection pads.
8. Height: 12 inches (300 mm) above roof.

D. High-Profile, Single-Base, Single-Pipe Stand:

1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Single vulcanized rubber or molded polypropylene.
3. Vertical Members: Two stainless-steel, continuous-thread, 1/2-inch (12-mm) rods.
4. Horizontal Member: One adjustable-height, galvanized- or stainless-steel, pipe-support slotted channel or plate.
5. Pipe Supports: Roller.
6. Hardware: Stainless steel.
7. Accessories: Protection pads, 1/2-inch (12-mm), continuous-thread, galvanized-steel rod, 1/2-inch (12-mm), continuous-thread, stainless-steel rod.
8. Height: 36 inches (900 mm) above roof.

E. High-Profile, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: Two or more; molded polypropylene.
3. Vertical Members: Two or more, stainless-steel channels.
4. Horizontal Members: One or more, adjustable-height, stainless-steel pipe support.
5. Pipe Supports: Roller.
6. Hardware: Stainless steel.
7. Accessories: Protection pads, 1/2-inch (12-mm), continuous-thread rod.
8. Height: 36 inches (900 mm) above roof.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.10 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.11 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.12 MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M).

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

3.02 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.

H. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

P. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
    e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.06 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 09 91 13 "Exterior Painting." Section 09 91 23 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.07 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger-shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C) pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction occurs.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.
12. Snubbers.
13. Restraint channel bracings.
14. Restraint cables.
15. Seismic-restraint accessories.
16. Mechanical anchor bolts.
17. Adhesive anchor bolts.

B. Related Requirements:

1. Section 21 05 48 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
2. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.03 DEFINITIONS

A. CBC: California Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the CBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the CBC: D.
2. Assigned Seismic Use Group or Building Category as Defined in the CBC: II.

a. Component Importance Factor: 1.0.
b. Component Response Modification Factor: 5.0.
c. Component Amplification Factor: 3.5.

3. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.02 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil and water resistant with elastomeric properties.
4. Surface Pattern: Smooth, Ribbed, or Waffle pattern.
5. Infused nonwoven cotton or synthetic fibers.
6. Load-bearing metal plates adhered to pads.
7. Sandwich-Core Material: Resilient and elastomeric.

a. Surface Pattern: Smooth, Ribbed or Waffle pattern.
b. Infused nonwoven cotton or synthetic fibers.

2.03 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.04 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

    a. Housing: Cast-ductile iron or welded steel.
    b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.05 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.06 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
    b. Top housing with threaded mounting holes and internal leveling device.

2.07 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

    a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
    b. Top plate with threaded mounting holes.
    c. Internal leveling bolt that acts as blocking during installation.

2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.08 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.09 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- (13-mm-) thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.

2. Maximum Load Per Support: 500 psig (3.45 MPa)on isolation material providing equal isolation in all directions.

2.10 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- (13-mm-) thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.11 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.12 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.13 SNUBBERS

A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.

2.14 RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.15 RESTRAINT CABLES

A. Restraint Cables: ASTM A492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.16 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.17 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

2.18 ADHESIVE ANCHOR BOLTS

A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.03 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 07 72 00 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 22 11 13 "Facility Water Distribution Piping" for piping flexible connections.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.06 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 22 05 48

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) stainless steel, 0.025-inch (0.64-mm) aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-

mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
5. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.04 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping.
2. Stencil Material: Aluminum.

3. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.05 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) stainless steel, 0.025-inch (0.64-mm) aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.06 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 09 91 23 "Interior Painting." Retain "Stenciled Pipe Label Option" Paragraph below only if stenciled labels are permitted.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Domestic Water Piping

a. Background: Safety green.
b. Letter Colors: White.

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Safety black.
b. Letter Color: White.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches (38 mm) 2 inches (50 mm), square.
b. Hot Water: 1-1/2 inches (38 mm) 2 inches (50 mm), square.

2. Valve-Tag Colors:

a. Cold Water: Safety green.
b. Hot Water: Safety green.

3. Letter Colors:

a. Cold Water: White.
b. Hot Water: White.

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Storm-water piping exposed to freezing conditions.
6. Supplies and drains for handicap-accessible lavatories and sinks.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Sustainable Design Submittals:

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN 50).
2. Jacket Materials for Pipe: 12 inches (300 mm) long by NPS 2 (DN 50).
3. Sheet Jacket Materials: 12 inches (300 mm) square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

a. One 10-foot (3-m) section of NPS 2 (DN 50) straight pipe.
b. One each of a 90-degree threaded, welded, and flanged elbow.
c. One each of a threaded, welded, and flanged tee fitting.
d. One NPS 2 (DN 50) or smaller valve, and one NPS 2-1/2 (DN 65) or larger valve.
e. Four support hangers including hanger shield and insert.

f. One threaded strainer and one flanged strainer with removable portion of insulation.
g. One threaded reducer and one welded reducer.
h. One pressure temperature tap.
i. One mechanical coupling.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

D. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.08 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Block Insulation: ASTM C552, Type I.
2. Special-Shaped Insulation: ASTM C552, Type III.
3. Preformed Pipe Insulation without Jacket: Comply with ASTM C552, Type II, Class 1.
4. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C552, Type II, Class 2.
5. Factory fabricate shapes according to ASTM C450 and ASTM C585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. Phenolic:

1. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C1126, Type III, Grade 1.
2. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C1126, Type II, Grade 1.
3. Factory fabricate shapes according to ASTM C450 and ASTM C585.
4. Factory-Applied Jacket: None ASJ. Requirements are specified in "Factory-Applied Jackets" Article.

K. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C534 or ASTM C1427, Type I, Grade 1 for tubular materials.

2.02 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

F. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

G. PVC Jacket Adhesive: Compatible with PVC jacket.

2.04 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
4. Color: White.

C. Vapor-Retarder Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
3. Color: White.

D. Vapor-Retarder Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
3. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm (0.66 metric perms) at manufacturer's recommended dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Color: White.

2.06 SEALANTS

A. Joint Sealants for Cellular-Glass and Phenolic Products:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.08 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

2.09 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: Color-code jackets based on system. Color as selected by Architect.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2. Stainless-Steel Jacket: ASTM A167 or ASTM A240/A240M.

a. Factory cut and rolled to size.

b. Material, finish, and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches (75 mm).
2. Thickness: 11.5 mils (0.29 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Width: 3 inches (75 mm).
2. Thickness: 6.5 mils (0.16 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches (50 mm).
2. Thickness: 6 mils (0.15 mm).

3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches (50 mm).
2. Thickness: 3.7 mils (0.093 mm).
3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.12 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) 3/4 inch (19 mm) wide with wing seal or closed seal.
2. Aluminum: ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) 3/4 inch (19 mm) wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

2.13 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers,

valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.07 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.08 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.09 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.

2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.12 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1/2 inch (13 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
d. Phenolic: 1 inch (25 mm) thick.
e. Polyolefin: 1/2 inch (13 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1 inch (25 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
d. Phenolic: 1 inch (25 mm) thick.
e. Polyolefin: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:

    a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    b. Flexible Elastomeric: 3/4 inch (19 mm) 1 inch (25 mm) thick.
    c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
    d. Phenolic: 1 inch (25 mm) thick.
    e. Polyolefin: 3/4 inch (19 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:

    a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    b. Flexible Elastomeric: 1 inch (25 mm) thick.
    c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
    d. Phenolic: 1 inch (25 mm) thick.
    e. Polyolefin: 1 inch (25 mm) thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:

    a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
    b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm thick.
    c. Polyolefin: 1/2 inch (13 mm) thick.

D. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:

    a. Cellular Glass: 2 inches (50 mm) thick.
    b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches (38 mm) thick.
    c. Phenolic: 1-1/2 inches (38 mm) thick.

E. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be one of the following:

    a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    b. Flexible Elastomeric: 3/4 inch (19 mm) thick.
    c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
    d. Phenolic: 1 inch (25 mm) thick.
    e. Polyolefin: 3/4 inch (19 mm) thick.

F. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:

    a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.

G. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.

3.16 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches (50 mm) thick.
b. Flexible Elastomeric: 2 inches (50 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
d. Phenolic: 2 inches (50 mm) thick.
e. Polyolefin: 2 inches (50 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches (50 mm) thick.
b. Flexible Elastomeric: 2 inches (50 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
d. Phenolic: 2 inches (50 mm) thick.
e. Polyolefin: 2 inches (50 mm) thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches (50 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
c. Phenolic: 2 inches (50 mm) thick.

D. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

E. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.

3.17 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches (50 mm) thick.

B. Chilled Water, All Sizes: Cellular glass, 2 inches (50 mm) thick.

3.18 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. PVC, Color-Coded by System: 20 mils (0.5 mm) thick.
3. Aluminum, Smooth: 0.020 inch (0.51 mm thick.
4. Painted Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
5. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.016 inch (0.41 mm) thick.

D. Piping, Exposed:

1. None.
2. PVC, Color-Coded by System: 20 mils (0.5 mm) 30 mils (0.8 mm) thick.
3. Aluminum, Smooth: 0.020 inch (0.51 mm thick.
4. Painted Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
5. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.016 inch (0.41 mm) thick.

3.19 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. PVC, Color-Coded by System: 20 mils (0.5 mm) 30 mils (0.8 mm) thick.
3. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
4. Painted Aluminum, Smooth: 0.020 inch (0.51 mm) 0.024 inch (0.61 mm) 0.032 inch (0.81 mm) thick.
5. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.016 inch (0.41 mm) thick.

D. Piping, Exposed:

1. PVC: 20 mils (0.5 mm) 30 mils (0.8 mm) 40 mils (1.0 mm) thick.
2. Painted Aluminum, Smooth: 0.020 inch (0.51 mm thick.
3. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.016 inch (0.41 mm) thick.

3.20 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 22 07 19

SECTION 22 08 00

COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Cx process requirements for the following plumbing systems, assemblies, and equipment:

1. Domestic hot- and cold-water piping.
2. Sanitary waste and vent piping.
3. Plumbing equipment.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
2. For construction checklists, comply with requirements in various Division 22 Sections specifying plumbing systems, system components, equipment, and products.

1.02 DEFINITIONS

A. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

B. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

C. IAPMO: International Association of Plumbing and Mechanical Officials.

D. IgCC: International Green Construction Code.

E. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For plumbing testing technician.

B. Construction Checklists:

1. Draft Cx plan, including draft construction checklists to be prepared by CxA under Section 019113 "General Commissioning Requirements." Contractor is to review Construction Checklist in accordance with requirements in Section 019113 "General Commissioning Requirements" and ASHRAE 202 and to resolve any issues with the CxA.

C. Test Equipment and Instruments: For all test equipment and instruments to be used in conducting Cx tests by Contractor, provide the following:

1. Equipment/instrument identification number.
2. Planned Cx application or use.
3. Manufacturer, make, model, and serial number.
4. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
5. Equipment manufacturers' proprietary instrumentation and tools. For each instrument or tool, identify the following:

    a. Instrument or tool identification number.
    b. Equipment schedule designation of equipment for which the instrument or tool is required.
    c. Manufacturer, make, model, and serial number.
    d. Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

1.04 QUALITY ASSURANCE

A. Plumbing Testing Technician Qualifications: Technicians to perform plumbing Construction Checklist verification tests. Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:

1. Journey level or equivalent skill level with knowledge of plumbing system, electrical concepts, and building operations.
2. Minimum three years' experience installing, servicing, and operating systems manufactured by approved manufacturer.

B. Testing Equipment and Instrumentation Quality and Calibration:

1. Capable of testing and measuring performance within the specified acceptance criteria.
2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
3. Be maintained in good repair and operating condition throughout duration of use on Project.
4. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

C. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:

    a. Be calibrated by manufacturer with current calibration tags permanently affixed.
    b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
    c. Plumbing system proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 Cx PROCESS

A. Perform Cx process for plumbing systems in accordance with:

1. IgCC, which requires compliance with ASHRAE 202.
2. ASHRAE 202.
3. Commissioning standards acceptable to the authority having jurisdiction.

3.02 CONSTRUCTION CHECKLISTS

A. Preliminary detailed construction checklists are to be prepared under Section 019113 "General Commissioning Requirements" for each plumbing system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in IgCC. Contractor performs the following:

1. Review plumbing preliminary construction checklists and provide written comments on Construction Checklist items where appropriate.
2. Return preliminary Construction Checklist with review comments within 10 days of receipt.
3. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)."
4. Use only construction checklists marked "Approved for Use, (date)." Mark construction checklists in the appropriate place, as indicated Project events are completed, and provide pertinent details and other information.

B. Systems Required to Be Commissioned under IgCC:

1. Domestic hot-water systems and controls.

C. Additional Systems Required to Be Commissioned:

1. Facility water-distribution piping, including the following:

a. Domestic and fire-suppression water piping, fittings, and specialties outside the building.
b. Sleeves and sleeve seals.
c. Meters and gauges.
d. General-duty and specialty valves.
e. Hangers and supports.
f. Vibration isolation and seismic restraints.

2. Domestic water piping, including the following:

a. Domestic cold- and hot-water piping, fittings, and specialties inside the building.
b. Sleeves and sleeve seals.
c. Meters and gauges.
d. General-duty and specialty valves.
e. Hangers and supports.
f. Vibration isolation and seismic restraints.

3. Sanitary waste and vent piping, including the following:

a. Gravity and forced-main sewerage piping, fittings, and specialties.
b. Sanitary waste interceptors.
c. Drains.
d. Sleeves and sleeve seals.
e. Meters and gauges.
f. General-duty and specialty valves.
g. Hangers and supports.
h. Vibration isolation and seismic restraints.

4. Plumbing fixtures, including the following:

a. Water closets, supports and connections, supplies, and flush valves.
b. Urinals, supports and connections, supplies, and flush valves.
c. Lavatories, supports, supplies, drain connections, and faucets.
d. Sinks, supports, supplies, drain connections, and faucets.
e. Showers, supplies, drain connections, and faucets.
f. Drinking fountains, supplies, and drainage connections.

3.03 Cx TESTING PREPARATION

A. Certify that plumbing systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating in accordance with the Contract Documents and approved submittals.

B. Certify that plumbing system instrumentation and control systems have been completed and calibrated, point-to-point checkout has been successfully completed, and systems are operating in accordance with their design sequence of operation, Contract Documents, and approved submittals. Certify that all sensors are operating within specified accuracy and that all systems are set to and maintaining set points as required by the design documents.

C. Set systems, subsystems, and equipment into operating mode to be tested in accordance with approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.04 Cx TEST CONDITIONS

A. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA, and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

B. If tests cannot be completed because of a deficiency outside the scope of the plumbing system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.

C. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.05 Cx TESTS COMMON TO PLUMBING SYSTEMS

A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.

B. Test systems, assemblies, subsystems, equipment, and components for operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response compared to acceptance criteria.

C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.

D. Comply with Construction Checklist requirements, including material verification, installation checks, startup, and performance test requirements specified in Division 22 Sections specifying plumbing systems and equipment.

E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:

1. Cx Construction Checklist verification tests.
2. Cx Construction Checklist verification test demonstrations.

3.06 CONSTRUCTION CHECKLIST EXAMPLES

A. Vibration Isolation in Plumbing Systems:

1. Prerequisites: Acceptance of results of construction checklists for vibration and seismic control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
2. Components to Be Tested:

    a. Vibration isolation control devices in plumbing systems.
    b. Seismic control devices for proper device selection and mounting.
    c. Support systems.

3. Test Purpose: Evaluate effectiveness of vibration isolation and proper installation of seismic control devices.
4. Test Conditions: Measure vibration of the facility structure at three locations designated by Owner's witness at the following operating conditions:

5. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.

B. Plumbing Gas and Water Meter Reporting:

1. Prerequisites: Acceptance of results of construction checklists for plumbing systems specified in the following Sections:

    a. Section 211100 “Facility Fire-Suppression Water Service Piping.”

    b. Section 230993 "Sequence of Operations for HVAC."

2. Test Scope:

    a. Monitored plumbing system gas and water meters.

3. Test Purpose:

    a. Verify accuracy of reporting of monitored plumbing system gas and water meters at building management system.

4. Test Conditions:

    a. Plumbing system gas and water meter recording systems operating in normal, automatic mode.
    b. Compare cumulative consumption data at plumbing system gas and water meter recording systems with independent, calibrated, flow-measuring instrumentation under the following conditions:

        1) Low Flow: 1 percent of maximum design flow rate for a period of four hours.
        2) High Flow: 80 percent of maximum design flow rate for a period of 20 minutes.

    c. Activate monitored plumbing alarms, one at a time.

5. Acceptance Criteria:

    a. Cumulative flow reported for low-flow condition is within 5 percent flow recorded by calibrated flow-measuring instrumentation.
    b. Cumulative flow reported for high-flow condition is within 1 percent flow recorded by calibrated flow-measuring instrumentation.

END OF SECTION 220800

SECTION 22 11 13

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes water-distribution piping and related components

1.03 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Application" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.02 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D2466.

B. PVC, AWWA Pipe: AWWA C900, DR-18, with bell end with gasket, and with spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Gaskets: AWWA C111, rubber.

5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.03 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.04 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:EJ.Flomatic Valves.Mueller Co.NIBCO INC.Zurn Industries, LLC.Nonrising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

3. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Flanged.

2.05 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. EJ.
b. McWane, Inc.
c. Mueller Co.

2. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.

b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 6 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.06 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:Ford Meter Box Company, Inc. (The).Jones, James Company.Mueller Co.Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.07 WATER METERS

A. Manufacturers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:Badger Meter, Inc.Displacement-Type Water Meters:

1. Description: With bronze main case.

a. Standard: AWWA C700.
b. Registration: Flow in gallons per minute.

C. Remote Registration System:

1. Description: Utility company standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

a. Standard: AWWA C707.
b. Registration: Flow in Flow in gallons per minute.
c. Data-Acquisition Units: Comply with utility company requirements for type and quantity.

2.08 RELIEF VALVES

A. Air-Release Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crispin-Multiplex Manufacturing Co.
b. GA Industries, Inc.
c. Val-Matic Valve & Manufacturing Corp.

2. Description: Hydromechanical device to automatically release accumulated air.

a. Standard: AWWA C512.
b. Pressure Rating: 300 psig (2070 kPa).
c. Body Material: Cast iron.
d. Trim Material: Stainless steel.
e. Water Inlet Size: 8 inch.
f. Air Outlet Size: 1 inch
g. Orifice Size: 3/32”

2.09 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
5. Size: 2 inch

6. Design Flow Rate: 76 GPM.
7. Selected Unit Flow Range Limits: 250 GPM.
8. Pressure Loss at Design Flow Rate: 11 psi
9. Body: Bronze with black UV stabilized fusion epoxy.
10. End Connections: Threaded FNPT (ANSI B1.20.1)
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Zurn Industries, LLC.

2. Standard: ASSE 1015 or AWWA C510.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
5. Size: 8 -inch.
6. Design Flow Rate: 610 gpm.
7. Selected Unit Flow Range Limits: 3500 gpm.
8. Pressure Loss at Design Flow Rate: 3 psi.
9. Body: Stainless steel.
10. End Connections: Flanged for NPS 2-1/2 (DN 65) and larger.
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories: OS&Y gate valves with flanged ends on inlet and outlet

C. Backflow Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Flow Controls; Conbraco Industries, Inc.
    b. WATTS.
    c. Zurn Industries, LLC.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.10 WATER METER BOXES

A. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER Meter" in cover; and with slotted, open-bottom base section of length to fit over service piping.

2.11 PROTECTIVE ENCLOSURES

A. Expanded-Metal Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Backflow Prevention Device InnClosures, Inc.
    b. BF Products Inc.
    c. Cross Brothers Inc.
    d. Le Meur Welding & Manufacturing Co.

2. Description: Enclosure designed to protect aboveground water piping, equipment, or specialties from damage.

    a. Material: ASTM F1267, expanded metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.
    b. Type: Type II, expanded and flattened.
    c. Class: Class 2, hot-dip, zinc-coated carbon steel.
    d. Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
    e. Locking device.
    f. Lugs or devices for securing enclosure to base.

2.12 FIRE HYDRANTS

A. Wet-Barrel Fire Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American AVK Co.
    b. Clow Valve Company; a subsidiary of McWane, Inc.
    c. Jones, James Company.
    d. Mueller Co.

2. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550.

    a. Standard: AWWA C503.
    b. Pressure Rating: 200 psi minimum.
    c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
    d. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.13 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire End & Croker Corporation.
b. Guardian Fire Equipment, Inc.
c. Potter Roemer LLC; a Division of Morris Group International.

2. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round escutcheon plate.

a. Standard: UL 405.
b. Connections: Four NPS 2-1/2 (DN 65) inlets and one NPS 4 (DN 100) outlet.
c. Inlet Alignment: Inline, horizontal.
d. Finish Including Sleeve: Rough chrome-plated.
e. Escutcheon Plate Marking: "AUTO SPKR & STANDPIPE."

2.14 ALARM DEVICES

A. Alarm Devices, General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Refer to Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping 2-inches shall be the following:

1. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.

F. Underground water-service piping 8-inches shall be the following:

1. PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 fabricated push-on-joint, ductile-iron mechanical-joint, ductile-iron fittings; and gasketed joints.

G. Water Meter Box Water-Service Piping shall be same as underground water-service piping.

H. Aboveground and Vault Water-Service Piping shall be the following:

1. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented threaded fittings; and threaded joints.

I. Underground Fire-Service-Main Piping 8-inches shall be the following:

1. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.

J. Aboveground and Vault Fire-Service-Main Piping 8-inches shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.03 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
2. Use the following for valves in vaults and aboveground:

a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, nonrising stem.
b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.
c. Check Valves: AWWA C508, swing type.

3. Relief Valves: Use for water-service piping in vaults and aboveground.

a. Air-Release Valves: To release accumulated air.

3.04 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 33 05 00 "Common Work Results for Utilities" for piping-system common requirements.

3.05 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

B. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

C. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install curb valve in water-service piping with head pointing up and with service box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install PVC, AWWA pipe according to ASTM F645 and AWWA M23.

F. Bury piping with depth of cover over top at least 36 inches, with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:

G. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping

material. Make connections to building-water-piping systems when those systems are installed.

I. Sleeves are specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

J. Mechanical sleeve seals are specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

K. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.06 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D2774 or ASTM D3139 and pipe manufacturer's written instructions.

3.07 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Bolted flanged joints.
4. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.08 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

D. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.09 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets and full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.10 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.11 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

3.12 WATER METER BOX INSTALLATION

A. Install water meter boxes per drawings.

3.13 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches (50 mm) above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.14 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.15 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

B. Install protective pipe bollards on two sides of each fire department connection.

3.16 CONNECTIONS

A. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve for fire water and service clamp and corporation valve for domestic water and irrigation.

B. Connect water-distribution piping to interior domestic water and fire-suppression piping.

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.17 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.18 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 "Earth Moving."

3.19 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 22 11 13

SECTION 22 13 13

FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. PVC pipe and fittings.
2. Cleanouts.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Pipe and fittings.
2. Cleanouts.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of pipe and fitting.

B. Field quality-control reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

B. Pipe: ASTM D3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.

C. Fittings: ASTM D3034, PVC with bell ends.

D. Gaskets: ASTM F477, elastomeric seals.

2.02 CLEANOUTS

A. PVC Cleanouts:

B. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.03 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350, and the following:

1. Cement: ASTM C150/C150M, Type II.
2. Fine Aggregate: ASTM C33/C33M, sand.
3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install cleanouts for changes in direction as indicated in drawings.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping with 36-inch (915-mm) minimum cover.
2. Install PVC Type PSM sewer piping according to ASTM D2321 and ASTM F1668.

F. Clear interior of piping and cleanouts of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join PVC Type PSM sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.

3.04 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.05 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Set cleanout frames and covers in earth in cast-in-place-concrete block, as indicated on drawings. Set with tops 1 inch above surrounding grade.

B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.06 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

B. Make connections to existing piping. and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of, and be flush with, inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. IDENTIFICATION

D. Comply with requirements in Section 31 20 00 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.07 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
b. Close openings in system and fill with water.
c. Purge air and refill with water.
d. Disconnect water supply.
e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Test plastic gravity sewer piping according to ASTM F1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.08 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 22 13 13

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Galvanized-steel pipe and fittings.
3. Stainless-steel drainage pipe and fittings.
4. Ductile-iron pipe and fittings.
5. Copper tube and fittings.
6. ABS pipe and fittings.
7. PVC pipe and fittings.
8. Specialty pipe fittings.
9. Encasement for underground metal piping.

B. Related Requirements:

1. Section 22 13 13 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.04 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.05 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.06 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
2. Waste, Force-Main Piping: 100 psig (690 kPa).

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.02 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

C. Ductile-Iron, Grooved-Joint Piping: AWWA C151/A21.51, with round-cut-grooved ends according to AWWA C606.

D. Ductile-Iron, Grooved-End Pipe Appurtenances:

1. Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings, with dimensions matching AWWA C110/A 21.10 ductile-iron pipe or AWWA C153/A 21.53 ductile-iron fittings, and complying with AWWA C606 for grooved ends.
2. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

2.04 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M (ASTM B 88M, Type B and Type C), water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.05 ABS PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

C. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

D. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

E. Solvent Cement: ASTM D 2235.

2.06 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

E. Adhesive Primer: ASTM F 656.

F. Solvent Cement: ASTM D 2564.

2.07 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

    a. Manufacturer:

        1) Ferco Inc.
        2) Froet Industries
        3) Mission Rubber Company

    b. Standard: ASTM C 1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. End Connections: Same size as and compatible with pipes to be joined.
    e. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

    a. Manufacturer:

        1) Cascade Waterworks
        2) Mission Rubber Company

    b. Standard: ASTM C 1460.
    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. End Connections: Same size as and compatible with pipes to be joined.

4. Pressure Transition Couplings:

    a. Manufacturer:

        1) Apollo Flow Controls
        2) Jay R. Smith
        3) JCM Industries
        4) Cascade Waterworks

    b. Standard: AWWA C219.
    c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
    d. Center-Sleeve Material: Manufacturer's standard.
    e. Gasket Material: Natural or synthetic rubber.

f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. Dielectric Unions:

a. Manufacturer:

1) WATTS
2) Zurn Industries

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
3) End Connections: Solder-joint copper alloy and threaded ferrous.

2. Dielectric Flanges:

a. Manufacturer:

1) WATTS
2) Zurn Industries

b. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

3. Dielectric-Flange Insulating Kits:

a. Manufacturer:

1) WATTS
2) Zurn Industries

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig (1035 kPa).
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

4. Dielectric Nipples:

a. Manufacturer:

1) WATTS
2) Zurn Industries

b. Description:

1) Standard: IAPMO PS 66.
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

2.08 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) or high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3 - EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earth Moving."

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

L. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 2 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Install steel piping according to applicable plumbing code.

P. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

Q. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

R. Install aboveground ABS piping according to ASTM D 2661.

S. Install aboveground PVC piping according to ASTM D 2665.

T. Install underground ABS and PVC piping according to ASTM D 2321.

U. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

V. Install underground, ductile-iron, force-main piping according to AWWA C600.

1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

W. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

X. Install force mains at elevations indicated.

Y. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
b. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

Z. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

AA. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

BB. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

CC. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

c. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.05 VALVE INSTALLATION

A. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
3. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.

B. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

C. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

3.06 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for ABS and PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.

F. Support vertical runs of cast iron steel stainless-steel and copper soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of ABS and PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.07 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves cleanouts and drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.08 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.09 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa).

b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa).
b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
c. Air pressure must remain constant without introducing additional air throughout period of inspection.
d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials.

a. Isolate test source and allow to stand for four hours.
b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
6. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper tube, Type M (Type C); copper pressure fittings; and soldered joints.

6. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; cast-iron hubless-piping couplings; and coupled joints.
3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
4. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; cast-iron hubless-piping couplings; coupled joints.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 (DN 40 and DN 50) shall be any of the following:

1. Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 (DN 65 to DN 150) shall be any of the following:

1. Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.
3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

J. Underground sanitary-sewage force mains NPS 4 (DN 100) and smaller shall be any of the following:

1. Hard copper tube, Type L (Type B); wrought-copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.

5. Fitting-type transition coupling for piping smaller than NPS 1-1/2 (DN 40) and pressure transition coupling for NPS 1-1/2 (DN 40) and larger if dissimilar pipe materials.

K. Underground sanitary-sewage force mains NPS 5 (DN 125) and larger shall be any of the following:

1. Hard copper tube, Type L (Type B); wrought-copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 22 13 16

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Trench drains.
5. Channel drainage systems.
6. Air-admittance valves.
7. Roof flashing assemblies.
8. Through-penetration firestop assemblies.
9. Miscellaneous sanitary drainage piping specialties.
10. Flashing materials.
11. Solids interceptors.

B. Related Requirements:

1. Section 33 42 00 "Stormwater Conveyance" for storm draining piping and piping specialties outside the building.

1.03 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.04 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that accessories, and components will withstand seismic forces defined in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.08 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Coordinate size and location of roof penetrations.

1.09 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cultures: Provide 1-gal. bottles of bacteria culture recommended by manufacturer of FOG disposal systems equal to 200 percent of amount installed, but no fewer than 2 1-gal. bottles.

PART 2 - PRODUCTS

2.01 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation; Z1088 Z1090 Z1091 Z1095 or comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze and PVC, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation; or comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
    c. Watts Drainage Products Inc.

2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

C. Horizontal, Plastic Backwater Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Light Commercial Operation; or comparable product by one of the following:

    a. Canplas LLC.
    b. IPS Corporation.
    c. NDS Inc.
    d. Oatey.
    e. Plastic Oddities; a division of Diverse Corporate Technologies.
    f. Sioux Chief Manufacturing Company, Inc.

2. Size: Same as connected piping.
3. Body: ABS.
4. Cover: Same material as body with threaded access to check valve.
5. Check Valve: Removable swing check.
6. End Connections: Socket type.

2.02 CLEANOUTS

A. Exposed Metal Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; or comparable product by one of the following:

        1) Josam Company.
        2) MIFAB, Inc.
        3) Smith, Jay R. Mfg. Co.
        4) Tyler Pipe.
        5) Watts Drainage Products.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Z1400, Z1400-BZ, Z1400-K, Z1402, Z1404, Z1406, Z1440, Z1445, Z1454, Z1455, Z1474, or comparable product by one of the following:

1) Josam Company.
2) MIFAB, Inc.
3) Smith, Jay R. Mfg. Co.
4) Tyler Pipe; Wade Div.

2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Polished bronze.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation; Z1441, Z1443, Z1446, Z1447, Z1464, Z1467 or comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.

4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

D. Plastic Floor Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Light Commercial Operation; or comparable product by one of the following:

    a. Canplas LLC.
    b. IPS Corporation.
    c. NDS Inc.
    d. Plastic Oddities.
    e. Sioux Chief Manufacturing Company, Inc.

2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.
5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.03 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation; Z300, Z310, Z415-B, Z415BZ, Z460B, Z461, Z508, Z520, Z662, or comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products.

2. Standard: ASME A112.6.3 with backwater valve.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Integral, ASME A112.14.1, swing-check type.

10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel and acid-resistant epoxy.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Bronze.
13. Top of Body and Strainer Finish: Polished bronze.
14. Top Shape: Round.
15. Top Loading Classification: Medium Duty.
16. Funnel: Not required.
17. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
18. Trap Material: Cast iron.
19. Trap Pattern: Standard P-trap.
20. Trap Features: Trap-seal primer valve drain connection.

B. Stainless-Steel Floor Drains :

1. ASME A112.6.3, Stainless-Steel Floor Drains:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Z1719, Z1726, Z1727, Z1730, Z1731, Z1732, Z1735, Z1736, Z1737, Z1738, Z1739 or comparable product by one of the following:

1) Josam Company.
2) MIFAB, Inc.
3) Smith, Jay R. Mfg. Co.
4) Tyler Pipe; Wade Div.
5) Watts Drainage Products.

2. Standard: ASME A112.6.3.
3. Outlet: Bottom Side.
4. Top or Strainer Material: Stainless steel.
5. Top Shape: Round.
6. Seepage Flange: Required.
7. Anchor Flange: Required.
8. Clamping Device: Required.
9. Trap-Primer Connection: Required.
10. Trap Material: Cast iron.
11. Trap Pattern: Standard P-trap.

2.04 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Ayrlett, LLC.
b. Durgo, Inc.
c. Oatey.
d. ProSet Systems Inc.
e. RectorSeal.
f. Studor, Inc.

3. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
4. Housing: Plastic.
5. Operation: Mechanical sealing diaphragm.
6. Size: Same as connected fixture or branch vent piping.

B. Stack Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Durgo, Inc.
b. Oatey.
c. Studor, Inc.

3. Standard: ASSE 1050 for vent stacks.
4. Housing: Plastic.
5. Operation: Mechanical sealing diaphragm.
6. Size: Same as connected stack vent or vent stack.

C. Wall Box:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Durgo, Inc.
b. Oatey.
c. RectorSeal.
d. Studor, Inc.

3. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
4. Size: About 9 inches wide by 8 inches high by 4 inches deep.

2.05 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Acorn Engineering Company; Elmdor/Stoneman Div.
    b. Thaler Metal Industries Ltd.

3. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

    a. Open-Top Vent Cap: Without cap.
    b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
    c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.06 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. ProSet Systems Inc.
    b. Or equal.

3. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
4. Size: Same as connected soil, waste, or vent stack.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

2.07 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.

2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings :

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps :

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals :

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints :

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.08 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.09 MOTORS

A. General requirements for motors are specified in Section 22 05 13 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment Mounting:

1. Comply with requirements for vibration isolation and seismic control devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment"

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

H. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.

I. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

J. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

K. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

L. Install fixture air-admittance valves on fixture drain piping.

M. Install stack air-admittance valves at top of stack vent and vent stack piping.

N. Install air-admittance-valve wall boxes recessed in wall.

O. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

P. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

Q. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

R. Assemble open drain fittings and install with top of hub 1 inch 2 inches above floor.

S. Install deep-seal traps on floor drains and other waste outlets, if indicated.

T. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

U. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

V. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

W. Install vent caps on each vent pipe passing through roof.

X. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

Y. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

Z. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

AA. Assemble components of FOG disposal systems and install on floor. Install trap, vent, fresh-air inlet, and flow-control fitting according to authorities having jurisdiction. Install shelf fastened to reinforcement in wall construction and adjacent to unit, unless otherwise indicated. Install culture bottle, culture metering pump, timer, and control on shelf. Install tubing between culture bottle, metering pump, and chamber.

BB. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

CC. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.

DD. Install wood-blocking reinforcement for wall-mounting-type specialties.

EE. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. FOG Disposal Systems: Connect inlet and outlet to unit, connect flow-control fitting and fresh-air inlet piping to unit inlet piping, and connect vent piping between trap and media chamber. Connect electrical power.

D. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

E. Grease Removal Devices: Connect controls, electrical power, factory-furnished accessories, and inlet, outlet, and vent piping to unit.

F. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

G. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 62 00 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.04 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. FOG disposal systems.
2. Grease interceptors.
3. Grease removal devices.
4. Oil interceptors.
5. Solids interceptors.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.05 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.06 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 33 00

ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Flow-control, electric, tankless, domestic-water heaters.
2. Thermostat-control, electric, tankless, domestic-water heaters.
3. Domestic-water heater accessories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

C. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.

Retain "Seismic Qualification Data" Paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

B. Seismic Qualification Data: Certificates, for commercial domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of commercial residential and tankless, electric, domestic-water heater.

D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.06 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including storage tank and supports.
    b. Faulty operation of controls.
    c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

    a. Electric, Tankless, Domestic-Water Heaters: Five years.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. Seismic Performance: Commercial, electric, domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Component Importance Factor: 1.0.

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

D. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.02 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Flow-Control, Electric, Tankless, Domestic-Water Heaters:

1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
2. Standard: UL 499 for electric, tankless, (domestic-water-heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.

a. Connections: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig (1035 kPa).
c. Heating Element: Resistance heating system.
d. Temperature Control: Flow-control fitting.
e. Safety Control: High-temperature-limit cutoff device or system.
f. Jacket: Aluminum or steel with enameled finish or plastic.

4. Support: Bracket for wall mounting.
5. Capacity and Characteristics:

a. Flow Rate: 6 gph
b. Maximum Temperature Setting: 140 deg F.
c. Electrical Characteristics:

1) Volts: 208 V.
2) Phases: Single.
3) Hertz: 60 Hz.
4) Minimum Circuit Ampacity: 9 A.

B. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:

1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
2. Standard: UL 499 for electric, tankless, (domestic-water-heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.

a. Connections: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig (1035 kPa).
c. Heating Element: Resistance heating system.
d. Temperature Control: Thermostat.
e. Safety Control: High-temperature-limit cutoff device or system.
f. Jacket: Aluminum or steel with enameled finish or plastic.

4. Support: Bracket for wall mounting.
5. Capacity and Characteristics:

a. Flow Rate: 6 gph (L/s) at 100 deg F (56 deg C) temperature rise.
b. Temperature Setting: 125 deg F (52 deg C) 140 deg F (60 deg C).
c. Electrical Characteristics:

1) Volts: 208 V.
2) Phases: Single.
3) Hertz: 60 Hz.
4) Minimum Circuit Ampacity: 9 A.

2.03 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

1. Source Limitations: Obtain domestic-water expansion tanks from single source from single manufacturer.
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig (1035 kPa).
b. Capacity Acceptable: 6 gal. minimum.

B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.

D. Heat-Trap Fittings: ASHRAE/IES 90.1.

E. Manifold Kits: Domestic-water-heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves per manufacturer’s requriements to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

F. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- (172.5-kPa-) maximum outlet pressure unless otherwise indicated.

G. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.

H. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than working-pressure rating of domestic-water heater.

I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

J. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

K. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches (457 mm) above the floor.

L. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.04 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 03 30 00 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Residential, Electric, Domestic-Water Heater Mounting: Install residential, electric, domestic-water heaters on domestic-water heater mounting bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches (457 mm) above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

D. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping.

E. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

F. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

H. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains.

I. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

J. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

K. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet.

L. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig (172 kPa).

M. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

N. Fill electric, domestic-water heaters with water.

O. Charge domestic-water expansion tanks with air to required system pressure.

P. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.02 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial and tankless, electric, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION 22 33 00

SECTION 22 42 13.13

COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves and tanks.
3. Toilet seats.
4. Supports.

1.03 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feet (9.1 m) from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.01 WALL-MOUNTED WATER CLOSETS

A. Water Closets: Wall mounted, top spud, accessible.

1. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height: Standard.
f. Rim Contour: Elongated.
g. Water Consumption: 1.28 gal. (4.8 L) per flush.
h. Spud Size and Location: NPS 1-1/2 (DN 40); top.

2. Support: Water closet carrier.
3. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.02 FLUSHOMETER VALVES

A. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves:

1. Standard: ASSE 1037.
2. Minimum Pressure Rating: 125 psig (860 kPa).
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Exposed Flushometer-Valve Finish: Chrome plated.
6. Panel Finish: Chrome plated or stainless steel.
7. Style: Concealed.

8. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
9. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Consumption: 1.1 gal. per flush.
11. Minimum Inlet: NPS 1 (DN 25).
12. Minimum Outlet: NPS 1-1/4 (DN 32).

2.03 TOILET SEATS

A. Toilet Seats:

1. Standard: IAPMO/ANSI Z124.5.
2. Material: Plastic.
3. Type: Commercial (Standard).
4. Shape: Elongated rim, open front.
5. Hinge: Self-sustaining, check.
6. Hinge Material: Noncorroding metal.
7. Seat Cover: Not required.
8. Color: White.

2.04 SUPPORTS

A. Water Closet Carrier:

1. Standard: ASME A112.6.1M.
2. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.03 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 22 11 13 "Facility Water Distribution Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.13

SECTION 22 42 13.16

COMMERCIAL URINALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.
3. Supports.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.01 WALL-HUNG URINALS

A. Urinals: Wall hung, back outlet, blowout.

1. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
d. Water Consumption: Water saving.
e. Spud Size and Location: NPS 1-1/4 (DN 32); top.
f. Outlet Size and Location: NPS 2 (DN 50); back.
g. Color: White.

2. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2 (DN 50).

3. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
4. Urinal Mounting Height: Standard.

B. Urinals: Wall hung, back outlet, siphon jet, accessible.

1. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet with extended shields.
d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
e. Water Consumption: Water saving.
f. Spud Size and Location: NPS 3/4 (DN 20); top.
g. Outlet Size and Location: NPS 2 (DN 50); back.
h. Color: White.

2. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2 (DN 50).

3. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
4. Urinal Mounting Height: Standard.

C. Urinals: Wall hung, back outlet, washout, accessible.

1. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Washout with extended shields.
d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
e. Water Consumption: Water saving.
f. Spud Size and Location: NPS 3/4 (DN 20), top.
g. Outlet Size and Location: NPS 2 (DN 50), back.
h. Color: White.

2. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2 (DN 50).

3. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
4. Urinal Mounting Height: Standard.

2.02 URINAL FLUSHOMETER VALVES

A. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves:

1. Standard: ASSE 1037.
2. Minimum Pressure Rating: 125 psig (860 kPa).
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Exposed Flushometer-Valve Finish: Chrome plated.
6. Panel Finish: Chrome plated or stainless steel.
7. Style: Concealed.
8. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
9. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Consumption: 0.125 gal. (1.9 L) per flush.
11. Minimum Inlet: NPS 3/4 (DN 20).
12. Minimum Outlet: NPS 1-1/4 (DN 32).

2.03 SUPPORTS

A. Type I Urinal Carrier:

1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
5. Install trap-seal liquid in waterless urinals.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.03 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 22 11 13 "Facility Water Distribution Piping"

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.04 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.05 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.16

SECTION 22 42 16.13

COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Lavatories.
2. Shampoo bowls.
3. Faucets.
4. Supply fittings.
5. Waste fittings.
6. Supports.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

C. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Division 01 include the following:

a. Servicing and adjustments of automatic faucets.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.01 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory: Rectangular, self-rimming, vitreous china, counter mounted.

1. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Self-rimming for above-counter mounting.
c. Nominal Size: Rectangular, 21 by 19 inches (533 by 483 mm).
d. Faucet-Hole Punching: Three holes, 4-inch (102-mm) centers.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting Material: Sealant.

B. Lavatory: Round, self-rimming, vitreous china, counter mounted.

1. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Self-rimming for above-counter mounting.
c. Nominal Size: Oval, 19 by 17 inches (483 by 432 mm).
d. Nominal Size: Round, 19 inches (483 mm).
e. Faucet-Hole Punching: Three holes, 4-inch (102-mm) centers.
f. Faucet-Hole Location: Top.
g. Color: White.
h. Mounting Material: Sealant.

C. Lavatory: Oval, vitreous china, undercounter mounted.

1. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For undercounter mounting.
c. Nominal Size: Oval, 19 by 16 inches (483 by 406 mm).
d. Faucet-Hole Punching: No holes.
e. Faucet-Hole Location: On countertop.
f. Color: White.
g. Mounting Material: Sealant and undercounter mounting kit.

2.02 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Automatic-type, hard-wired, electronic-sensor-operated, mixing, solid-brass valve.

1. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Single hole.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
8. Mounting Type: Deck, concealed.
9. Spout: Rigid type.
10. Spout Outlet: Aerator or laminar flow.
11. Drain: Not part of faucet.

2.03 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF 372 for faucet-spout-outlet materials that will be in contact with potable water.

B. Description: Chrome-plated-brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.04 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key or wheel handle.

F. Risers:

1. NPS 1/2 (DN 15).
2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.05 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32) NPS 1-1/4 (DN 32).
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-(0.30-mm-) thick stainless-steel tube to wall; and stainless-steel wall flange.

2.06 SUPPORTS

A. Type II Lavatory Carrier:

1. Standard: ASME A112.6.1M.

B. Type III Lavatory Carrier:

1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 13 "Facility Water Distribution Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.13

SECTION 22 42 16.16

COMMERCIAL SINKS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Service basins.
2. Service sinks.
3. Utility sinks.
4. Handwash sinks.
5. Sacristy sinks.
6. Sink faucets.
7. Laminar-flow, faucet-spout outlets.
8. Supports.
9. Supply fittings.
10. Waste fittings.
11.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.01 SERVICE BASINS

A. Service Basins: Terrazzo, floor mounted.

1. Fixture:

a. Standard: IAPMO PS 99.

b. Shape: Square.

c. Nominal Size: 28 by 28 inches.

d. Height: 8 inches.

e. Tiling Flange: Not required.

f. Rim Guard: On all top surfaces.

g. Color: Not applicable.

h. Drain: Grid with NPS 2 (DN 50) outlet.

2. Mounting: On floor and flush to wall.

2.02 SINK FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual type, single control or two lever handle mixing valve.

1. Standard: ASME A112.18.1/CSA B125.1.

2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.

3. Body Type: Centerset or single hole.

4. Body Material: Commercial, solid brass.

5. Finish: Chrome plated.

6. Maximum Flow Rate: 2.2 gpm (8.3 L/min.).

7. Handle(s): Lever.

8. Mounting Type: Back/wall, exposed.

9. Spout Type: Swing, solid brass.

10. Vacuum Breaker: Not required for hose outlet.

11. Spout Outlet: Hose thread according to ASME B1.20.7.

2.03 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF 372 for faucet-spout-outlet materials that will be in contact with potable water.

B. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.04 SUPPORTS

A. Type II Sink Carrier:

1. Standard: ASME A112.6.1M.

2.05 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key or wheel handle.

F. Risers:

1. NPS 1/2 (DN 15).

2. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

2.06 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 (DN 40) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 (DN 40).

2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall; and chrome-plated brass or steel wall flange.

3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick stainless-steel tube to wall; and stainless-steel wall flange.

2.07 GROUT

A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.03 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 13 "Facility Water Distribution Piping"

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.16

SECTION 22 47 13

DRINKING FOUNTAINS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes drinking fountains and related components.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountain.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include operating characteristics, and furnished specialties and accessories.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 DRINKING FOUNTAINS

A. Drinking Fountains: Stainless steel, wheelchair accessible, wall mounted.

1. Stainless-Steel Drinking Fountains:

a. Haws Corporation
b. Halsey Taylor.
c. Most Dependable Fountains, Inc.
d. Stern-Williams Co., Inc.

2. Standards:

a. Comply with ASME A112.19.3/CSA B45.4.

b. Comply with NSF 61 and NSF 372.
c. Comply with ICC A117.1.

3. Type Receptor: On horizontal support.
4. Receptor Shape: Rectangular Round.
5. Back Panel: Stainless-steel wall plate behind drinking fountain.
6. Bubblers: One Two Three, with adjustable stream regulator, located on deck.
7. Maximum Water Flow: 0.15 gpm (0.0095 L/s).
8. Control: Push button or push bar.
9. Drain: Grid type with NPS 1-1/4 (DN 32) tailpiece.
10. Supply: NPS 3/8 (DN 10) with shutoff valve.
11. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) chrome-plated brass P-trap and waste.
12. Support: Type I water cooler carrier.
13. Drinking Fountain Mounting Height: Handicapped/elderly according to ICC A117.1.

2.02 SUPPORTS

A. Type I Water Cooler Carrier:

1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains on floor.

C. Install recessed drinking fountains secured to wood blocking in wall construction.

D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation.

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 13 "Facility Distribution Piping"

C. Install ball or gate shutoff valve on water supply to each fixture.

D. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.05 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 47 13

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with

indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Used)

END OF SECTION 23 05 13

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
3. Section 23 31 13 "Metal Ducts" for duct hangers and supports.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.

5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.05 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in the State of California to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.02 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.

3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.04 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, factory-fabricated steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of fiberglass, polyurethane or stainless steel.
3. Flammability: ASTM D635, ASTM E84, and UL 94.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.

    a. Flammability: ASTM D635, ASTM E84, and UL 94.

2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.05 PLASTIC PIPE HANGERS

A. Description: Similar to MSS SP-58, Types 1 through 58, factory-fabricated steel pipe hanger except hanger is made of plastic.

B. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Flammability: ASTM D635, ASTM E84, and UL 94.

2.06 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc or Hot-dip galvanized.
8. Paint Coating: Green epoxy, acrylic, or urethane.
9. Plastic Coating: PVC.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dip galvanized.
8. Paint Coating: Green epoxy, acrylic, or urethane.
9. Plastic Coating: PVC.

2.07 FIBERGLASS STRUT SYSTEMS

A. Description: Structural-grade, factory-formed, glass-fiber-resin channels and angles for supporting multiple parallel pipes.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

2. Channels: Continuous slotted fiberglass-reinforced plastic channel with inturned lips.
3. Channel Width: Selected for applicable load criteria.
4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
5. Fitting and Accessory Materials: Same as those for channels and angles.
6. Rated Strength: Selected to suit applicable load criteria.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.08 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.09 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless-steel.
2. Outdoor Applications: Stainless steel.

2.10 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand:

1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Hardware: Galvanized steel or polycarbonate.
4. Accessories: Protection pads.

C. Low-Profile, Single Base, Single-Pipe Stand:

1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Vertical Members: Two, galvanized stainless-steel, continuous-thread 1/2-inch rods.
4. Horizontal Member: Adjustable horizontal, galvanized stainless-steel pipe support channels.
5. Pipe Supports: Roller Strut, clamps or Clevis hanger.
6. Hardware: Galvanized or Stainless steel.
7. Accessories: Protection pads.
8. Height: 12 inches above roof.

D. High-Profile, Single Base, Single-Pipe Stand:

1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Single vulcanized rubber or molded polypropylene.
3. Vertical Members: Two, stainless-steel, continuous-thread 1/2-inch rods.
4. Horizontal Member: One, adjustable height, stainless-steel pipe support slotted channel or plate.
5. Pipe Supports: Roller or Clevis hanger.
6. Hardware: Stainless steel.
7. Accessories: Protection pads, 1/2-inch continuous-thread stainless-steel rod.
8. Height: 36 inches above roof.

E. High-Profile, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: Two or more; vulcanized rubber.
3. Vertical Members: Two or more, galvanized-steel channels.
4. Horizontal Members: One or more, adjustable height, galvanized-steel pipe support.
5. Pipe Supports: Roller or Clevis hanger.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads, 1/2-inch continuous-thread rod.
8. Height: 36 inches above roof.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.11 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.12 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.02 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.07 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Air-spring isolators.
11. Restrained-air-spring isolators.
12. Elastomeric hangers.
13. Spring hangers.
14. Snubbers.
15. Restraint channel bracings.
16. Restraint cables.
17. Seismic-restraint accessories.
18. Mechanical anchor bolts.
19. Adhesive anchor bolts.
20. Vibration isolation equipment bases.
21. Restrained isolation roof-curb rails.

B. Related Requirements:

1. Section 21 05 48 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.
2. Section 22 05 48 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.03 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic and wind forces required to select vibration isolators and seismic and wind restraints and for designing vibration isolation bases.

a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic- and Wind-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
    d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.

E. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-spring mounts and restrained-air-spring mounts to include in operation and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: 110 mph.
2. Building Classification Category: II.
3. Minimum 10 lb/sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.

    a. Component Importance Factor: 1.0.
    b. Component Response Modification Factor: 5.0.
    c. Component Amplification Factor: 3.5.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second):
4. Design Spectral Response Acceleration at 1.0-Second Period:
5. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

    a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.02 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. California Dynamics Corporation.
    b. Mason Industries, Inc.
    c. Vibration Eliminator Co., Inc.
    d. Vibration Isolation.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth or Ribbed pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.

    a. Surface Pattern: Smooth Ribbed pattern.
    b. Infused nonwoven cotton or synthetic fibers.

2.03 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ace Mountings Co., Inc.
    b. Mason Industries, Inc.
    c. Vibration Eliminator Co., Inc.
    d. Vibration Isolation.

2. Mounting Plates:

    a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded.
    b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.04 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ace Mountings Co., Inc.
   b. California Dynamics Corporation.
   c. Mason Industries, Inc.
   d. Vibration Eliminator Co., Inc.
   e. Vibration Isolation.

2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

   a. Housing: Cast-ductile iron or welded steel.
   b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.05 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Ace Mountings Co., Inc.
   b. California Dynamics Corporation.
   c. Mason Industries, Inc.
   d. Vibration Eliminator Co., Inc.
   e. Vibration Isolation.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.06 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Kinetics Noise Control, Inc.
    d. Vibration Eliminator Co., Inc.
    e. Vibration Isolation.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top housing with attachment and leveling bolt.

2.07 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Kinetics Noise Control, Inc.
    d. Vibration Eliminator Co., Inc.
    e. Vibration Isolation.

2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

    a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top plate with threaded mounting holes.
    c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.08 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Kinetics Noise Control, Inc.
    d. Vibration Eliminator Co., Inc.
    e. Vibration Isolation.

2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.09 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.10 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.11 AIR-SPRING ISOLATORS

A. Freestanding, Single or Multiple, Compressed-Air Bellows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Firestone Industrial Products Company.

2. Bellows Assembly: Upper and lower powder-coated steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows or similar elastomeric material.
3. Maximum Natural Frequency: 3 Hz.
4. Operating Pressure Range: 25 to 100 psig.
5. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
6. Tank valves.

2.12 RESTRAINED-AIR-SPRING ISOLATORS

A. Freestanding, Single or Multiple, Compressed-Air Bellows with Vertical-Limit Stop Restraint:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Firestone Industrial Products Company.

2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

    a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top plate with threaded mounting holes.
    c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.

4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
8. Bellows Assembly: Upper and lower powder-coated steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows or similar elastomeric material.
9. Maximum Natural Frequency: 3 Hz.
10. Operating Pressure Range: 25 to 100 psig.
11. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
12. Tank valves.

2.13 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Mason Industries, Inc.
    d. Vibration Eliminator Co., Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.14 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Ace Mountings Co., Inc.
    b. Kinetics Noise Control, Inc.
    c. Mason Industries, Inc.

d. Vibration Eliminator Co., Inc.
e. Vibration Isolation.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.15 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

2.16 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hilti, Inc.
2. Mason Industries, Inc.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to

building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.17 RESTRAINT CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Vibration & Seismic Technologies, LLC.

B. Restraint Cables: ASTM A603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.18 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. B-line, an Eaton business.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.19 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hilti, Inc.
2. Kinetics Noise Control, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

2.20 ADHESIVE ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hilti, Inc.
2. Kinetics Noise Control, Inc.

B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

2.21 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Vibration Eliminator Co., Inc.

B. Steel Rails: Factory-fabricated, welded, structural-steel rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Rails shall have shape to accommodate supported equipment.

3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

D. Concrete Inertia Base: Factory-fabricated or field-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.22 RESTRAINED ISOLATION ROOF-CURB RAILS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ace Mountings Co., Inc.
2. California Dynamics Corporation.
3. Mason Industries, Inc.

B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.

C. Upper Frame: The upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces.

D. Lower Support Assembly: The lower support assembly shall be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. The lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly. Adjustable, restrained-spring isolators shall be mounted on elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.03 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 07 72 00 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded

items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.06 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.07 AIR-SPRING ISOLATOR INSTALLATION

A. Independent Isolator Installation:

1. Install tank valve into each air isolator.
2. Inflate each isolator to height and pressure specified on Drawings.

B. Pressure-Regulated Isolator Installation:

1. Connect all pressure regulators to a single dry, filtered constant air supply.
2. Inflate isolators to height and pressure specified on Drawings.

3.08 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."

END OF SECTION 23 05 48

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: stainless steel, 0.025-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brimar Industries, Inc.
    b. Champion America.
    c. Craftmark Pipe Markers.
    d. LEM Products Inc.
    e. Marking Services, Inc.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Marking Sevices Inc.
5. National Marker Company.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Black White.

D. Background Color: White.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Craftmark Pipe Markers.
5. Kolbi Pipe Marker Co.
6. Marking Sevices Inc.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.04 DUCT LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Kolbi Pipe Marker Co.
5. LEM Products Inc.
6. Marking Sevices Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: White.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.05 STENCILS

A. Stencils for Piping:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brimar Industries, Inc.
b. Craftmark Pipe Markers.
c. Kolbi Pipe Marker Co.

2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

B. Stencils for Ducts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brimar Industries, Inc.
b. Craftmark Pipe Markers.
c. Kolbi Pipe Marker Co.

2. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel. Paint may be in pressurized spray-can form.

C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brimar Industries, Inc.
b. Craftmark Pipe Markers.
c. Kolbi Pipe Marker Co.

2. Lettering Size: Minimum letter height of 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.06 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Kolbi Pipe Marker Co.
5. Marking Sevices Inc.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: stainless steel, 0.025-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link chain.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.07 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Carlton Industries, LP.
3. Kolbi Pipe Marker Co.
4. Marking Sevices Inc.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 09 91 23 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Refrigerant Piping: Black letters on a safety-orange background.

3.05 DUCT LABEL INSTALLATION

A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.

C. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.06 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

    a. Refrigerant: 1-1/2 inches, round.
    b. Gas: 1-1/2 inches, round.

2. Valve-Tag Colors:

    a. Flammable Fluids: Black letters on a safety-yellow background.
    b. Combustible Fluids: White letters on a safety-brown background.
    c. Potable and Other Water: White letters on a safety-green background.
    d. Refrigerant: White letters on a safety-purple background,

3.07 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

    a. Constant-volume air systems.
    b. Variable-air-volume systems.

2. Testing, Adjusting, and Balancing Equipment:

    a. Motors.
    b. Condensing units.

3. Testing, adjusting, and balancing existing systems and equipment.
4. Duct leakage tests.
5. Control system verification.

1.03 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.04 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.06 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. TAB Specialists Qualifications: Certified by NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.07 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation,"

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses, close to the fan and prior to any outlets, to obtain total airflow.
    c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.

b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:

    a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
    b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
    c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
    d. Adjust controls so that terminal is calling for minimum airflow.
    e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
    f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
    g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.

5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
    c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

6. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
    b. Verify that terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
9. Verify final system conditions as follows:

    a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
    b. Re-measure and confirm that total airflow is within design.
    c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
    d. Mark final settings.
    e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
    f. Verify tracking between supply and return fans.

3.07 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.08 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.09 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.10 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.11 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.12 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.

8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.

i. Center-to-center dimensions of sheave and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.

n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft.
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.

c. Application.
d. Dates of use.
e. Dates of calibration.

3.14 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager and commissioning authority.

B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Owner may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.15 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.06 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type II for sheet materials.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Aeroflex USA, Inc.
    b. Armacell LLC.

F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. CertainTeed Corporation.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Knauf Insulation.
    d. Manson Insulation Inc.

G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. CertainTeed Corporation.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Knauf Insulation.
    d. Manson Insulation Inc.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of

Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.03 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

1. VOC Content: 300 g/L or less.
2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
4. Color: White.

C. Vapor-Retarder Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: 0 to 180 deg F.
3. Color: White.

D. Vapor-Retarder Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: Minus 50 to plus 220 deg F.
3. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Color: White.

2.04 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.05 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. Sealant shall have a VOC content of 420 g/L or less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. Sealant shall have a VOC content of 420 g/L or less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.06 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.08 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

2.09 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.

D. Metal Jacket:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. ITW Insulation Systems; Illinois Tool Works, Inc.

2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 2.5-mil-thick polysurlyn.

3. Stainless-Steel Jacket: ASTM A167 or ASTM A240/A240M.

a. Factory cut and rolled to size.
b. Material, finish, and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 2.5-mil-thick polysurlyn.

E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Ideal Tape Co., Inc., an American Biltrite Company.
c. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Ideal Tape Co., Inc., an American Biltrite Company.
c. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Compac Corporation.
   b. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Avery Dennison Corporation, Specialty Tapes Division.
   b. Ideal Tape Co., Inc., an American Biltrite Company.
   c. Knauf Insulation.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ITW Insulation Systems; Illinois Tool Works, Inc.

2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal.
3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) AGM Industries, Inc.
        2) Hardcast, Inc.
        3) Midwest Fasteners, Inc.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) AGM Industries, Inc.
        2) CL WARD & Family Inc.
        3) Gemco.
        4) Hardcast, Inc.
        5) Midwest Fasteners, Inc.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) AGM Industries, Inc.
        2) Gemco.

    b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      1) Gemco.

   b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      1) AGM Industries, Inc.
      2) Gemco.
      3) Hardcast, Inc.

   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) AGM Industries, Inc.
2) Gemco.
3) Hardcast, Inc.
4) Midwest Fasteners, Inc.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Gemco.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

2.12 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A167 or ASTM A240/A240M, Type 304.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

    1. Install insulation continuously through hangers and around anchor attachments.
    2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
    3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

    1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.07 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.08 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Polyolefin: 1 inch thick.

B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Polyolefin: 1 inch thick.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

4. Polyolefin: 1 inch thick.

D. Concealed, round and flat-oval, exhaust-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Polyolefin: 1 inch thick.

E. Concealed, rectangular, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

F. Concealed, rectangular, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

G. Concealed, rectangular, outdoor-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

I. Concealed, return-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

J. Exposed, rectangular, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

K. Exposed, rectangular, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

L. Exposed, rectangular, outdoor-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

M. Exposed, rectangular, exhaust-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

N. Exposed, return-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

3.12 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Concealed, rectangular, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

C. Concealed, rectangular, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

D. Concealed, return-air plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

E. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

F. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

G. Exposed, rectangular, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

H. Exposed, rectangular, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

I. Exposed, return-air plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. PVC: 20 mils thick.

D. Ducts and Plenums, Exposed:

1. PVC: 20 mils thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. Aluminum, Corrugated: 0.040 inch thick.
2.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Corrugated: 0.040 inch thick.

E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Stainless Steel, Type 304 or Type 316, Smooth, with 1-1/4-Inch-Deep Corrugations 4-by-1-Inch Box Ribs: 0.024 inch thick.

END OF SECTION 23 07 13

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes Cx process requirements for the following HVAC systems, assemblies, and equipment:

1. Energy supply systems.
2. Heat generation systems.
3. Cooling generation systems.
4. Central-station air-handling systems.
5. Air, steam, and hydronic distribution systems.
6. Heating and cooling terminal and unitary equipment.
7. HVAC controls.
8. TAB verification.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
2. For construction checklists, comply with requirements in various Division 23 Sections specifying HVAC systems, system components, equipment, and products.

1.03 DEFINITIONS

A. BAS: Building automation system.

B. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

C. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

D. IgCC: International Green Construction Code.

E. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they mean "as-built" systems, assemblies, subsystems, equipment, and components.

F. TAB: Testing, adjusting, and balancing.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For BAS and HVAC testing technician.

B. Construction Checklists:

1. Draft Cx plan, including draft construction checklists to be prepared by CxA under Section 019113 "General Commissioning Requirements." Div. 23 Subcontractor is to review Construction Checklist in accordance with requirements in Section 019113 "General Commissioning Requirements" and ASHRAE 202 and to resolve any issues with the CxA.

C. Test Equipment and Instruments: For all test equipment and instruments to be used in conducting Cx tests by Div. 23 Subcontractor, provide the following:

1. Equipment/instrument identification number.
2. Planned Cx application or use.
3. Manufacturer, make, model, and serial number.
4. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
5. Equipment manufacturers' proprietary instrumentation and tools. For each instrument or tool, identify the following:

    a. Instrument or tool identification number.
    b. Equipment schedule designation of equipment for which the instrument or tool is required.
    c. Manufacturer, make, model, and serial number.
    d. Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

1.05 QUALITY ASSURANCE

A. BAS Testing Technician Qualifications: Technicians performing BAS Construction Checklist verification tests, Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations are to have the following minimum qualifications:

1. Journey level or equivalent skill level with knowledge of BAS, HVAC, electrical concepts, and building operations.
2. Minimum three years’ experience installing, servicing, and operating systems manufactured by approved manufacturer.
3. International Society of Automation (ISA)-Certified Control Systems Technician (CCST) Level I.

B. HVAC Testing Technician Qualifications: Technicians to perform HVAC Construction Checklist verification tests, Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:

1. Journey level or equivalent skill level; vocational school four-year-program graduate or an Associate's degree in mechanical systems, air conditioning, or similar field. Degree may be offset by three years' experience in servicing mechanical systems in the HVAC industry. Generally, required knowledge includes HVAC systems, electrical concepts, building operations, and application and use of tools and instrumentation to measure performance of HVAC equipment, assemblies, and systems.
2. Minimum three years’ experience that is to include installing, servicing, and operating systems manufactured by approved manufacturer.

C. Testing Equipment and Instrumentation Quality and Calibration:

1. Capable of testing and measuring performance within the specified acceptance criteria.
2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
3. Be maintained in good repair and operating condition throughout duration of use on Project.
4. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

D. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:

    a. Be calibrated by manufacturer with current calibration tags permanently affixed.
    b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.

2. HVAC proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 Cx PROCESS:

A. Perform Cx process in accordance with Section 019113 "General Commissioning Requirements" for BAS and HVAC and in accordance with the following:

1. IgCC, which requires compliance with ASHRAE 202.
2. ASHRAE 202.
3. Commissioning standards acceptable to the authority having jurisdiction.

3.02 CONSTRUCTION CHECKLISTS

A. Preliminary detailed construction checklists are to be prepared under Section 019113 "General Commissioning Requirements" for each BAS and HVAC system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in IgCC and ASHRAE 202. Contractor performs the following:

1. Review BAS and HVAC preliminary construction checklists and provide written comments on checklist items where appropriate.
2. Return preliminary Construction Checklist with review comments within 10 days of receipt.
3. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)."
4. Use only construction checklists marked "Approved for Use, (date)" When performing tests. Mark construction checklists in the appropriate place as indicated Project events are completed, and provide pertinent details and other information.

B. Systems required to be commissioned under IgCC:

1. Heating, ventilating, air-conditioning, and refrigeration systems (mechanical and/or passive) and associated controls.
2. Renewable energy systems and energy storage systems.
3. Energy and building management and demand-control systems.

C. Additional systems required to be commissioned:

1. Energy supply systems, including the following:
   a. Renewable energy systems.
   b. Energy storage systems.

2. Heat generation systems, including the following:
   a. Furnaces.
   b. Auxiliary equipment.

3. Cooling generation systems, including the following:
   a. Direct-expansion refrigeration systems.

4. Air-handling systems, including the following:

   a. Supply, return, and exhaust air fans, motors, and drives.
   b. Automatic and gravity dampers.
   c. Heating and cooling devices.
   d. Humidification and dehumidification devices.
   e. Air filters.
   f. Hangers and supports.
   g. Interlock between air-handling system and fire/smoke alarm system.
   h. Vibration and seismic control devices.

5. Air duct systems, including the following:

   a. Duct systems.
   b. Air-duct accessories, including volume dampers, fire and smoke dampers, turning vanes, sound attenuators, and flexible connectors.
   c. Duct-mounted access doors and panels.
   d. Hangers and supports.
   e. Vibration and seismic control devices.

6. Refrigerant piping, including the following:

   a. Refrigerant piping, fittings, and specialties.
   b. Refrigerant charge.
   c. Sleeves and sleeve seals.
   d. Meters and gauges.
   e. General-duty and specialty valves.
   f. Hangers and supports.
   g. Vibration and seismic control devices.

7. Smoke-control systems, including the following:

   a. Exhaust and makeup fans, motors, and drives.
   b. Exhaust and makeup air distribution systems.
   c. Smoke dampers.
   d. Smoke detectors.
   e. Fire and smoke alarm system interface.

8. Heating and cooling terminal and unitary equipment, including the following:
   a. VRF heat pump units.
   b. VAV terminal boxes.

9. Vibration isolation and seismic control systems.
10. Controls and instrumentation, including the following:

    a. Energy monitoring and recording system.
    b. Controllers and sensors.

c. Automatic control valves, dampers, and actuators.
d. Control interface with fans, pumps, dampers, and other equipment and systems.
e. Demand-control systems.

11. TAB Verification:

a. Airflow.
b. Space pressurization.

12. Documentation:

a. Mechanical systems manuals.
b. Documentation of required commissioning.

13. Mechanical insulation, including the following:

a. Duct and plenum insulation.
b. HVAC piping insulation.

3.03 Cx TESTING PREPARATION

A. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating in accordance with the Contract Documents and approved submittals.

B. Certify that HVAC instrumentation and control systems have been completed and calibrated, point-to-point checkout has been successfully completed, and systems are operating in accordance with their design sequence of operation, Contract Documents, and approved submittals. Certify that all sensors are operating within specified accuracy and all systems are set to and maintaining set points as required by the design documents.

C. Certify that TAB procedures have been completed and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested in accordance with approved test procedures (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.04 Cx TEST CONDITIONS

A. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA, and document simulated conditions and

methods of simulation. After tests, return configurations and settings to normal operating conditions.

2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

B. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.

C. If seasonal testing is specified, complete appropriate initial performance tests and documentation, and schedule seasonal tests.

3.05 Cx TESTS COMMON TO HVAC SYSTEMS

A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.

B. Test systems, assemblies, subsystems, equipment, and components for operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response in accordance with acceptance criteria.

C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.

D. Comply with Construction Checklist requirements, including material verification, installation checks, startup, and performance test requirements specified in Division 23 Sections specifying HVAC systems and equipment.

E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:

1. Cx Construction Checklist verification tests.
2. Cx Construction Checklist verification test demonstrations.

3.06 CONSTRUCTION CHECKLIST EXAMPLES

A. Vibration Isolation in HVAC Systems:

1. Prerequisites: Acceptance of results of construction checklists for vibration and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment".
2. Components to Be Tested:

    a. Vibration isolation control devices in HVAC systems.
    b. Support systems.

3. Test Purpose: Evaluate effectiveness of vibration isolation control devices.
4. Test Conditions, Constant Speed Equipment: Measure vibration of the facility structure at three locations designated by Owner's witness while the isolated equipment operates.
5. Test Conditions, Variable Speed Equipment: Measure vibration of the facility structure at three locations designated by Owner's witness at the following operating conditions:

    a. Maximum speed.
    b. Minimum speed.
    c. Critical speed.

6. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.

3.07 TAB VERIFICATION

A. Prerequisites: Completion of "Examination" Article requirements and correction of deficiencies, as specified in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

B. Completion of "Preparation" Article requirements for preparation of a TAB plan that includes strategies and step-by-step procedures, and system-readiness checks and reports, as specified in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

C. Scope: HVAC air systems.

D. Purpose: Differential flow relationships intended to maintain air pressurization differentials between the various areas of Project.

E. Conditions of the Test:

1. Cx Test Demonstration Sampling Rate: As specified in "Inspections" Article in Section 230593 "Testing, Adjusting, and Balancing for HVAC."
2. Systems operating in full heating mode with minimum outside-air volume.
3. Systems operating in full cooling mode with minimum outside-air volume.
4. For measurements at air-handling units with economizer controls; systems operating in economizer mode with 100 percent outside air.

F. Acceptance Criteria:

1. Under all conditions, rechecked measurements comply with "Inspections" Article in Section 230593 "Testing, Adjusting, and Balancing for HVAC."
2. Additionally, no rechecked measurement shall differ from measurements documented in the final report by more than the tolerances allowed.
3. Under all conditions, where the Contract Documents indicate a differential in airflow between supply and exhaust and/or return in a space, the differential relationship shall be maintained.

3.08 TERMINAL UNIT EQUIPMENT Cx TESTS

A. VAV Terminal Air Units with Coils:

1. Prerequisites: Installation verification of the following:

a. Occupancy Input Device: Occupancy sensor.
b. Occupancy Output Device: DDC system binary output.
c. Room Temperature Input Device: Room thermostat.
d. Room Temperature Output Device: Electronic damper actuators and control-valve operators.
e. Display the following at the operator's workstation:

1) Room/area served.
2) Room occupied/unoccupied.
3) Room temperature indication.
4) Room temperature set point.
5) Room temperature set point, occupied.
6) Room temperature set point, unoccupied.
7) Air-damper position as percentage open.
8) Control-valve position as percentage open.

2. Scope: VAV terminal air units in supply-air systems and associated controls.
3. Purpose:

a. Occupancy-dependent room temperature set-point reset.
b. Room temperature control.

4. Conditions of the Test:

a. Cx Test Demonstration Sampling Rate: 10 percent of each model/size unit.
b. Temperature Control - Occupied: Start with the room unoccupied. Occupy the room and observe the change to occupied status. Observe temperature control until room temperature is stable at occupied set point, plus or minus 1.0 deg F.
c. Temperature Control - Unoccupied: Start with the room occupied. Vacate the room and observe the change to unoccupied status. Observe temperature control until room temperature is stable at unoccupied set point, plus or minus 1.0 deg F.

5. Acceptance Criteria:

a. Temperature Control - Occupied:

1) Control system status changes from "occupied" to "unoccupied" after the specified time.
2) Room temperature is stable at occupied set point, plus or minus 1.0 deg F within 10 minutes of occupancy. Room temperature does not overshoot or undershoot set point by more than 2.0 deg F during transition.

b. Temperature Control - Unoccupied:

1) Control system status changes from "unoccupied" to "occupied" after the specified time.
2) Room temperature is stable at unoccupied set point, plus or minus 1.0 deg F within 30 minutes of occupancy.

B. VRF Heat Pump Units:

1. Prerequisites: Installation verification of the following:
   a. Room Temperature Input Device: Room thermostat.
   b. Room Temperature Output Device: Electronic damper actuators and control-valve operators.
   c. Display the following at the operator's workstation:

      1) Room/area served.
      2) Room occupied/unoccupied.
      3) Room temperature indication.
      4) Room temperature set point.
      5) Room temperature set point, occupied.
      6) Room temperature set point, unoccupied.
      7) Indoor system/fan status.
      8) Outdoor system/fan status.
      9) Indoor fan speed.

2. Scope: VRF heat pump units and associated controls.
3. Purpose:
   a. Room temperature control.

4. Conditions of the Test:

   a. Cx Test Demonstration Sampling Rate: 10 percent of each model/size unit.
   b. Temperature Control - Occupied: Start with the room unoccupied. Occupy the room and observe the change to occupied status. Observe temperature control until room temperature is stable at occupied set point, plus or minus 1.0 deg F.
   c. Temperature Control - Unoccupied: Start with the room occupied. Vacate the room and observe the change to unoccupied status. Observe temperature control until room temperature is stable at unoccupied set point, plus or minus 1.0 deg F.

5. Acceptance Criteria:

   a. Temperature Control - Occupied:

      1) Control system status changes from "occupied" to "unoccupied" after the specified time.
      2) Room temperature is stable at occupied set point, plus or minus 1.0 deg F within 10 minutes of occupancy. Room temperature does not

overshoot or undershoot set point by more than 2.0 deg F during transition.

b. Temperature Control - Unoccupied:

1) Control system status changes from "unoccupied" to "occupied" after the specified time.
2) Room temperature is stable at unoccupied set point, plus or minus 1.0 deg F within 30 minutes of occupancy.

3.09 AIR-HANDLING SYSTEM Cx TESTS

A. Supply Fan(s) Variable-Volume Control:

1. Prerequisites: Installation verification of the following:
   a. Volume-Control Input Device: Static-pressure transmitter or Differential-pressure switch sensing supply-duct static pressure referenced to conditioned-space static pressure.
   b. Volume-Control Output Device: Receiver controller or DDC system analog output to motor speed controller. Set variable-speed drive to minimum speed when fan is stopped.
   c. High-Pressure Input Device: Static-pressure transmitter sensing supply-duct static pressure referenced to static pressure outside the duct.
   d. High-Pressure Output Device: DDC system binary output to alarm panel.
   e. Display the following at the operator's workstation:

      1) Supply-fan-discharge static-pressure indication.
      2) Supply-fan-discharge static-pressure set point.
      3) Supply-fan airflow rate.
      4) Supply-fan speed.

2. Scope: VAV supply fan units and associated controls.
3. Purpose:

   a. Supply-air discharge static pressure control.
   b. Response to excess supply-air discharge static pressure condition.

4. Conditions of the Test:

   a. Minimum supply-air flow.
   b. Midrange Supply-Air Flow: 50 to 60 percent of maximum.
   c. Maximum supply-air flow.
   d. Excess supply-air discharge static pressure.

5. Acceptance Criteria:

   a. At all supply-air flow rates, and during changes in supply-air flow, discharge air static pressure is at set point plus or minus 2 percent.

b. Fan stops and an alarm is initiated at the operator's workstation when supply-air discharge static pressure is at the excess static pressure, plus or minus 2 percent.

B. Air-Handler Mixed-Air Control:

1. Prerequisites: Installation verification of the following:

a. Minimum Position Input Device: DDC system time schedule .
b. Output Device: Receiver controller or DDC system analog output to modulating damper actuator(s).
c. Heating Reset Input Device: Room thermostat .
d. Supply and Mixed-Air Temperature Input Device: Electronic temperature sensor.
e. Cooling Reset Input Device: Outdoor- and return-air, duct-mounted electronic temperature sensors.
f. Display the following at the operator's workstation:

1) Mixed-air-temperature indication.
2) Mixed-air-temperature set point.
3) Mixed-air damper position.

2. Scope: Air handler with mixed-air control and associated controls.
3. Purpose:

a. Occupied time control.
b. Minimum damper position control.
c. Heating reset control.
d. Supply and Mixed-air temperature control.
e. Cooling reset control.
f. Unoccupied time control.

4. Conditions of the Test:

a. Occupied Time Control: Start in unoccupied schedule. Advance to occupied schedule time.
b. Minimum Damper Position Control: Command system to mode in which minimum damper position is required.
c. Heating Reset Control: Create a call for heating.
d. Supply and Mixed-Air Temperature Control: Override supply and mixed-air temperature set points to values 2.0 deg F above current supply and mixed-air temperatures.
e. Cooling Reset Control: Override outdoor-air temperature to a value that exceeds return-air temperature.
f. Unoccupied Time Control: Advance to unoccupied schedule time.
g. Control Data Trend Log: Set up a data trend log of the following input device values and output device commands. Record data at hourly intervals. Submit trend data for 24-hour periods in which natural conditions require heating reset control, supply or mixed-air temperature control, and cooling reset control.

1) Minimum position input device.
2) Heating reset input device.
3) Supply or Mixed-air temperature input device.
4) Cooling reset input device.

5. Acceptance Criteria:

a. Occupied Time Control: Mixed-air control is active in occupied mode.
b. Minimum Damper Position Control: Controller opens minimum outdoor-air dampers.
c. Heating Reset Control: Controller closes minimum outdoor-air dampers.
d. Supply and Mixed-Air Temperature Control: Controller modulates outdoor-, return-, and relief-air dampers to maintain temporary supply and mixed-air temperature set point, plus or minus 1.0 deg F.
e. Cooling Reset Control: Controller sets outdoor-air dampers to minimum position when outdoor-air temperature exceeds return-air temperature.
f. Unoccupied Time Control: Controller positions outdoor- and relief-air dampers closed and return-air dampers open.
g. Control Data Trend Log: Data verify control in accordance with sequence of control.

END OF SECTION 230800

SECTION 23 09 00

CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.01 RESPONSIBILITY

A. All necessary controls components for the proper operation of the controls system as described, except where directly excluded or listed as work not included, shall be by a factory authorized controls contractor.

B. The final design, installation, programming, graphics and start-up shall be the responsibility of the controls contractor. The programming and graphics shall be done through the existing DMV network system. All graphics shall match the existing network system.

C. The controls contractor is responsible for including the proper settings of each control loop (set point, throttling range, integral and derivative) as necessary to achieve system stability and controls accuracy. The database shall have the capability of changing any or all of these settings by the operator at any time, as required.

D. The controls contractor shall be responsible for the installation and warranty of the controls system and shall be responsible for the: engineering, programming, graphics generation, system start-up, start-up reports, and loading the system files and graphics on the server at DMV Headquarters in Sacramento, the DMV HVAC Engineer's computer, and the DMV Chief Engineer's computer.

E. The controls contractor shall be responsible for providing installation and setup of all software, programming, graphics and cables necessary to direct connect the DMV Engineer's computer to all programmed controlling devices to allow viewing, controlling, program editing, program uploading and downloading, and controller setups.

F. The controls contractor shall install all programmable hardware/devices and programs to be flawless and seamless in communications, monitoring, control, editing, uploading and downloading, setting up and configuring from the secure server at the DMV Headquarters in Sacramento to the new field office HVAC controls.

1.02 DESCRIPTION OF WORK

A. Provide a DDC control system as shown on the construction drawings and described in this specification section. Provide seamless communications interface to the host server computer and interface all software required for control, programming, and design of the graphical interface. EMS strategies and graphics shall be consistent with existing format. The DDC control system will consist of conformance Level 3 controllers and communicate with the existing Server over the DMV Ethernet WAN.

B. BMS will communicate with electric, water and gas meters to record demand and consumption data; the lighting control panel to show schedule and status of lighting circuits; and all HVAC equipment as required for control, supervision and data logging.

C. All control wiring regardless of voltage shall be installed in conduit if the wiring will be exposed to potential damage consistent with Division 26 requirements. Control wiring installed above accessible ceiling areas may be installed with open plenum rated cabling if supported properly and identified as EMS communication cable or sensor wire.

D. DDC control system will communicate with the DMV server located in Sacramento over the DMV Ethernet WAN. The Ethernet drop shall be installed by the controls contractor but not physically connected to the DMV network hub. The DMV HVAC Engineer will do the final plug at the DMV network hub.

E. Controls contractor will include all costs associated with providing the graphical software, training, graphics, control panels and system programming and all control components required for a complete and functional control system as specified.

1.03 QUALITY ASSURANCE

A. The DDC control system must be developed using existing proven equipment and must be readily available from inventory of the controls manufacturer or vendor at the time of bid. Controls contractor must provide an ACM (Ascent Control Module) to communicate through the existing software with full administration rights. Nothing in this specification is intended to override this responsibility.

B. The basis of design for the DDC control system is Alerton Envision for BACtalk NATIVE BACnet to match the existing DMV controls network.

1. Controls contractor may provide an Johnson Controls METASYS or other approved equal system provide all conditions of the specification and the provisions of the General Conditions of the Contract for Construction, Subarticle 3.12.10 Substitutions and Approved Equals are met.
2. Controls contractor providing controls by a manufacturer other than the basis of design product must arrange with the State to provide a mock up, at no cost to the State, to demonstrate that the proposed controls will function as well as the basis of design product. The contractor must demonstrate that the proposed system will integrate seamlessly with the existing DMV control network and that a seamless communications interface to the existing Alerton Graphical WEB Host Server will be provided, including interface of all software required for control, programming, and design of the graphical interface. DDC control strategies and graphics shall be consistent with existing format.

C. Control diagrams show in general the equipment required for the control sequence specified. Variations in the selection of temperature control and DDC equipment that will produce the required control sequences and meet the quality assurance criteria shall be submitted for review.

1.04 WORK INCLUDED

A. DDC control systems shall include all relays, temperature sensors, and control devices required to control the mechanical equipment as shown on the drawings. Control devices shall be installed as required to perform the necessary functions and operate in the proper sequence.

B. Controls contractor shall be responsible for installing and interlocking the duct mounted smoke detectors to the smoke/fire dampers indicated on the drawings. Duct smoke detectors provided by Division 26 will be installed under this section.

C. Control equipment, including control panels that are not factory mounted shall be furnished and installed by a representative of the DDC control system manufacturer who has been factory trained in the installation of the control system. Temperature control equipment, including panels but not including tubing, fittings, wire, conduit, non-automatic valves and other standards marketed apparatus, shall bear the nameplate of the manufacturer; and the entire system, including piping and wiring, shall be installed by qualified mechanics in the direct employment of the temperature control contractor.

D. Provide all interfaces, positioning and indicating devices shown on the drawings for interface to the DDC control system.

E. All installation work, including wiring/piping of the control system and internal wiring of the temperature control panels, shall be done under this Section.

F. Provide all wiring, conduit, relays, time switches; BACnet based controllers, etc., for a complete and functional control system as shown on the control diagrams. Control wiring and conduit shall be installed in conformance to the requirements of local codes. Before ordering controls or authorizing the control installation, submit for the State's approval detailed control diagram showing all controls, wiring, piping, etc. Detailed wiring diagram for the various equipment interlocks shall be submitted to coordinate the overall system operation with the State's operating staff to insure proper operation of the entire system.

G. Secure complete wiring diagrams of the various pieces of equipment, such as air handling units, condensate pumps, AC units, etc. and incorporate into overall submittal drawings. Submittal drawings shall consist of actual fan system or mechanical system layouts on not less than 11 x 17 inch paper, complete in all details.

H. Adjust and Validate: Contractor shall adjust and validate the entire control system and demonstrate compliance to the system point's list and required diagnostics. Calibration, using signal simulation techniques, shall be considered adequate as the first level of adjustment. Final adjustment shall be performed dynamically on operating systems.

I. Training and Documentation

1. A training session in the operation of the control system shall be conducted for the benefit of the State's operating personnel. Two (2) separate training sessions shall be conducted at the State's facility and each session shall last not less than four (4) hours or at the State's option provide equivalent intensive training for operators at control vendor's training facility.

2. Upon system completion, the contractor shall submit a letter stating that system adjustment and validation have been completed and that the State's operating personnel have been instructed in its use.
3. The contractor shall present the State with an acceptance statement for a signature. The statement shall verify that the State's operating staff has received both training and operations and maintenance information.

J. Warranty

1. Controls contractor shall provide a (1) year warranty for both parts and labor on the DDC system from the date of completion.
2. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system acceptance.
3. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.
4. This warranty shall apply equally to both hardware and software.

K. All temperature control panels and control components that are not shipped directly to the AHU manufacturer, shall be field mounted and wired and shall include properly labeled and marked terminal strips to enable easy field connection. All control panels for air-handling units shall be tested by controls contractor before shipping to air-handler manufacturer.

L. Furnish all remote field devices, except those specifically excluded, to assure a complete and operating system (sensors, wells, transmitters, power supplies, duct smoke detectors, CO2 sensors, damper actuators, control valves, etc.).

M. Include all necessary cables to connect DDC Building Ethernet Unit to host computer.

N. Provide complete start-up and field calibration of the control system. The set points shown are suggested starting points only. This Contractor must set the controls at the proper values to assure that all systems are stable, hold the required conditions, and function as intended.

O. Provide factory-wired control panels that meet all codes. NEMA 1 for panels mounted indoors; NEMA 4 or NEMA-3R for panels mounted outdoors.

P. Provide complete engineering/detailed control drawings showing all devices, terminal numbers, schedules, legends, labels, etc., as required to properly display the system to be installed and to allow early trouble-shooting in the future. The diagrams shall also indicate set points, throttling range, ratios and all other switch settings and adjustments.

Q. Provide a detailed written sequence of operation that specifically describes the system operation in terms easily understandable by the State's operating staff and describes how the contractor's specific equipment will accomplish making the system operate as intended. This shall be more detailed than the engineer's sequence and specifically describe the operation of each device.

R. During start-up, the Contractor shall “tune the loops” as required to obtain stable operation, hold the required conditions, and maintain as tight control as possible. The Contractor shall submit, as part of his operation and maintenance manuals, a listing of the final set-up values.

S. Exposed wiring connected to wall or column mounted space sensors will be concealed in wire mold.

1.05 DRAWINGS AND SUBMITTAL

A. Control drawings are diagrammatic and shall be used in conjunction with the points list and construction documents to design a complete and functional DDC control system.

B. Submittals shall illustrate point-to-point wiring terminations and include snapshots of EMCS front end graphic screens. As-Built drawings shall show interface terminations to Alerton BACnet Ethernet LAN and all wiring changes that occurred during construction.

PART 2 - PRODUCTS

2.01 GENERAL

A. DDC control system shall consist of three levels of controllers. Alerton Server existing at the Sacramento DMV Headquarters, ACM BACnet controller / routers, and distributed intelligent Visual Logic equipment level controllers.

B. BACnet Controller

1. ACM shall be a 32-bit intelligent field panel that communicates over Ethernet, MS/TP physical layers as described in the ASHRAE 135 standard. The ACM scans all the VLCs to update information and coordinate global control functions of the building. Multiple ACMs and PC workstations can be connected together over the Ethernet LAN.

C. Visual Logic Controllers (VLCs)

1. Unit control modules will be intelligent stand-alone control modules with up to 27 universal inputs and outputs. VLCs will be conformance level three BACnet devices.
2. Provide new control devices that have been factory and field calibrated in perfect working order. Re-calibration, as required in the field, shall be performed at the time of start-up for proper sequence and operation of the control system.
3. All input/output devices, and sensors, etc. shall be compatible with the DDC Controller. Unless noted otherwise, signals shall be as follows:

    a. Analog Input: 4 - 20 ma DC; 0 - 10V, 0 - 20V RTD; Thermistor; Balco.
    b. Analog Output: 4 - 20 ma DC or 0 - 10V DC.
    c. Digital Input: Dry form “C” contacts.

d. Digital Output: 24 volts AC.
e. Pulsed Input: 0 - 5V DC powered max; 36 events/ second.

D. VLC VAV Controllers: Single Duct VAV box controllers will have 5 inputs, one airflow transducer, and one space temperature sensor with set point adjustment and after hour override and VAV box supply air temperature sensor. VAV box controllers will have 2 damper floating control outputs.

E. HVAC Equipment Interface

1. It shall be the responsibility of the controls contractor to obtain factory wiring diagrams of all HVAC equipment provided on this project to insure proper DDC interface without jeopardizing factory internal safeties of the equipment.

2.02 ACM BUILDING LEVEL CONTROLLER OR ACM CONTROLLER

A. General

1. ACM shall provide real-time (hardware) clock functions. It shall also provide communications via BACnet standard protocols to all field controllers. ACM shall interface with operator terminal(s) via BACnet protocols for information display.
2. ACM shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet), and master slave token passing (MS/TP). ACM shall have capability to easily function as a 4-way router with the addition of simple plug-in modules.
3. ACM shall be capable of deciding global strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable. Program execution at ACM shall be a minimum of once per second.
4. Programming shall be object-oriented using control program blocks. Documentation in flowchart form for all programming shall be provided as part of the final system as-built documentation. Samples of flowchart documentation shall be included in submittals. All flowcharts shall be generated and automatically downloaded to controller. No reentry of database information shall be necessary.
5. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator’s terminal or field computer.
6. Controller shall have a minimum of 4 MB battery-backed static RAM along with 64K of EPROM. Battery shall retain static RAM memory and clock functions for a minimum of 1 year. Battery shall be a field-replaceable (non-rechargeable) lithium type.
7. ACM shall include display for network setup and monitoring. Display shall be backlit LCD with 2-line by 20-character display. Include 8-key keypad for operator entry of data.

B. BACnet Conformance

1. ACM shall as a minimum support, MS/TP, Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. ACM shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:

    a. Clock Functional Group.
    b. COV Event Initiation.
    c. Files Functional Group.
    d. Device Communications Functional Group.
    e. Time Master.

2. Refer to section 22.2 in the ASHRAE BACnet Standard 135-1995, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum Analog Value, Binary Value, Calendar, Command, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Remote Communications

1. Provide all functions that will allow remote communications via the DMV Ethernet WAN.
2. Load system file on DMV's Alerton server and WEBtalk off-site computer that allows operator to view and change all information associated with system on color graphic displays. Operator shall be able to change all parameters in this section from off-site location.
3. The system server shall be able and programmed to send e-mail messages for critical alarm conditions.

D. Schedules

1. Each ACM shall support a minimum of 100 BACnet Schedule Objects and 100 BACnet Calendar Objects.
2. Each schedule object (Weekly or Exception) shall be capable of performing an optimum start. Optimum start calculation shall be based on outside air temperature, zone air temperature, deviation from zones, daytime heating and cooling set point, and individual zone adaptive heating and cooling coefficients that are adjusted each day based on performance parameters of the individual zone.

E. Logging Capabilities

1. Each ACM shall log as minimum 150-user selectable object properties. Multiple properties may be logged for each object with a minimum of 100 samples per object property any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's terminal. Start of sampling may be by one of the following: Selectable log beginning and ending by using BACnet Calendar and Schedule Objects.
2. - Object change of value (all types of analog objects)
3. - Object change of state (all types of binary objects)
4. Logs may be viewed both on-site and off-site via remote communication.
5. ACM shall periodically upload trended data to operator's terminal for long term archiving if desired.
6. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

F. Alarm Generation

1. Object change of values and change of states may be identified as alarm conditions. When such conditions exist, the ACM identifies each alarm through BACnet Get Alarm Summary Service. This summary of active alarms (Event State property value not equal to NORMAL) is presented to and displayed at the operator's terminal for system user action.
2. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.

2.03 ROUTER, CONVERTER, REPEATER

A. Routing functions shall be performed using only BACnet standard protocols as defined by ANSI/ASHRAE Standard 135-1995. The converter interconnects a standard computer serial port with an MS/TP LAN. Repeater functions shall be handled by a device designed to selectively interconnect 4 (four) portions of MS/TP LAN as a minimum.

2.04 AIR HANDLER LOGIC CONTROLLERS

A. Provide one or more native BACnet logic controllers for each air handler and provide native BACnet logic controllers as needed for central plant control that adequately cover all objects listed in object list. All controllers shall interface to ACM via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. No auxiliary or non-BACnet controllers shall be used.

B. BACnet Conformance

1. Logic controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 KBPS, as native BACnet devices. Logic controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

    a. Files Functional Group.
    b. Reinitialize Functional Group.
    c. Device Communications Functional Group.

2. Refer to section 22.2 in the ASHRAE BACnet Standard 135-1995, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Logic controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K Thermistor, 0–10VDC, 0–5 VDC, 4–20 ma and dry contact signals. Any input on controller may be either analog or digital. Controller shall include binary and analog outputs on board.

D. All program sequences shall be stored on board logic controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices.

E. Programming of logic controller shall be completely modifiable in the field over installed BACnet LANs or remotely via DMV Ethernet WAN. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Logic controller shall be programmed using programming tools as described in operator’s terminal section.

F. All programming tools shall be provided as part of system. Provide documentation in flowchart form of all programming as part of the final system as-built documentation. Include samples of flowchart documentation in submittals.

G. Logic controller shall include software scheduling functions on board without depending on any external device. Scheduling shall be via a BACnet schedule object for seven-day of-the-week scheduling. Controller shall include interface capability for optional plug-in hardware clock with battery backup. Provide optional hardware clock as shown on object list given in drawing set.

2.05 SENSORS AND MISCELLANEOUS DEVICES

A. TEMPERATURE SENSORS: All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable. Duct sensors to be electronically identical, housing suitable for the application. Metal guards shall be provided as shown on drawings.

B. Wall mounted space temperature sensors shall be stainless steel plate type sensor. An override push button for after hour operation of the HVAC system shall be provided where indicated on the plans.

2.06 MINIMUM CONTROL REQUIREMENTS

A. Factory installation by AHU Manufacturer

1. All controllers and devices.
2. Sensors, relays, switches.
3. Schematics.

B. Field Installation by Controls Manufacturer's Representative

1. All zone, CO2, and duct supply sensors.
2. Time override switch/es.
3. Main Control Panel Enclosure to interface with existing Alerton controls.

    a. Manufacture by: Hoffman Medium Enclosures Type I or equal.

4. All control field wiring.

C. New DDC Control System: Controlling, Monitoring, and Alarming Points

1. Minimum Analog Input (AI).

    a. Temperature – OA, MA, RA, Zone SA (All), Zone Room/Area (All).
    b. Carbon Dioxide (CO2) – Main Work/Public Area.

2. Minimum Analog Output (AO)

    a. Dampers – OA, MA, Exhaust, Zones (All).
    b. Valves – Mixing, Diverting (If applicable).

3. Minimum Binary Input (BI)

    a. Motors Status – Supply Fan, Return/Exhaust Fan, ACCU Compressors (All).
    b. Others – Primary and Secondary filters, Smoke Detectors, Heating Staging, Time Override.

4. Minimum Binary Output (BO)

    a. Motor control – Supply Fan, Return/Exhaust Fan, Compressors (All).

b. Other – Heat and Cool Lockouts, Heat Staging.

5. Alarm Points

a. Critical – Supply Fan Failure, ACCU Cooling Failure, Heating Failure, Smoke Detector.
b. Non-Critical – Primary and Secondary Filter, Return/Exhaust Fan Failure.

6. Schedule

a. 365 day programmable.
b. Time Override.
c. Holidays.
d. Special Events.

7. Misc. Control

a. Zone Set Points (All), HD Set Point, CD Set Point, MAT Set Point, Minimum OA, Heat LO, Cool LO, Heating Offset, Cooling Offset, Time Override.

8. Password Protection

a. Minimum 200 users with changeable levels of Security.
b. Tracking users' logon and logoff, and changes made.

9. Trending (Vendors Initial Setup)

a. Continuous Trending of all AI, AO, BI and BO points at one minute intervals for a minimum of one year then Archiving to CDs for historical data.

D. Graphics (Minimum)

1. To match the layout, size, color, and control as the existing Alerton Envision for BACtalk.
2. Full control of all BO and AO points, schedule, lockouts, and settings.

E. Remote and Local Communications to the New DDC Control System

1. The new controls shall interfaced with the existing Alerton Envision for BACtalk Native BACnet DDC control Network system located at the DMV Headquarters, Sacramento, California.

a. The new controls shall interface, be compatible, totally viewable and controllable through the DMV's existing network system.

F. Programs

1. Controls contractor shall provide, configure and load five copies of all software on DMV laptops required for installing, programming, operating, and backing up all programmable controlling devices that DMV does not already have.

2. This includes all cables and devices needed for a direct connection to the new controlling devices.
3. Controls contractor shall provide DMV with a backup copy of all the sites programs files and graphics.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the State in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved.

3.02 INSTALLATION (GENERAL)

A. Install in accordance with manufacturer's instructions.

B. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

C. All control wiring and conduit will be installed by controls contractor. All control wiring will be installed in EMT conduit in dry locations and Rigid IMC conduit with seal tight connections in exposed locations. Control wiring installed above accessible ceilings will be allowed if installed in a neat and professional manner. All open wiring will be labels as EMS wiring every few feet.

3.03 LOCATION AND INSTALLATION OF COMPONENTS

A. Locate and install components for easy accessibility; in general, space sensors are to be mounted 42-48 inches above finished floor with a minimum of 3'-0" clear access space in front of sensors. Obtain approval on locations from the State prior to installation.

B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.

C. Identify all equipment and panels. Provide permanently mounted tags for all panels.

D. Provide stainless steel or brass thermo wells suitable for respective application and for installation under other sections—sized to suit pipe diameter without restricting flow.

3.04 INTERLOCKING AND CONTROL WIRING

A. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and all national, state and local electrical codes. All 120 VAC interlock wiring will be in conduit. All work shall be in compliance with NECA 1.

B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions.

C. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.

D. Provide auxiliary pilot duty relays on motor starters as required for control function.

E. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings.

F. All control wiring in the mechanical, electrical, telephone rooms to be installed in EMT Conduit. All other wiring to be installed neatly and inconspicuously per local code requirements.

3.05 FIELD SERVICES

A. Prepare and start DDC control system under provisions of this section.

B. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

C. Provide the State with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.06 COLOR GRAPHICS REQUIRED FOR PROJECT

A. Complete floor plan with all space temperatures and space temperature sensor locations.

B. Graphic of each HVAC unit with all points listed in points list available on the graphic for control and diagnostic functions.

C. Graphic of all other ancillary systems such as boilers, pumps, etc. and all associated sensors and status points.

END OF SECTION 23 09 00

SECTION 23 09 23

DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls. Provide and install all necessary hardware and software to meet the specified functional requirements.

B. Provide a complete control system including front end computer and software. Furnish all labor, materials, equipment, and service necessary for a complete and operating Native BACnet based Temperature Control System based upon the ANSI/ASHRAE™ Standard 135–2016, BACnet as shown on the drawings and as described herein.

C. Prepare individual hardware layouts, interconnection drawings and control loop configuration data from project design data.

D. Implement the detailed design for all system input/output points, distributed control and system data bases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

E. Provide and install all controllers, panels, and all interconnecting data communication network cables and all interconnecting cables between all operator terminals and peripheral devices (such as printers, etc.) called for in this section.

F. Replace all variable air volume (VAV) terminal damper actuators, wall mounted thermostats and VAV heating coil control valves including actuators. Actuators shall be type to function long term in a floating control based system. Triac devices are prohibited.

G. Provide as-built documentation, software, and all Direct Digital Control (DDC) control logic and all associated support documentation on approved media which accurately represents the final system.

H. Supply all equipment and accessories in accordance with the requirements of all applicable national, state and local codes.

I. Scheduled equipment performance is minimum capacity required.

J. Scheduled electrical capacity shall be considered as maximum available.

K. Unless noted otherwise, all conduit and wiring associated with the temperature control system, regardless of voltage, is included as part of this Section. Obtain power for temperature control devices from adequate sources.

L. This project includes connection to controls such as actuators, Packaged direct expansion unit with gas fired heat and other locations as applicable to provide a complete HVAC control system.

1.02 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. Native BACnet: A control network technology platform for designing and implementing interoperable control devices and networks. Based upon ANSI/ASHRAE Standard 135-2016.

D. MS/TP: Master slave/token passing.

E. PC: Personal computer.

F. PID: Proportional plus integral plus derivative.

G. RTD: Resistance temperature detector.

H. ASIC: Application specific integrated circuit.

1.03 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

    a. Water Temperature: Plus or minus 1 deg F.
    b. Water Flow: Plus or minus 5 percent of full scale.
    c. Water Pressure: Plus or minus 2 percent of full scale.

d. Space Temperature: Plus or minus 1 deg F.
e. Ducted Air Temperature: Plus or minus 1 deg F.
f. Outside Air Temperature: Plus or minus 2 deg F.
g. Dew Point Temperature: Plus or minus 3 deg F.
h. Temperature Differential: Plus or minus 0.25 deg F.
i. Relative Humidity: Plus or minus 5 percent.
j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
k. Airflow (Terminal): Plus or minus 10 percent of full scale.
l. Air Pressure (Space): Plus or minus 0.01-inch wg.
m. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
n. Electrical: Plus or minus 5 percent of reading.

1.04 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Bill of materials of equipment indicating quantity, manufacturer, and model number.
3. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
4. Wiring Diagrams: Power, signal, and control wiring. Provide point to point wiring diagrams and engineered drawings, complete list of equipment and materials including manufacturer's catalog cuts, and installation instructions.
5. Provide complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Indicate terminal identification for all control wiring on the shop drawings.
6. Provide the following minimum system documentation:

a. System configuration diagrams in simplified block format.
b. Input / Output point and alarm point summary listing.

c. Electrical drawings showing all system internal and external connection points, terminal block layouts and terminal identification.
d. As part of Maintenance and Operating Data, provide manufacturer's instructions and drawings for installation, maintenance and operation of all materials.
e. Overall system operation and maintenance instructions, including preventive maintenance and troubleshooting instructions.

7. Details of control panel faces, including controls, instruments, and labeling.
8. Provide a complete written Sequence of Operations.
9. DDC System Hardware:

   a. Schematic diagrams and floor plans for field sensors and control hardware.
   b. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

10. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
11. Controlled Systems:

    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram.
    d. Points list.

1.05 INFORMATIONAL SUBMITTALS

A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135-2016.

B. Field quality-control test reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. Include the following:

1. Maintenance instructions and lists of spare parts for each type of control device.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

5. Calibration records and list of set points.

B. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Replacement Materials: One space thermostat and one VAV box controller matching installed devices.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, Accessories and Installations shall comply with the following:

1. Shall be listed and labeled as defined in 2016 California Electrical Code, Article 100, by a testing agency acceptable to the State IOR, and marked for intended use.
2. CCR – 2016 California Code of Regulations, Title 24, Part 3, Basic Electrical Requirements, State Building Standards Electrical Code.
3. CEC – 2016 California Electrical Code.
4. NEMA - National Electrical Manufacturer's Association.

C. Comply with ASHRAE 135-2016 for DDC system components.

D. All BACnet application specific controllers submitted for use on this project must be certified as complaint with BACnet through the BACnet Manufacturers' Association (BMA) BACnet Testing Lab and must have a "BTL Mark". The temperature control system must be developed using existing proven equipment and must be readily available from inventory of the controls manufacturer or vendor at the time of bid.

E. Provide standard controllers and components, of regular manufacture and be readily available from inventory of the BACnet System Manufacturer. All systems and components shall have been thoroughly tested and proven in actual use.

F. Operator workstation shall utilize Microsoft Windows 7 Professional or newer and Microsoft 2016 Office Professional. Workstations and controllers shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section.

G. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in the system.

H. All BACnet based peer-to-peer controllers, central system controllers and local user displays shall be UL listed under Standard UL 916, category PAZX.

I. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 CONTROL SYSTEM

A. Manufacturers:

1. Alerton Inc.
2. Automated Logic Corporation.
3. Delta Controls Inc.
4. Or equal.

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.03 DDC EQUIPMENT (reference 2.2 Control System)

A. Operator Workstation: One PC-based microcomputer with minimum configuration as follows:

1. Case: ATX case, 400W minimum power supply with 80% minimum efficiency.
2. Motherboard: With minimum of 4 integrated USB 3.0 ports, minimum of 4 memory slots, minimum of 4 SATA 6Gb/s, HDMI, DP and DVI-D video ports, 10/100/1000 Mbps onboard ethernet controller, integrated audio, BIOS, and hardware monitoring.
3. Processor: Intel Core i7-7700 with 3.6 GHz, AMD or equal.
4. Random-Access Memory: 32 GB Dual Channel DDR4-2133/2400 RAM.
5. Graphics: AMD Radeon RX VEGA 64 8192MB graphics card, Nvidia or equal.
6. Monitor: 27 inches, widescreen, LED backlight LCD, 1920x1080 minimum resolution, 75Hz refresh rate, 8ms maximum response time, DVI and HDMI connectors, USB 3.0 ports.
7. Keyboard: QWERTY, 105 keys in ergonomic shape, USB, optical.
8. CD/DVD: Disk drive with capability to burn new disks, 16X DVD-ROM with Cyberlink Power DVD.
9. Hard-Disk Drive: 2TB, SATA III, internal.
10. Mouse: Six button, optical.
11. Operating System: Microsoft Windows 10 Professional (64-bit) with high-speed Internet access.

    a. ASHRAE 135-2016 Compliance: Workstation shall use ASHRAE 135-2016 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

12. Basic software: Microsoft Office Professional 2016.
13. BACnet Conformance

    a. Operator's workstation shall as a minimum support Point-to-Point (PTP) and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device. Operator's terminal shall comply with the requirements of BACnet conformance class 3 devices and support all BACnet services necessary to provide the following BACnet functional groups:

        1) Clock Functional Group
        2) Event Response Functional Group
        3) Time Master Functional Group
        4) Device Communications

b. Refer to section BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
c. Standard BACnet object types accessed by the workstation shall include as a minimum: Analog Value, Analog Input, Analog Output, Binary Value, Binary Input, Binary Output, Calendar, Device, Event Enrollment, File, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
d. The Operator Workstation shall comply with BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs). Workstation shall support Foreign Device Registration to allow temporary workstation connection to IP network.

14. Displays

a. Operator's workstation shall display all data associated with project as called out on drawings and/or object type list supplied. Graphic background files shall be created using AutoCAD background files. System shall be capable of displaying graphic file, text, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Workstation shall allow user to change all field-resident BACnet System functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.
b. Binary objects shall be displayed as ACTIVE/INACTIVE/NULL or with customized text. System shall be supplied with a library of standard graphics, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) are not accepted.
c. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual graphic items on the display screen as an overlay to the system graphic. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trend logs.
d. If touch activation screen is provided, a mouse shall be usable to move the pointer arrow to the desired item for selection of new display or to allow the operator to make changes to object data.

15. Custom Application Software:

    a. English language oriented.
    b. Full-screen character editor/programming environment.
    c. Allow development of independently executing program modules with debugging/simulation capability.
    d. Support conditional statements.
    e. Support floating-point arithmetic with mathematic functions.
    f. Contains predefined time variables.

16. Password Protection

    a. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on.
    b. Operator's terminal shall provide security for up to 10 users minimum. Each user shall have an individual User ID, User Name and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID shall be 0–8 characters, User Name shall be 0–29 characters, and Password shall be 4–8 characters long. Each system user shall be allowed individual assignment of only those control functions and menu items to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator's terminal. Each user shall also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels.
    c. Operator terminal shall be capable of allowing assigned users access to the terminal from remote locations via the internet connection. This access shall meet all conditions and have all capabilities as set forth in Password Protection paragraph b.
    d. System shall include an Auto Logout Feature that shall automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period shall be adjustable by system administrator.

17. Operator Activity Log

    a. Operator Activity Log shall be included with system that tracks all operator changes and activities. System shall track what is changed in the system, who performed this change, date and time of system activity and value of the change before and after operator activity. Operator shall be able to display all activity, sort the changes by user and also by operation.
    b. Log shall be gathered and archived to hard drive on operator workstation as needed. Operator shall be able to export data for display and sorting in a spreadsheet.
    c. Any displayed data, that is changeable by the operator, may be selected using the right mouse button and the operator activity log shall then be selectable on the screen. Selection of the operator activity log using this method shall show all operator changes of just that displayed data.

18. Scheduling

    a. Operator's workstation shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily with events being the highest.
    b. Holiday and special event schedules shall display data in calendar format. Operator shall be able to schedule holidays and special events directly from these calendars.
    c. Operator shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.
    d. System shall include a Schedule Wizard for set up of schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right clicking on value displayed on graphic and then selecting Schedule.

19. Alarm Indication and Handling

    a. Operator's workstation shall provide audible, visual, and printed means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s), currently running. Printout of alarms shall be sent to the assigned terminal and port.
    b. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to normal, time and date of alarm acknowledgment and identification of operator acknowledging alarm.
    c. Alarm messages shall be in user-definable text (English language) and shall be entered either at the operator's terminal or via remote communication.
    d. When any alarm occurs it shall be broadcast to all assigned recipients by sending an email via the internet connection. System shall be capable of sending alarm messages to at least 10 assigned recipients. The message shall include the building name "EDD Office Building – 1225 4th Avenue, Oakland, CA" and description of the alarm.

20. Trend log Information

    a. System server shall periodically gather historically recorded data stored in the building controllers and archive the information Archived files shall be appended with new sample data, allowing samples to be accumulated. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operator's workstation. Operator shall be able to scroll through all trended data. All trend log information shall be displayed in standard engineering units.
    b. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x,y) graphs that display up to ten object types at the same time in different colors. Graphs shall show object values relative to time.

c. Operator shall be able to change trend log setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics on which object is displayed.

21. Energy Log Information

a. System server shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units.
b. All data shall be stored in data base file format for direct use by third-party programs. Operation of system shall stay completely online during all graphing operations.
c. Operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.

22. Configuration/Setup

a. Provide means for operator to display and change system configuration. This shall include, but not be limited to, system time, day of the week, date of daylight savings set forward/set back, printer termination, port addresses, modem port and speed, etc. Items shall be modified using understandable terminology with simple mouse/cursor key movements.

23. Field Engineering Tools

a. Operator's workstation software shall include field-engineering tools for programming all controllers supplied. All controllers shall be programmed using graphical tools that allow the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from other types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.
b. User shall be able to pick graphical function block from menu and place on screen. Provide zoom in and zoom out capabilities. Function blocks shall be downloaded to controller without any reentry of data.
c. Programming tools shall include a real time operation mode. Function blocks shall display real time data and be animated to show status of data inputs and outputs when in real time operation. Animation shall show change of status on logic devices and countdown of timer devices in graphical format.
d. Field engineering tools shall also include a database manager of applications that include logic files for controllers and associated graphics. Operator shall be able to select unit type, input/output configuration and

other items that define unit to be controlled. Supply minimum of 250 applications as part of workstation software.

e. Field engineering tool shall include Device Manager for automatic detection of devices connected anywhere on the BACnet network by scanning of the entire network. This function shall display device instance, network identification, model number and description of connected devices. It shall record and display software file loaded into each controller. A copy of each file shall be stored on the computer's hard drive. If needed, this file shall be downloaded to the appropriate controller by selection using the mouse.

f. System shall include backup/restore function that will back up entire system to selected medium and then restore system from that media.

24. Software

a. Furnish and install control system manufacturers BACtalk Software onto new Workstation/Server Computer. Third party software is not acceptable.

b. At the conclusion of project, contractor shall leave with DTA Facility Manager a CD ROM that includes the complete software operation system and project graphics, setpoints, system parameters, etc. This backup shall allow the DTA assigned operator to completely restore the system in the case of a computer malfunction.

B. BUILDING CONTROLLER (BCM)

1. General Requirements

a. Building Controller shall be of modular construction such that various modules may be selected to fit the specific requirements of a given project. Modules shall consist of a power supply module, a BACnet Ethernet-MS/TP module, a BACnet MS/TP only module and a modem module for telephone communication as a minimum. Equipment controls that require special interfaces may use Modbus modules as needed. However, all Ethernet communications and all controllers including central plant controllers, advanced application controllers and unitary controllers supplied by BMS manufacturer shall utilize the BACnet protocol standard.

b. Modules shall be selected to fit the particular project application. Up to 7 modules shall be powered by a single power supply module. All modules shall be panel mounted on DIN rail for ease of addition and shall be interconnected via simple plug in cable. A module in the middle shall be replaceable without removing any other modules.

c. All modules shall be capable of providing global control strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the building controller module or by another controller. The software program implementing these strategies shall be completely flexible and user definable. All software tools necessary for programming shall be provided as part of project software. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.

d. Programming shall be object-oriented using control function blocks, supporting DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be supplied and be resident on workstation. The same tool shall be used for all controllers.
e. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's workstation computer.
f. Controller shall have a memory needed to ensure high performance and data reliability. Battery shall provide power for orderly shutdown of controller and storage of data in nonvolatile flash memory. Battery backup shall maintain real-time clock functions for a minimum of 20 days.
g. Global control algorithms and automated control functions shall execute via 32-bit processor.
h. Schedules

1) Each building controller module shall support a minimum of 80 BACnet Schedule Objects and 80 BACnet Calendar Objects.
2) Building controller modules shall provide normal 7 day scheduling, holiday scheduling and event scheduling.

i. Logging Capabilities

1) Each building controller shall log as minimum 320 values. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
2) Building controller shall periodically upload trended data to networked operator's workstation for long term archiving.
3) Archived data stored in database format shall be available for use in third-party spreadsheet or database programs such as Microsoft Excel.

j. Alarm Generation

1) Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
2) Each alarm may be dialed out as noted elsewhere.
3) Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.
4) Controller must be able to handle up to 320 alarm setups stored as BACnet event enrollment objects – system destination and actions individually configurable.

2. Ethernet – MS/TP Module

a. Ethernet – MS/TP Module shall support every function as listed under paragraph A, General Requirements, of this section and the following.

b. All communication with operator workstation and all application controllers shall be via BACnet. Building controller Ethernet – MS/TP module shall incorporate as a minimum, the functions of a 2-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz) and master slave token passing (MS/TP) LAN. Ethernet – MS/TP module shall also route messages from all other Building Controller modules onto the BACnet Ethernet network.

1) MS/TP LAN must be software configurable from 9.6 to 76.8Kbps.
2) The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).

c. BACnet Conformance

1) Ethernet – MS/TP module shall as a minimum support MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global Controller shall be a BACnet conformance class 3 device and support all BACnet services, Functional Groups and all standard BACnet object types.
2) The Building Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).

3. Power Supply Module

a. Power supply module shall power up to 7 Building Controller Modules. Input for power shall accept between 17 and 30 VAC, 47 to 65 Hz.
b. Power supply module shall include rechargeable battery for orderly shutdown of controller modules including storage of all data in flash memory and for continuous operation of real time clocks for minimum of 20 days.

C. CENTRAL PLANT AND AIR HANDLER APPLICATION CONTROLLERS (ALC-LGR/ALC-AAR)

1. Provide one or more native BACnet application controllers for each air handler and provide native BACnet application controllers as needed for central plant control that adequately cover all objects listed in object list. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller. No auxiliary or non-BACnet controllers shall be used.

2. BACnet Conformance

    a. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary such as Files Functional Group, Reinitialize Functional Group and Device Communications Functional Group.
    b. Refer to BACnet Functional Groups in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
    c. Standard BACnet object types supported shall include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. Application controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0–10VDC, 0–5 VDC, 4–20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of 3 inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0–10VDC or 0–20mA. Software shall include scaling features for analog outputs. Application controller shall include 24VDC voltage supply for use as power supply to external sensors.
4. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator's terminal section.
5. Application controller shall include support for intelligent room sensor. Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

D. APPLICATION SPECIFIC Z341 CONTROLLERS (VAV)

1. Provide one native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.
2. BACnet Conformance

    a. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary such as Files Functional Group, Reinitialize Functional Group and Device Communications Functional Group.
    b. Refer to BACnet Functional Groups in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
    c. Standard BACnet object types supported shall include as a minimum– Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5 VDC, 4–20 mA, dry contact signals and a minimum of 3 pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.
4. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.
5. Application controller shall include support for intelligent room sensor. Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

E. SENSORS and MISCELLANEOUS DEVICES

1. Temperature Sensors

a. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches about finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.

2. Intelligent Room Sensor with LCD Readout – ZSP

a. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.
b. The Intelligent Room Sensor shall display room temperature. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.
c. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word “OFF” in unoccupied mode unless a function button is pressed.
d. See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.

F. MISCELLANEOUS CONTROL DEVICES

1. Differential Pressure Transmitter Assembly – Water:

a. Assembly shall consist of a differential pressure sensor and an electronic 2-wire, 4 to 20-milliamp transmitter assembly enclosed in a gasketed, dust and watertight case. All body cavities open to the process fluid shall be provided with drain ports at the cavity bottom and vent ports at the top of the cavity. Both drain and vent ports shall be minimum ¼-inch nominal pipe thread.
b. The transmitter shall be 24-volt DC powered and capable of sustaining up to 50 psig differential pressures in either direction, up to the body rating without damage of the instrument, loss of accuracy, or zero shift. Minimum pressure rating: 200 psig.

c. The transmitter shall be fully compensated for both process and ambient temperature variations. The transmitter shall be furnished complete with input gauges and factory mounted 3-valve manifold.
d. Accuracy: plus or minus 1 percent of full range.
e. Repeatability: 0.5 percent.
f. Pressure Transmitter shall have a digital display.
g. Acceptable Manufacturers: Veris Industries, Ebtron or equal.

2. Current Sensing Switches:

a. Current switches shall be utilized for monitoring motor operation. Switch set point shall be fixed so that a contact closure is made any time the motor is operating within a range of 15-200 amps. Induced current from the motor power feed shall power current switch. Current switch shall be a self gripping split-core type with optional mounting bracket; shall be isolated to 600 VAC rms, shall have an adjustable mounting bracket for installation flexibility. Output shall be N.O. Solid State, 1.0A @ 30VAC/DC with a minimum aperture of 0.5”x0.6” for motor power feed.
b. Acceptable Manufacturers: Veris Industries, Ebtron or equal.

G. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

H. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.04 TEMPERATURE CONTROL VALVE AND TERMINAL DAMPER ACTUATORS

A. Manufacturers:

a. Danfoss.
b. Belimo.
c. Or equal.

1. Valve Actuator: Electronic.

    a. Actuator shall be modulating, floating (tri-state). Provide spring return as indicated in the Sequence of Operations or where fail safe position is specified.
    b. Modulating actuators shall be positive positioning, responding to 0-10Vdc or 4-20mA signal. Each actuator shall be provided with a visual position indicator and include an actuator generated 0-10Vdc or 4-20mA position feedback signal.
    c. Power shall be 120VAC or 24VAC/VDC as required.
    d. Actuator shall provide the minimum torque required for proper actuation and valve close-off.
    e. Actuator shall include a clutch release, and button or crank to allow for manual override.
    f. Housing: Minimum requirement NEMA type 2 (4/4X) / IP54 (IP67).
    g. Agency Listings: ISO 9001, cULus, CE or CSA.
    h. All actuators shall utilize a sensorless brushless DC motor which is controlled by an ASIC. The ASIC monitors and controls the actuators's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition.
    i. Shall be overload protected electronically throughout rotation.

2. Damper Actuators: Electronic.

    a. General: Size actuators to operate their appropriate dampers with sufficient reserve power to provide smooth modulating, floating point action as required for the application, or as specified by the sequence of operations. Select spring return actuators as required to provide positive shut off based upon application.
    b. Where multiple actuators are used to drive multiple damper sections, multiple damper sections shall not be mechanically linked together. In multiple damper installations, where dampers are controlled by the same signal, multi-function-technology actuators with built-in rescaling functions shall be furnished and installed.
    c. Electric/Electronic Actuators:

        1) Actuator shall be modulating, floating point (tri-state) or multi-function-technology, as required by application, or as specified on the contract documents. Provide actuator with reserve power or spring return (as required by application) sized for required close-off pressure and as indicated in the Sequence of Operations, or where fail safe positioning is specified.
        2) Actuator power shall be either 120VAC or 24VAC/VDC.
        3) Modulating actuators shall be positive positioning, responding to 0-5 Vdc, 0-10Vdc, or 4-20mA control signals. Each actuator shall be provided with a visual position indicator and include an actuator generated 0-10Vdc or 4-20mA position feedback signal.
        4) Actuator shall include a clutch release, and button or crank to allow for manual override.
        5) Housing: Minimum requirement NEMA type 2 (4/4X) / IP54 (IP67).

6) Agency Listings: ISO 9001, cULus, CE or CSA.
7) All actuators shall utilize a sensorless brushless DC motor which is controlled by an ASIC. The ASIC monitors and controls the actuators's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition.
8) Shall be overload protected electronically throughout rotation.

PART 3 - EXECUTION

3.01 GENERAL

A. All electric wiring and all installation work including piping of control systems and internal wiring of panelboards for temperature control and indicating systems shall be done by an authorized representative of the controls manufacturer whose primary business is the installation and maintenance of temperature control and indicating systems. Wiring shall conform to 2016 California Electric Code.

B. Identify each item of control equipment with stamped tape firmly attached to equipment and each panel with nameplate of 1/16 inch laminated plastic with black background and white letters 1/4 inch high.

C. Control system shall be connected to the existing systems. All control adjustments shall be accessible without use of ladder.

D. All thermostat bulbs in water lines shall be installed in separable wells packed with heat-conductive compound.

E. There shall be no power wiring in excess of 40 VAC peak voltages run in conduit with communications trunk wiring. In cases where power or signal wiring is run in conduit with trunk wiring, all communication trunk wiring and power wiring shall be run using separate twisted shielded pairs (24 awg) with the shields grounded in accordance with the manufacturers wiring practices.

3.02 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. All temperature control and control interlock wiring shall be installed in plenum rated cable in concealed accessible locations (ceiling plenums) and in EMT conduit in mechanical, electrical or exposed areas. All conduits outdoors shall be provided with appropriate outdoor weather-tight fittings.

D. Install in accordance with manufacturer's instructions.

E. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to insure a complete operating system in accordance with the sequences of operation and point schedules.

F. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices with top side at 48 inches above the floor.

G. Install labels and nameplates to identify control components according to Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.03 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."

B. Install building wire and cable according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable as follows:

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
4. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
5. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
6. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.

5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
5. Check temperature instruments and material and length of sensing elements.
6. Check DDC system as follows:

    a. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    b. Verify that spare I/O capacity has been provided.
    c. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.05 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:

    a. Check analog inputs at 0, 50, and 100 percent of span.
    b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    c. Check digital inputs using jumper wire.
    d. Check digital outputs using ohmmeter to test for contact making or breaking.
    e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:

    a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:

    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. Temperature:

    a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
9. Provide diagnostic and test instruments for calibration and adjustment of system.
10. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature set points.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train EDD Designated Facilities managers and Department of General Services (DGS) maintenance personnel (or other designated entity) to adjust, program, fully understand all screens in the Operator Workstation and control panels, operate and maintain HVAC instrumentation and controls. Training shall be provided for a minimum of 5 personnel in two separate sessions. The first session shall be a minimum of 6 hours training time. The second session shall be 3 to 5 days after the first session and shall include a minimum of 2 hours training time. Training activity shall be scheduled with the State IOR a minimum of 7 days prior to the first training. All training shall be digitally videotaped and two copies shall be placed on common media such as DVD or USB 3.0 drives. These shall be delivered to EDD Facilities Representative and signed receipt shall be delivered to the State IOR. Refer to Division 01 for "Demonstration and Training."

END OF SECTION 23 09 23

SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. A.Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

1. Split System Air Conditioning Equipment
2. Water Meters
3. Gas Meter

B. Related Sections include the following:

1. Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.03 DEFINITIONS

A. DDC: Direct digital control.

B. VAV: Variable air volume.

1.04 CONTROL SEQUENCES

A. Split System Air Conditioning System

1. The system consists of Indoor Air Conditioning Units (IACU), BC Controller, Heat Pump (HP), and Heat Recovery Unit (HRU).
2. The units shall be controlled during the occupied/unoccupied modes via the unitary microprocessor control system. The DDC system shall monitor an alarm at the split system controller for system failure.
3. The CMCN shall operate at 24VDC. Controller power and communications shall be via a common non-polar communications bus. The split system shall be enabled by the DDC system. Each unit shall be controlled by the unitary microprocessor control system. The DDC system shall enable and disable the unitary controls from a manual command at the operator workstation only.

4. Automatic/Manual Control

    a. The units disconnect whether remote or in a motor control center shall be accompanied by an H-O-A (Hand/Off/Auto) switch on the starter panel. In the “H” position, the system shall be energized and the system safety devices shall protect the circuit. With the H-O-A switch on the starter panel in the "H" position, the unit shall start. With the H-O-A switch in the "A" position, the unit shall operate in response to DDC control and system safety circuits.

5. Optimum Start

    a. The units scheduled start time, controlled by the unitary controls, shall be altered by mathematical start program calculation. The result of the calculation shall be to compute the equipment start time so that the space temperature can be moved from its unoccupied mode setting, to the occupied mode setting for the space controlled, early enough to meet the scheduled start time for the space.

6. Optimum Stop

    a. The units scheduled stop time, controlled by the unitary controls, shall be altered by mathematical start program calculation. The result of the calculation is to compute the equipment stop time, so that the space temperature is allowed to drift from its occupied mode setting for the space controlled, to the upper or lower temperature limit by the scheduled stop time.

7. Unoccupied Mode, AHU

    a. The unit controller, along with “Time of Day” program shall cause the indoor air conditioning units to go to unoccupied mode settings when called for by the schedule program. The space temperature settings shall be set to reset to 65 degrees F (adj.) winter. In the unoccupied mode the heat recovery unit shall be off and the outside air damper shall be closed. During heating season, the system shall use space temperature sensors to indoor air conditioning units to prevent the space temperature from falling below the minimum setpoint. The outside air damper shall remain closed.

8. Occupied Mode, AHU

    a. The room terminal unit controller, along with “Time of Day” program shall cause the air handling unit to go to occupied mode settings to start and run continuously and controls to be energized. The air handling unit control shall be energized and switched from unoccupied temperature setting to an occupied setting (70 degrees F (adj.) minimum and 75 degrees F (adj.) maximum). The outside air damper shall be manually set by tab to maintain outside air volume.

9. Warm-up Cycle Control

    a. When schedule calls for occupied mode startup, and the return air temp is 5 degrees F (adj.) or more below setpoint of 70 degrees F (adj.), a “warm-up” cycle shall initiate.
    b. During the warm-up cycle the outside air damper shall be closed. Upon this call for heating the heating control valve shall be open. When return air temperature increases above the setpoint of 70 degrees F (adj.), the warm-up cycle shall be terminated.

10. Morning Warm-up Mode

    a. The unitary control system shall mathematically calculate based on the systems heuristics and internal algorithms, the optimum start time for obtaining the desired space temperature setpoint at the time of occupancy. The unitary control system shall position the equipment as follows:

        1) Supply Air Fan = ON
        2) Refrigerant Valves = 100% Open
        3) Outside Air Damper = 100% Open

    b. When the zone sensor has risen 1 degrees F (adj.) above the occupied setpoint temperature the unitary control system shall place the unit into the occupied mode.

11. Occupied Mode - Heating

    a. When the unit enters the occupied mode the unitary control system shall position the unit control equipment as follows:

        1) Supply Air Fan = ON
        2) Refrigerant Valves = ON (REVERSED – HEATING)
        3) Modulating Outside Air Damper = 100% Open

12. Unoccupied Mode

    a. When the unit is indexed into the unoccupied mode the unit fan shall shut down, and all equipment shall modulate to their fail-safe position.

        1) Supply Air Fan = OFF
        2) Refrigerant Valves = Closed
        3) Outside Air Damper = 100% Closed

    b. Heating - If the space temperature drops below 55 degrees F (adj.) the unitary control system shall start the unit’s supply fans. These units shall run with heating refrigerant valves fully open until the space temperature rises to 3 degrees F (adj.) above setpoint.

B. Water Flow Meter (typical of 2, 1 landscape water, 1 domestic water)

1. Water Meter

a. The controller shall monitor the water meter for water consumption on a continual basis. These values shall be made available to the system at all times.

2. Alarm shall be generated as follows:

a. Meter Failure: Sensor reading indicates a loss of pulse output from the water meter.

3. Peak Demand History

a. The controller shall monitor and record the peak (high and low) demand readings from the water meter. These readings shall be recorded on a daily, month-to-date, and year-to-date basis.

4. Usage History

a. The controller shall monitor and record water meter readings so as to provide a water consumption history. Usage readings shall be recorded on a daily, month-to-date, and year-to-date basis.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Water Flow Rate	x										
Demand									x		x
Peak Month-to-Date									x		x
Peak Today									x		x
Peak Year-to-Date									x		x
Usage Month-to-Date									x		x
Usage Today									x		x
Usage Year-to-Date									x		x
Meter Failure										x	
Totals	1	0	0	0	0	0	0	0	7	1	7

Total Hardware (1) Total Software (8)

C. Gas Meter (typical of 1)

1. Gas Meter

a. The controller shall monitor the gas meter for gas consumption on a continual basis. These values shall be made available to the system at all times.

2. Alarm shall be generated as follows:

a. Meter Failure: Sensor reading indicates a loss of pulse output from the gas meter.

3. Peak Demand History

a. The controller shall monitor and record the peak (high and low) demand readings from the gas meter. Peak readings shall be recorded on a daily, month-to-date, and year-to-date basis.

4. Usage History

a. The controller shall monitor and record gas meter readings so as to provide a gas consumption history. Usage readings shall be recorded on a daily, month-to-date, and year-to-date basis.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Gas Flow Rate	x										
Demand									x		x
Peak Month-to-Date									x		x
Peak Today									x		x
Peak Year-to-Date									x		x
Usage Month-to-Date									x		x
Usage Today									x		x
Usage Year-to-Date									x		x
Meter Failure										x	
Totals	1	0	0	0	0	0	0	0	7	1	7

Total Hardware (1) Total Software (8)

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 23 09 93

SECTION 23 11 23

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Manual gas shutoff valves.
5. Earthquake valves.
6. Pressure regulators.
7. Service meters.
8. Dielectric fittings.

1.03 DEFINITIONS

A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.

4. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars and supports.
5. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

C. Qualification Data: For qualified professional engineer.

D. Welding certificates.

E. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.09 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 08 31 13 "Access Doors and Frames."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 5 psig.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.02 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) Baker Hughes Company.
        2) Smith-Blair, Inc.
        3) Viega LLC.

    b. Stainless-steel flanges and tube with epoxy finish.
    c. Buna-nitrile seals.
    d. Stainless-steel bolts, washers, and nuts.

B. Drawn-Temper Copper Tube: Comply with ASTM B88, Type K.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

    a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

2.03 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Y-Pattern Strainers:

1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.04 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.05 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.

2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. A.Y. McDonald Mfg. Co.
    b. Apollo Flow Controls; Conbraco Industries, Inc.
    c. BrassCraft Manufacturing Co.; a Masco company.

2. Body: Bronze, complying with ASTM B584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.

5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.06 EARTHQUAKE VALVES

A. Earthquake Valves, Maximum Operating Pressure of 5 psig: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Vanguard Valves, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig.
4. Cast-aluminum body with nickel-plated chrome steel internal parts.
5. Nitrile-rubber valve washer.
6. Sight windows for visual indication of valve position.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

2.07 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. American Meter Company.
    b. Fisher Control Valves & Instruments; a brand of Emerson Process Management.
    c. Invensys.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig.

2.08 SERVICE METERS

A. Diaphragm-Type Service Meters: Comply with ANSI B109.1.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. American Meter Company.
   b. Invensys.
   c. Itron Gas.

2. Case: Die-cast aluminum.
3. Connections: Steel threads.
4. Diaphragm: Synthetic fabric.
5. Diaphragm Support Bearings: Self-lubricating.
6. Compensation: Continuous temperature.
7. Meter Index: Cubic feet.
8. Meter Case and Index: Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig.
11. Pressure Loss: Maximum 0.5-inch wg.
12. Accuracy: Maximum plus or minus 1.0 percent.

B. Service-Meter Bars:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. American Meter Company.
   b. Itron Gas.
   c. Lyall, R. W. & Company, Inc.

2. Malleable- or cast-iron frame for supporting service meter.
3. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.

4. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.

2.09 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. HART Industrial Unions, LLC.
   b. Matco-Norca.
   c. WATTS.

2. Description:

   a. Standard: ASSE 1079.
   b. Pressure Rating: 125 psig minimum at 180 deg F.
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Capitol Manufacturing Company.
   b. Matco-Norca.
   c. WATTS.

2. Description:

   a. Standard: ASSE 1079.
   b. Factory-fabricated, bolted, companion-flange assembly.
   c. Pressure Rating: 125 psig minimum at 180 deg F.
   d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.10 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

B. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.03 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

D. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

E. Install fittings for changes in direction and branch connections.

F. Install pressure gage downstream from each service regulator. Pressure gages are specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

3.04 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage downstream from each line regulator. Pressure gages are specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.05 SERVICE-METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground.

B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 05 50 00 "Metal Fabrications" for pipe bollards.

3.06 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.07 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.08 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements for pipe hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for steel piping and copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for corrugated stainless-steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within 12 inches of each fitting.

F. Support vertical runs of steel piping and copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.09 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 LABELING AND IDENTIFYING

A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 PAINTING

A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (flat).
d. Color: Gray.

B. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI INT 5.1E.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (flat).
d. Color: Gray.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.14 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
2. Drawn-temper copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

B. Aboveground natural-gas piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.
2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
2. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.
2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Underground, below building, piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:

1. PE valves.
2. NPS 2 and Smaller: Bronze plug valves.
3. NPS 2-1/2 and Larger: Cast-iron, lubricated plug valves.

3.17 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

E. Valves in branch piping for single appliance shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 23 11 23

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 DEFINITIONS

A. OSHPD: Office of Statewide Health Planning and Development (State of California).

1.04 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For sealants, indicating VOC content.
4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of all duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

D. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible". Seismically brace duct hangers and supports in accordance with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level (SHL): D.

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.02 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct of Type 316 stainless steel indicated by manufacturer to be suitable for outdoor installation.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct of Type 316 stainless steel indicated by manufacturer to be suitable for outdoor installation.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Ductmate Industries, Inc.
    b. McGill AirFlow LLC.
    c. MKT Metal Manufacturing.
    d. Spiral Manufacturing Co., Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved,

duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.04 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60.
2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

2.05 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Adhesive shall have a VOC content of 80 g/L or less.

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Aeroflex USA, Inc.
b. Armacell LLC.

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. Adhesive shall have a VOC content of 80 g/L or less.
b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Fiberglass-Free Duct Liner: Made from partially recycled cotton or polyester products and containing no fiberglass. Airstream surface overlaid with fire-resistant facing to prevent surface erosion by airstream, complying with NFPA 90A or NFPA 90B. Treat natural-fiber products with antimicrobial coating.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Bonded Logic, Inc.

2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested in accordance with ASTM C518.
3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with ASTM E84; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

    a. Adhesive shall have a VOC content of 80 g/L or less.

D. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

E. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm or greater.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.06 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. Sealant shall have a VOC content of 420 g/L or less.
11. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Sealant shall have a VOC content of 420 g/L or less.
9. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. Sealant shall have a VOC content of 420 g/L or less.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.07 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.

F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.08 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ductmate Industries, Inc.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A603, galvanized-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E488/E488M.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXHAUST DUCTS SERVING COMMERCIAL DISHWASHERS AND OTHER HIGH-HUMIDITY LOCATIONS

A. Install dishwasher exhaust ducts and other exhaust ducts from wet, high-humidity locations without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to dishwasher or toward drain.

B. Provide a drain pocket at each low point and at the base of each riser with a 1-inchtrapped copper drain from each drain pocket to open site floor drain.

C. Minimize number of transverse seams.

D. Do not locate longitudinal seams on bottom of duct.

3.04 DUCTWORK EXPOSED TO WEATHER

A. All external joints are to have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.

B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.

C. Single Wall:

1. Ductwork shall be Type 316 stainless steel.

a. If duct outer surface is uninsulated, protect outer surface with suitable paint. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting."

2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 23 07 13 "Duct Insulation."

3.05 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.06 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.07 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.08 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.09 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
    b. Supply Ducts with a Pressure Class of 2- Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

c. Return Ducts with a Pressure Class of 2- Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
d. Exhaust Ducts with a Pressure Class of 2- Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
e. Outdoor-Air Ducts with a Pressure Class of 2- Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
5. Test for leaks before applying external insulation.
6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 STARTUP

A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
2. Underground Ducts: Concrete-encased, galvanized sheet steel.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive 3-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 4.

2. Ducts Connected to Constant-Volume Air-Handling Units:

    a. Pressure Class: Positive 3-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 4.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

    a. Pressure Class: Positive 3-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 4.

4. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive 3-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 4.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive or negative 1-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 4.

2. Ducts Connected to Air-Handling Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 4.

3. Ducts Connected to Equipment Not Listed above:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.

c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and B if positive pressure.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
b. Concealed: Carbon-steel sheet.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 2-inch wg.
e. Airtight/watertight.

4. Ducts Connected to Dishwashers, Dishwasher Hoods, and Other High-Humidity Locations:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
d. Welded longitudinal seams; welded or flanged transverse joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg.
f. Airtight/watertight.

5. Ducts Connected to Fans Exhausting Fume Hood, Laboratory, and Process (ASHRAE 62.1, Class 3 and Class 4) Air:

a. Type 316, stainless-steel sheet.

1) Exposed to View: No. 4 finish.
2) Concealed: No. 2D finish.

b. PVC-coated, galvanized sheet steel with thicker coating on duct interior.
c. Pressure Class: Positive or negative 6-inch wg.

d. Welded seams and joints.

6. Ducts Connected to Equipment Not Listed above:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure; A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 4.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 8.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 4-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

G. Liner:

1. Supply-Air Ducts: Fibrous glass, Type I or Flexible elastomeric, 1-1/2 inches thick.
2. Return-Air Ducts: Fibrous glass, Type I or Flexible elastomeric, 1 inch thick.
3. Exhaust-Air Ducts: Fibrous glass, Type I or Flexible elastomeric, 1 inches thick.
4. Supply Fan Plenums: Fibrous glass, Type II or Flexible elastomeric, 1-1/2 inches thick.
5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II or Flexible elastomeric, 2 inches thick.
6. Transfer Ducts: Fibrous glass, Type I or Flexible elastomeric, 1 inches thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

    a. Velocity 1000 fpm or Lower:

        1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
        2) Mitered Type RE 4 without vanes.

    b. Velocity 1000 to 1500 fpm:

        1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
        2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
        3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

    c. Velocity 1500 fpm or Higher:

        1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
        2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
        3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Conical spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Control dampers.
3. Flange connectors.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Duct accessory hardware.

B. Related Requirements:

1. Section 28 46 21.11 "Addressable Fire-Alarm Systems" for duct-mounted fire and smoke detectors.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts and No. 2 finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Aluminum, Manual Volume Dampers:

1. Standard leakage rating.
2. Suitable for horizontal or vertical applications.
3. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
    e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

5. Blade Axles: Galvanized steel.
6. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Aluminum.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.04 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.05 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Double wall.

2.06 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Continuous and two sash locks.

c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches.
d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

B. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1-2004 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Connect ducts to duct silencers with flexible duct connectors.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream and downstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 23 05 53 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

P. Install duct test holes where required for testing and balancing purposes.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 36 00

AIR TERMINAL UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.
2. Underfloor air distribution terminal units.
3. Casing liner.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of air terminal unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for air terminal units.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For air terminal units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.

2. Size and location of initial access modules for acoustic tile.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:

a. Instructions for resetting minimum and maximum air volumes.
b. Instructions for adjusting software set points.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan-Powered-Unit Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

2.02 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Krueger.
2. METALAIRE, Inc.

3. Titus.
4. Trane.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.040-inch- thick galvanized steel, single wall.

1. Casing Liner: Comply with requirements in "Casing Liner" Article for flexible elastomeric duct liner.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections, size matching inlet size.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from zero to 140 deg F, shall be impervious to moisture and fungus, shall be suitable for 10-inch wg static pressure, and shall be factory tested for leaks.

E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, 3 percent of nominal airflow at 6-inch wg inlet static pressure.
2. Damper Position: Normally open.

F. Attenuator Section: 0.034-inch steel sheet.

1. Attenuator Section Liner: Comply with requirements in "Casing Liner" Article for flexible elastomeric duct liner.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

G. Multioutlet Attenuator Section: With two 6-inch- diameter collars, each with locking butterfly balancing damper.

2.03 UNDERFLOOR AIR DISTRIBUTION TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Price Industries.
2. Titus.
3. Trane.

B. Configuration: Volume-damper assembly and fan in series arrangement inside unit casing with control components inside a protective metal shroud within a raised access floor. Designed for ducted air supply.

C. Casing: 0.040-inch- thick galvanized steel, single wall.

1. Integral floor discharge diffusers.
2. Mixing damper.
3. VAV throttling damper.
4. Leveling feet.
5. Casing Liner: Comply with requirements in "Casing Liner" Article for flexible elastomeric duct liner.
6. Air Outlet: S-slip and drive connections.
7. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, 3 percent of nominal airflow at 6-inch wg inlet static pressure.
2. Damper Position: Normally open.

E. Velocity Sensors: Multipoint array with velocity sensors in air inlets and air outlets.

F. Controller Type: Terminal Unit Controller.

G. Accessories:

1. Inlet filter.
2. Disconnect switch.
3. Transformers.
4. Airflow switch.

2.04 CASING LINER

A. Casing Liner: Fibrous-glass duct liner, complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Minimum Thickness: 1 inch.

a. Maximum Thermal Conductivity:

1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Solvent-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

B. Casing Liner: Flexible elastomeric duct liner fabricated of preformed, cellular, closed-cell, sheet materials complying with ASTM C534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Minimum Thickness: 3/4 inch.
2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.02 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." Comply with requirements for seismic-restraint devices in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on air terminal units that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items before drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Install heavy-duty sleeve anchors with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.03 TERMINAL UNIT INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.04 CONNECTIONS

A. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.

B. Hot-Water Piping: Connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Comply with requirements in Section 23 31 13 "Metal Ducts" for connecting ducts to air terminal units.

D. Make connections to air terminal units with flexible connectors complying with requirements in Section 23 33 00 "Air Duct Accessories."

3.05 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Air terminal unit will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.07 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified..

3.08 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 36 00

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Displacement Flow Recessed Diffuser

1.02 REFERENCE STANDARDS

A. All referenced standards and recommended practices in this section pertain to the most recent publication thereof, including all addenda and errata.

B. ASHRAE 55 – Thermal Environmental Conditions for Human Occupancy

C. ASHRAE 70 – Method of Testing the Performance of Air Outlets and Air Inlets

D. ASHRAE 170 – Ventilation of Health Care Facilities

E. ASTM D610 – Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces.

F. ASTM D714 – Standard Test Method for Evaluating Degree of Blistering of Paints.

G. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes

H. ASTM D4752 – Standard Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub

1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Conduct a pre-installation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and efficient manner.

1.04 SUBMITTALS

A. See Division 01 – Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and sound power levels for each of the second through sixth octave bands in dBA.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication.

D. Certificates: Certify that air capacities, pressure drops, and selection procedures meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate support details, installation instructions, recommendations, and service clearances required.

F. Project Record Documents: Record actual locations of units and control components.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 WARRANTY

A. See Division 01 - Closeout Submittals, for additional warranty requirements.

B. Provide 12 month manufacturer warranty from date of shipment for displacement diffusers.

PART 2 - PRODUCTS

2.01 DISPLACEMENT FLOW RECESSED DIFFUSER

A. Basis of Design: Price Industries, Inc.

1. Displacement Flow Recessed Diffuser: Model DFR

B. Performance:

1. The diffuser manufacturer shall provide sound and pressure drop data derived from tests in accordance with ASHRAE 70.
2. Performance data for Draft Rate (%DR) shall be provided based on tests in accordance with ASHRAE 55.
3. A software program shall be available to aid in performance assessment by allowing room comfort evaluation for specific operating conditions and diffuser locations.

    a. If evaluation software is not available, the manufacturer shall supply, free of charge, a CFD model of the representative spaces completed by a modeling contractor who has demonstrable qualifications to model such a space.
    b. The qualifications shall include no less than 10 years of experience in the modeling of displacement ventilation systems, thorough validation of the code through comparison to empirical data, as well as a list of references.

2.02 DISPLACEMENT FLOW RECESSED DIFFUSER

A. General:

1. Furnish and install Price Model DFR displacement flow recessed diffuser with the sizes, capacities, and options as indicated on the plans and air outlet schedule.
2. The displacement diffuser shall deliver air to the occupied space at low noise levels, with uniform, low velocity across the diffuser face in all ducting configurations without the use of nozzles.

B. Construction:

1. The displacement flow recessed diffuser shall be constructed with an aluminum equalization baffle behind the perforated diffuser face for uniform, low velocity distribution of supply air. Both the equalization baffle and the face shall be securely retained in the diffuser frames.
2. The diffuser shall be supplied with an installation frame for recessed installation.
3. The diffuser frame shall be constructed of high strength aluminum for rigidity and protection of the perforated face and side panels. The perforated front panel shall be constructed of painted 18 gauge perforated steel, and the installation frame shall be 24 gauge steel.
4. The diffuser shall not have visible fasteners on the front or side panels.
5. The diffuser inlet shall be available for duct connection at the rear.
6. Plastic nozzle arrays or any plastic components shall be unacceptable.

C. Diffuser finish shall be (select one):

1. All steel components shall have B12 White baked-on powder coat finish. Epoxies and their derivatives shall not be acceptable. Visible non-metallic components shall not be acceptable.

    a. The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.

b. The paint film thickness shall be a minimum of 2.0 mils.
c. The finish shall have a hardness of 2H.
d. The finish shall withstand a minimum salt spray exposure of 500 hours with no measurable creep in accordance with ASTM D1654, and 1000 hours of exposure with no rusting or blistering as per ASTM D610 and ASTM D714.
e. The finish shall have an impact resistance of 80 inch-pounds.

2. All stainless steel components shall have #4 polished finish on exposed surfaces.

D. Mounting/Fastening:

1. The diffuser shall be installed within the supplied installation frame. The diffuser shall have no visible fasteners or framing, and shall be held within the supplied installation frame with secure mounting clips.

E. Options:

1. Mud Frame:

a. The diffuser shall be supplied with a mud frame for drywall applications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that conditions are suitable for installation.

B. Verify that field measurements are as shown on the drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. See drawings for the size(s) and locations of displacement diffusers.

C. Connect to ductwork in accordance with Section 23 31 13.

3.03 ADJUSTING

A. Ensure supply air to the diffusers by performing pitot traverse of the main supply duct.

B. Balance outlets according to manufacturer's recommendations.

C. Verify that field measurements are as shown on the drawings.

3.04 FIELD QUALITY CONTROL

A. See Division 01 – Quality Requirements for additional requirements.

3.05 CLEANING

A. See Section 01 74 19 – Construction Waste Management and Disposal for additional requirements.

3.06 CLOSEOUT ACTIVITIES

A. See Division 01 – Closeout Submittals for closeout documentation requirements.

B. See Division 01 – Demonstration and Training for additional requirements.

END OF SECTION 23 37 13

SECTION 23 72 23.13

PACKAGED INDOOR HEAT WHEEL ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Heat wheels in packaged energy-recovery units.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include packaged, indoor, heat wheel, energy-recovery-unit rated capacities, operating characteristics, furnished specialties, and accessories.
2. Fans:

a. Certified fan-performance curves with system operating conditions indicated.
b. Certified fan-sound power ratings.
c. Fan construction and accessories.
d. Motor ratings, electrical characteristics, and motor accessories.

B. Sustainable Design Submittals:

1. Product data showing compliance with ASHRAE 62.1.
2. Laboratory Test Reports: For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For air-to-air energy recovery equipment.

1. Include plans, elevations, sections, details, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, elevations, and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Seismic Qualification Data: Certificates, for air-to-air energy-recovery equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-to-air energy-recovery equipment to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of each type of filter specified.
2. Fan Belts: One set(s) of belts for each belt-driven fan in energy-recovery units.
3. Wheel Belts: One set(s) of belts for each heat wheel.

1.07 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, indoor, heat wheel energy-recovery units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Packaged Energy-Recovery Units: Two years.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

B. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1.
2. Capacity ratings for air-to-air energy-recovery equipment shall comply with ASHRAE 84.

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.

D. UL Compliance:

1. Packaged heat-recovery ventilators shall comply with requirements in UL 1812 or UL 1815.
2. Electric coils shall comply with requirements in UL 1995.

E. Comply with ASTM E84 or UL 723.

1. Component Importance Factor: 1.0.

2.02 PACKAGED, INDOOR, HEAT WHEEL ENERGY-RECOVERY UNITS

A. Manufacturer:

1. Within limitations of the specifications provide unit from single manufacturer. Manufacturer known to comply with specifications:

a. Lossnay

B. Source Limitations: Obtain packaged, indoor, heat wheel energy-recovery units from single manufacturer.

C. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, gasketed hinged access doors or removable panels with neoprene gaskets for inspection and access to internal parts, minimum 1- inch-thick, 6 thermal insulation, knockouts for electrical connections, exterior drain connection, and lifting lugs.

E. Heat Wheel:

1. Casing:

a. Manufacturer's standard construction with standard factory finish.

b. Slide-in, slide-out cassette style for easy access.

2. Rotor: Aluminum, metallic, or polymer segmented wheel, strengthened with radial spokes impregnated with nonmigrating, water-selective, four-angstrom, molecular-sieve desiccant coating.

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Supply and Exhaust Fans: Forward-curved, centrifugal fan with restrained, spring isolators of 1- inch static deflection.

1. Motor and Drive: Direct driven.
2. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

G. Filters:

1. Description: Flat, nonpleated or Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
2. UL Compliance: Comply with UL 900.
3. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
4. Filter Media Frame: Beverage board with perforated metal retainer or metal grid on outlet side.
5. Filter-Mounting Frames: Arranged with access doors or panels on both sides of unit. Filters shall be removable from one side or lift out from access plenum.

H. Wiring: Fabricate units with space within housing for electrical conduits. Wire motors and controls, so only external connections are required during installation.

1. Indoor Enclosure: NEMA 250, Type 12 enclosure contains relays, starters, and terminal strip.
2. Include nonfused disconnect switches.

2.03 SOURCE QUALITY CONTROL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended application.

B. AHRI Compliance: Capacity ratings for air-to-air energy-recovery equipment certified as complying with AHRI 1060.

C. Fan Performance Rating: Comply with AMCA 211 and label fans with AMCA-certified rating seal. Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency according to AMCA 210/ASHRAE 51.

D. Fan Sound Rating: Comply with AMCA 301 or AHRI 260 (IP). Air-handling unit fan sound ratings shall comply with AMCA 301 or AHRI 260 (IP).

E. UL Compliance:

1. Packaged heat recovery ventilators shall comply with requirements in UL 1812 or UL 1815.
2. Electric Coils: Comply with UL 1995.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before packaged, indoor, heat wheel energy-recovery unit installation. Replace with new insulation materials any filter media that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install packaged, indoor, heat wheel energy-recovery units, so supply and exhaust airstreams flow in opposite directions, and rotation is away from exhaust side to purge section to supply side.

1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
3. Access doors and panels are specified in Section 23 33 00 "Air Duct Accessories."

B. Equipment Mounting:

1. Comply with requirements for vibration-isolation and seismic-control devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

C. Suspended Units: Suspend and brace units from structural-steel support frame, using threaded steel rods and spring hangers. Comply with requirements for vibration-isolation devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

D. Install units with clearances for service and maintenance.

E. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

3.03 DUCTWORK CONNECTIONS

A. Comply with requirements for ductwork according to Section 23 31 13 "Metal Ducts."

B. Connect duct to units with flexible connections. Comply with requirements in Section 23 33 00 "Air Duct Accessories."

3.04 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to unit, allow service and maintenance.

C. Connect piping to units mounted on vibration isolators with flexible connectors.

D. Condensate Drain Piping: Pipe drains from drain pans to nearest floor drain, same size as condensate drain connection.

1. Construct deep trap at connection to drain pan, and install cleanouts at changes in direction.

3.05 ELECTRICAL CONNECTIONS

A. Install electrical devices furnished with units but not factory mounted.

B. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

E. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.06 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables."

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Packaged, indoor, heat wheel energy-recovery equipment will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.08 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.09 ADJUSTING

A. Adjust moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy-recovery units.

END OF SECTION 23 72 23.13

SECTION 23 74 16.11

PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes packaged, small-capacity, rooftop air-conditioning units (RTUs) with the following components:

1. Casings.
2. Fans, drives, and motors.
3. Coils.
4. Refrigerant circuit components.
5. Air filtration.
6. Gas furnaces.
7. Dampers.
8. Electrical power connections.
9. Controls.
10. Roof curbs.
11. Accessories.

1.03 DEFINITIONS

A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, small-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.04 ACTION SUBMITTALS

A. Product Data: For each RTU.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.

5. Fans:

    a. Include certified fan-performance curves with system operating conditions indicated.
    b. Include certified fan-sound power ratings.
    c. Include fan construction and accessories.
    d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include gas furnaces with performance characteristics.
9. Include dampers, including housings, linkages, and operators.

B. Shop Drawings: For each packaged, small-capacity, rooftop air-conditioning unit.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wind- and Seismic-Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Sample Warranty: For manufacturer's warranty.

C. Seismic Qualification Data: Certificates, for RTUs, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Restraint of internal components.

D. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Source quality-control reports.

F. System startup reports.

G. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of filters for each unit.
2. Gaskets: One set(s) for each access door.
3. Fan Belts: One set(s) for each belt-driven fan.
4. Filters: One set(s) of filters for each unit.

1.08 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of air-handling unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 year(s) from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. UL Compliance: Comply with UL 1995.

G. Delegated Design: Engage a qualified professional engineer licensed in the State of California to design mounting and restraints for RTUs, including comprehensive engineering analysis.

1. Design RTU supports to comply with wind and seismic performance requirements.

H. Wind-Restraint Performance:

1. Basic Wind Speed: 110.
2. Building Classification Category: II.
3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

I. Seismic Performance: RTUs, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: 1.0.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. AAON.

2.03 UNIT CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Double-Wall Construction:

1. Outside Casing Wall: Galvanized steel, minimum 18 gauge thick with manufacturer's standard finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
2. Inside Casing Wall: G90-coated galvanized steel, 0.034 inch thick.
3. Floor Plate: G90 galvanized steel, treadplate, minimum 18 gauge thick.
4. Casing Insulation:

a. Materials: Injected polyurethane foam insulation.
b. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. Static-Pressure Classifications:

1. For Unit Sections Upstream of Fans: Minus 3-inch wg.
2. For Unit Sections Downstream and Including Fans: 3-inch wg.

E. Panels and Doors:

1. Panels:

a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
c. Gasket: Neoprene, applied around entire perimeters of panel frames.
d. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

2. Access Doors:

a. Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
b. Gasket: Neoprene, applied around entire perimeters of panel frames.
c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Locations and Applications:

    a. Fan Section: Inspection and access panels.
    b. Access Section: Doors.
    c. Coil Section: Inspection and access panels.
    d. Damper Section: Inspection and access panels.
    e. Filter Section: Inspection and access panels large enough to allow periodic removal and installation of filters.
    f. Mixing Section: Doors.

F. Condensate Drain Pans:

1. Location: Each type of cooling coil.
2. Construction:

    a. Single-wall, galvanized-steel or noncorrosive polymer sheet.

3. Drain Connection:

    a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
    b. Minimum Connection Size: NPS 1.

4. Slope: Minimum 0.125-in./ft. slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
5. Length: Extend drain pan downstream from leaving face for distance to comply with ASHRAE 62.1.
6. Width: Entire width of water producing device.
7. Depth: A minimum of 2 inches deep.
8. Pan-Top Surface Coating for Galvanized-Steel Drain Pans: Asphaltic waterproofing compound.
9. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.04 FANS, DRIVES, AND MOTORS

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.

1. Shafts: With field-adjustable alignment.
2. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.

3. Mounting: For internal vibration isolation and seismic control. Factory-mount fans with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of 1 inch.
4. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch-wide by 0.028-inch-thick, galvanized-steel sheet.

    a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

C. Drives, Direct: Factory-mounted, direct drive.

D. Drives, Belt: Factory-mounted, V-belt drive, with adjustable alignment and belt tensioning, and with 1.25 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing, dynamically balanced at the factory.
2. Belts: Oil resistant, non-sparking and nonstatic; in matched sets for multiple-belt drives.
3. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch- thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.

E. Condenser-Coil Fan: propeller, mounted on shaft of permanently lubricated multispeed motors.

F. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Enclosure Type: Open, dripproof.
4. Enclosure Materials: Cast iron.
5. Efficiency: Premium efficient as defined in NEMA MG 1.
6. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
7. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.05 COILS

A. General Requirements for Coils:

1. Comply with AHRI 410.
2. Fabricate coils section to allow for removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).

3. Coils shall not act as structural component of unit.

B. Supply-Air Refrigerant Coil:

1. Tubes: Copper.
2. Fins:

a. Material: Aluminum.
b. Fin Spacing: Maximum 12 fins per inch.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Galvanized steel.
6. Coatings: None.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

a. Working Pressure: Minimum 300 psig.

C. Outdoor-Air Refrigerant Coil:

1. Tubes: Copper.
2. Fins:

a. Material: Aluminum.
b. Fin Spacing: Maximum 12 fins per inch.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Galvanized steel.
6. Coatings: None.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

a. Working Pressure: Minimum 300 psig.

2.06 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, variable-speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.

8. Brass service valves installed in compressor suction and liquid lines.

2.07 AIR FILTRATION

A. Panel Filters:

1. Description: Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
4. Filter-Media Frame: Beverage board with perforated metal retainer, or metal grid, on outlet side.

B. Adhesive, Sustainability Projects: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.

C. Adhesive, LEED for Schools Projects: As recommended by air-filter manufacturer and that complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.08 GAS FURNACES

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

B. CSA Approval: Designed and certified by and bearing label of CSA.

C. Burners: Stainless steel.

1. Rated Minimum Turndown Ratio: 9 to 1.
2. Fuel: Natural gas.
3. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
4. Gas Control Valve: Modulating.
5. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

D. Heat-Exchanger and Drain Pan: Stainless steel.

E. Venting, Gravity: Gravity vented with vertical extension.

F. Safety Controls:

1. Gas Manifold: Safety switches and controls complying with ANSI standards.

2.09 DAMPERS

A. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg.

B. Barometric relief dampers.

C. Electronic Damper Operators:

1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
3. Operator Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
    b. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
    c. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
6. Size dampers for running torque calculated as follows:

    a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
    b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
    c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
    d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
    e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
    f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

7. Coupling: V-bolt and V-shaped, toothed cradle.
8. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
9. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.
10. Power Requirements (Modulating): Maximum 10 VA at 24 V ac or 8 W at 24 V dc.

11. Proportional Signal: 2 to 10 V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
12. Temperature Rating: Minus 22 to plus 122 deg F.
13. Run Time: 60 seconds.

2.10 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.11 CONTROLS

A. Control equipment and sequence of operation are specified in Section 23 09 23 "Direct Digital Control (DDC) System for HVAC."

2.12 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

B. Curb Dimensions: Height of 14 inches.

2.13 ACCESSORIES

A. Electric heater with integral thermostat maintains minimum 50 deg F temperature in gas burner compartment.

B. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

D. Remote potentiometer to adjust minimum economizer damper position.

E. Return-air bypass damper.

F. Factory- or field-installed, demand-controlled ventilation.

G. Safeties:

1. Smoke detector.
2. Condensate overflow switch.
3. Phase-loss reversal protection.
4. High and low pressure control.

5. Gas furnace airflow-proving switch.

H. Coil guards of painted, galvanized-steel wire.

I. Hail guards of galvanized steel, painted to match casing.

J. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

K. Door switches to disable heating or reset set point when open.

L. Outdoor-air intake weather hood with moisture eliminator.

M. Oil separator.

N. Service Lights and Switch: Factory installed in fan and coil sections with weatherproof cover. Factory wire lights to a single-point field connection.

2.14 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

E. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 3000-hour salt-spray test according to ASTM B117.

1. Standards:

a. ASTM B117 for salt spray.
b. ASTM D2794 for minimum impact resistance of 100 in-lb.
c. ASTM B3359 for cross-hatch adhesion of 5B.

2. Application: Spray.
3. Thickness: 1 mil.
4. Gloss: Minimum gloss of 60 on a 60-degree meter.

2.15 SOURCE QUALITY CONTROL

A. AHRI Compliance:

1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
3. Comply with AHRI 270 for testing and rating sound performance for RTUs.
4. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested according to AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to AHRI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 07 72 00 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.03 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to RTU, allow space for service and maintenance.

C. Connect piping to unit mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4, ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Gas Piping: Comply with applicable requirements in Section 23 11 23 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

F. Hot- and Chilled-Water Piping: Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

G. Steam and Condensate Piping: Install shutoff valve at steam supply connections, float and thermostatic trap, and union or flange at each coil return connection. Install gate valve and inlet strainer at supply connection of dry steam humidifiers, and inverted bucket steam trap to condensate return connection.

H. Refrigerant Piping: Install shutoff valve and union or flange at each supply and return connection.

3.04 DUCT CONNECTIONS

A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 23 33 00 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.05 ELECTRICAL CONNECTIONS

A. Connect electrical wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 26 05 53 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.
3. Locate nameplate where easily visible.

3.06 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.07 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. RTU will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.08 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Inspect for visible damage to unit casing.
3. Inspect for visible damage to furnace combustion chamber.
4. Inspect for visible damage to compressor, coils, and fans.

5. Inspect internal insulation.
6. Verify that labels are clearly visible.
7. Verify that clearances have been provided for servicing.
8. Verify that controls are connected and operable.
9. Verify that filters are installed.
10. Clean condenser coil and inspect for construction debris.
11. Clean furnace flue and inspect for construction debris.
12. Connect and purge gas line.
13. Remove packing from vibration isolators.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency:

    a. Measure gas pressure on manifold.
    b. Inspect operation of power vents.
    c. Measure combustion-air temperature at inlet to combustion chamber.
    d. Measure flue-gas temperature at furnace discharge.
    e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

a. Supply-air volume.
b. Return-air volume.
c. Relief-air volume.
d. Outdoor-air intake volume.

27. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke and firestat alarms.

29. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.09 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.10 CLEANING

A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. RTU will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 23 74 16.11

SECTION 23 81 29

VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes complete VRF HVAC system(s) including, but not limited to the following components to make a complete operating system(s) according to requirements indicated:

1. Indoor, concealed, ceiling-mounted units for ducting.
2. Indoor, exposed, wall-mounted units.
3. Indoor, recessed, ceiling-mounted units.
4. Indoor, suspended, ceiling-mounted units.
5. Indoor, dedicated outdoor air ventilation units.
6. Indoor, energy recovery ventilator.
7. Outdoor, air-source heat recovery units.
8. Heat recovery control units.
9. System controls.
10. System refrigerant and oil.
11. System condensate drain piping.
12. System refrigerant piping.
13. Metal hangers and supports.
14. Metal framing systems.
15. Fastener systems.
16. Pipe stands.
17. Miscellaneous support materials.
18. Piping and tubing insulation.
19. System control cable and raceways.

1.03 DEFINITIONS

A. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.

B. HRCU: Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones. "Heat Recovery Control Unit" is the term used by ASHRAE

for what different manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.

C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

E. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units.

F. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.

G. VRF: Variable refrigerant flow.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for indoor and outdoor units and for HRCUs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit and HRCU control.
6. Include description of control software features.
7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
8. Include refrigerant type and data sheets showing compliance with requirements indicated.
9. For system design software.
10. Indicate location and type of service access.

B. Shop Drawings: For VRF HVAC systems.

1. Include plans, elevations, sections, and attachment or mounting details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For fully and partially exposed indoor units with factory finishes viewable by occupants.

1. Include a Sample for each unique finish with unit identification, detailed description of application, and cross-referenced floor plans showing locations.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural floors, roofs and associated members to which equipment, piping, ductwork, cables, and conduit will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Wall-mounted controllers located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
5. Size and location of access doors and panels installed behind walls and inaccessible ceilings for products installed behind walls and requiring access.
6. Items penetrating finished ceiling including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Service access panels.

B. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.

    a. Retain copies of Installer certificates on-site and make available on request.

2. For VRF HVAC system manufacturer.

3. For VRF HVAC system provider.

C. Seismic Qualification Data: Certificates, for equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Test Reports: Where tests are required, for each product, for tests performed by a qualified testing agency.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's warranties.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters:

a. One set(s) for each unit with replaceable filters.
b. One set(s) for each unit type and unique size of washable filters.

2. Indoor Units: One for each unique size and type installed.
3. Controllers for Indoor Units: One for each unique controller type installed.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of VRF HVAC systems and products.
2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of 10 years within time of bid.
3. VRF HVAC systems and products that have been successfully tested and in use on at least five completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:

    a. Product research and development.
    b. Product and application engineering.
    c. Product manufacturing, testing, and quality control.
    d. Technical support for system installation training, startup, commissioning, and troubleshooting of installations.
    e. Owner training.

B. Factory-Authorized Service Representative Qualifications:

1. Authorized representative of, and trained by, VRF HVAC system manufacturer.
2. In-place facility located within 100 miles of Project.
3. Demonstrated past experience with products being installed for period within five consecutive years before time of bid.
4. Demonstrated past experience on five projects of similar complexity, scope, and value.

    a. Each person assigned to Project shall have demonstrated past experience.

5. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
6. Service and maintenance staff assigned to support Project during warranty period.
7. Product parts inventory to support ongoing system operation for a period of not less than five years after Substantial Completion.
8. VRF HVAC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.
4. Each person assigned to Project shall have demonstrated past experience.

a. Demonstrated past experience with products being installed for period within five consecutive years before time of bid.
b. Demonstrated past experience on five projects of similar complexity, scope, and value.

5. Installers shall have staffing resources of competent, trained, and experienced full-time employees that are assigned to execute work according to schedule.

D. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in a clean and dry place.

B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.

C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.

D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

E. Replace installed products damaged during construction.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and u

2. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.

b. For Parts, Including Controls: Five year(s) from date of Substantial Completion.
c. For Labor: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Known Manufacturers able to meet specifications include but are not limited to

1. Mitsubishi Citi-Multi Line

B. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:

1. Indoor and outdoor units, including accessories.
2. Controls and software.
3. HRCUs.
4. Refrigerant isolation valves.
5. Specialty refrigerant pipe fittings.

2.02 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

1. Two-pipe system design.
2. System(s) operation, heat recovery as indicated on Drawings.
3. Each system with one refrigerant circuit shared by all indoor units connected to system.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. AHRI Compliance: System and equipment performance certified according to AHRI 1230 and products listed in AHRI directory.

D. ASHRAE Compliance:

1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 62.1: For indoor air quality.
3. ASHRAE 135: For control network protocol with remote communication.
4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

E. UL Compliance: Comply with UL 1995.

2.03 PERFORMANCE REQUIREMENTS

A. Service Access:

1. Provide and document service access requirements.
2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
6. Comply with OSHA regulations.

B. System Design and Installation Requirements:

1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

C. Isolation of Equipment: Provide isolation valves to isolate each HRCU, indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

D. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:

1. Not less than 50 percent.
2. Not more than 130 percent.
3. Range acceptable to manufacturer.

E. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.

F. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

G. Outdoor Conditions:

1. Suitable for outdoor ambient conditions encountered.

a. Design equipment and supports to withstand wind loads of governing code.

b. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.

2. Maximum System Operating Outdoor Temperature: See Drawings.
3. Minimum System Operating Outdoor Temperature: See Drawings.

H. Seismic Performance: VRF HVAC system(s) shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: 1.0.

I. Sound Performance: Sound levels generated by operating HVAC equipment shall be within requirements indicated.

1. Indoor: See Drawings.
2. Outdoor: See Drawings.

J. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.

K. Capacities and Characteristics: As indicated on Drawings.

2.04 INDOOR, EXPOSED, WALL-MOUNTED UNITS

A. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.

6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Gravity.

    a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:

1. Fan(s):

    a. Direct-drive arrangement.
    b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
    c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Efficiency: MERV 11.
3. Washable Media: Manufacturer's standard filter with antimicrobial treatment.

G. Grille Assembly: Manufacturer's standard discharge grille with field-adjustable air pattern mounted in top or front face of unit cabinet.

H. Unit Accessories:

1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.
3. .

I. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: Coil leaving refrigerant temperature.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation mode, manual operation mode, filter service notification, drain assembly high water level safety shutdown and notification, run test switch.
5. Communication: Network communication with other indoor units and outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring inraceways to comply with NFPA 70.

2.05 INDOOR, RECESSED, CEILING-MOUNTED UNITS

A. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.

2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Internal Tubing: Copper tubing with brazed joints.
6. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:

1. Fan(s):

   a. Direct-drive arrangement.
   b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
   c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
   d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Bottom, to accommodate filter replacement without the need for tools.
2. Efficiency: ASHRAE 52.2, MERV 11.
3. Media: If more than one filter type is indicated, Contractor has option to choose.

   a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
   b. Washable: Manufacturer's standard filter with antimicrobial treatment.

G. Discharge-Air Grille Assembly: Mounted in bottom of unit cabinet.

1. Discharge Pattern: One-, two-, three-, or four-way throw as indicated on Drawings.

    a. Discharge Pattern Adjustment: Field-adjustable limits for up and down range of motion.
    b. Discharge Pattern Closure: Ability to close individual discharges of units with multiple patterns.

2. Motorized Vanes: Modulating up and down flow pattern for uniform room air distribution.
3. Additional Branch Supply Duct Connection: Sheet metal knockout for optional connection to one additional supply branch duct.

H. Return-Air Grille Assembly: Manufacturer's standard grille mounted in bottom of unit cabinet.

I. Outdoor Air Ventilation Connection: Sheet metal knockout for optional connection to outdoor air ventilation duct.

J. Unit Accessories:

1. Outdoor Air Ventilation Kit: Connection, motorized damper, and control to satisfy unit control sequence of operation indicated on Drawings.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
3. .

K. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: Coil entering refrigerant temperature Coil leaving refrigerant temperature.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation mode, manual operation mode, filter service notification, drain assembly high water level safety shutdown and notification, run test switch.
5. Communication: Network communication with other indoor units and outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.

4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring inraceways to comply with NFPA 70.

2.06 OUTDOOR, AIR-SOURCE HEAT RECOVERY UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.

B. Cabinet:

1. Galvanized steel and coated with a corrosion-resistant finish.

    a. Coating with documented salt spray test performance of 1000 hours according ASTM B117 surface scratch test (SST) procedure.

2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
2. Protection: Integral protection against the following:

    a. High refrigerant pressure.
    b. Low oil level.
    c. High oil temperature.
    d. Thermal and overload.
    e. Voltage fluctuations.
    f. Phase failure and phase reversal.
    g. Short cycling.
    h. .

3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
4. Vibration Control: Integral isolation to dampen vibration transmission.
5. Oil management system to ensure safe and proper lubrication over entire operating range.

6. Crankcase heaters with integral control to maintain safe operating temperature.
7. Fusible plug.

D. Condenser Coil Assembly:

1. Plate Fin Coils:

   a. Casing: Aluminum, galvanized, or stainless steel.
   b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
   c. Tubes: Copper, of diameter and thickness required by performance.

2. Aluminum Microchannel Coils:

   a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
   b. Single- or multiple-pass arrangement.
   c. Construct fins, tubes, and header manifolds of aluminum alloy.

3. Coating: None.

E. Condenser Fan and Motor Assembly:

1. Fan(s): Propeller type.

   a. Direct-drive arrangement.
   b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
   c. dynamically balanced.

2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

G. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
2. Factory-Installed Controller: Configurable digital control.

3. Factory-Installed Sensors:

    a. Refrigerant suction temperature.
    b. Refrigerant discharge temperature.
    c. Outdoor air temperature.
    d. Refrigerant high pressure.
    e. Refrigerant low pressure.
    f. Oil level.
    g. .

4. Features and Functions: Self-diagnostics, time delay, auto-restart, fuse protection, auto operation mode, manual operation mode, night setback control, run test switch.
5. Communication: Network communication with indoor units and other outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring inraceways to comply with NFPA 70.

I. Unit Hardware: Zinc-plated steel, or stainless steel. Coat exposed surfaces with additional corrosion-resistant coating if required to prevention corrosion when exposed to salt spray test for 1000 hours according ASTM B117.

J. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.07 HEAT RECOVERY CONTROL UNITS (HRCUs)

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.

B. Cabinet:

1. Galvanized-steel construction.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

D. Refrigeration Assemblies and Specialties:

1. Specially designed by manufacturer for type of VRF HVAC system being installed, either two or three pipe.
2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.
3. Each system piping connection upstream of heat recovery unit shall be fitted with an isolation valve to allow for service to any heat recovery control unit in the system without interrupting operation of the system.
4. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.

    a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.

E. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Communication: Network communication with indoor units and outdoor unit(s).
4. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

F. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring inraceways to comply with NFPA 70.

G. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.08 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units, HRCUs, and outdoor units shall include integral controls and connect through a manufacturer-selected control network.
2. Network Communication Protocol: Manufacturer proprietary or open control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:

    a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.
    b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 5 minutes of battery backup operation after a power loss.
    c. Integration shall include control monitoring scheduling change of value notifications.

4. Operator Interface:

    a. Operators shall interface with system and unit controls through the following:

        1) Operator interfaces integral to controllers.
        2) Owner-furnished PC connected to central controller(s).
        3) Web interface through web browser software.
        4) Integration with Building Automation System.

b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:

1) On/off control.
2) Temperature set-point adjustment.

B. VRF HVAC System Operator Software for PC:

1. Software offered by VRF HVAC system manufacturer shall provide system operators with ability to monitor and control VRF HVAC system(s) from a single dedicated Owner-furnished PC.
2. Software shall provide operator with a graphic user interface to allow monitoring and control of multiple central controllers from a single device location through point-and-click mouse exchange.
3. Plan views shall show building plans with location of indoor units and identification superimposed on plans.
4. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
5. Schedules operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Schedules daily, weekly, and annual events.
6. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
7. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
8. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
9. Supports Imperial Temperature Units: Fahrenheit.
10. Displays service notifications and error codes.
11. Monitors and displays up to 3000 item error history and 10000 item operation history for regular reporting and further archiving.
12. Monitors and displays cumulative operating time of indoor units.
13. Able to disable and enable operation of individual controllers for indoor units.
14. Information displayed on individual controllers shall also be available for display.
15. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.

C. Central Controllers:

1. Centralized control for all indoor and outdoor units from a single central controller location.

a. Include multiple interconnected controllers as required.

2. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.

3. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.

    a. Sets schedule for daily, weekly, and annual events.
    b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.

4. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
5. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
6. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
7. Service diagnostics tool.
8. Able to disable and enable operation of individual controllers for indoor units.
9. Information displayed on individual controllers shall also be available for display through central controller.
10. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.
11. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
12. Operator interface through a backlit, high-resolution color display touch panel and web accessible through standard web browser software.

D. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Temperature Units: Fahrenheit.
4. On/Off: Turns indoor unit on or off.
5. Hold: Hold operation settings until hold is released.
6. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
7. Temperature Display: 1-degree increments.
8. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between 55 °F and 85 °F.
9. Fan Speed Setting: Select between available options furnished with the unit.
10. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
11. Seven-day programmable operating schedule with up to eight events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
12. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
13. Occupancy detection.
14. Service Notification Display: "Filter".
15. Service Run Tests: Limit use by service personnel to troubleshoot operation.
16. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
17. User and Service Passwords: Capable of preventing adjustments by unauthorized users.

18. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
19. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

2.09 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, Class A1 refrigerant classification.
3. R-410a.

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.10 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.

B. Copper Tubing:

1. Drawn-Temper Tubing: According to ASTM B88, Type L, ASTM B88, Type M or Type DWV according to ASTM B306.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B32, lead-free alloys, and water-flushable flux according to ASTM B813.

2.11 SYSTEM REFRIGERANT PIPING

A. Refrigerant Piping:

1. Copper Tube: ASTM B280, Type ACR.
2. Wrought-Copper Fittings: ASME B16.22.
3. Brazing Filler Metals: AWS A5.8/A5.8M.

B. Refrigerant Tubing Kits:

1. Furnished by VRF HVAC system manufacturer.
2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
3. Standard one-piece length for connecting to indoor units.

4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
5. Factory Charge: Dehydrated air or nitrogen.

C. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

D. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.12 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or copper-coated steel.

B. Plastic Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, galvanized-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

2.13 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated, pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel for use indoors and of stainless steel for use outdoors.
6. Metallic Coating for Use Indoors: Electroplated zinc hot-dip galvanized or mill galvanized.
7. Plastic Coating for Use Outdoors: PVC polyurethane epoxy or polyester.

2.14 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Stainless steel.

2.15 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.16 MISCELLANEOUS SUPPORT MATERIALS

A. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

B. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.17 PIPING AND TUBING INSULATION

A. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
b. Indoors: 3/4 inch thick.
c. Outdoors: 3/4 inch thick.

2. Field-Applied Jacket:

a. Concealed: None required.
b. Indoors, Exposed to View: None required.
c. Outdoors, Exposed to View: Aluminum, smooth, 0.020 inch thick.

B. Refrigerant Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
b. Indoors: 1 inch thick.
c. Outdoors: 1 inch thick.

2. Field-Applied Jacket:

a. Concealed: None required.
b. Indoors, Exposed to View: None required.
c. Outdoors, Exposed to View: Aluminum, smooth, 0.020 inch thick.

C. Flexible Elastomeric Insulation Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

2.18 SYSTEM CONTROL CABLE

A. Cable Rating: Listed and labeled for application according to NFPA 70.

1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

    a. Flame Travel Distance: 60 inches or less.
    b. Peak Optical Smoke Density: 0.5 or less.
    c. Average Optical Smoke Density: 0.15 or less.

2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

B. Low-Voltage Control Cabling:

1. Paired Cable: NFPA 70, Type CMG.

    a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
    b. PVC insulation.
    c. Braided or foil shielded.
    d. PVC jacket.
    e. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

    a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
    b. PVC insulation.
    c. Braided or foil shielded.
    d. PVC jacket.
    e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
    f. Flame Resistance: Comply with NFPA 262.

C. Ethernet Network Cabling: TIA-568-C.2 Category 6 cable with RJ-45 connectors.

1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of category cable indicated.
2. Conductors: 100-ohm, 23 AWG solid copper.
3. Shielding: Shielded twisted pairs (FTP).
4. Cable Rating: By application.
5. Jacket: Gray thermoplastic.

D. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for control wiring and cable raceways.

2.19 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

2.20 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.

B. Equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports for historical record. Submit reports only if requested.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine products before installation. Reject products that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.

D. Examine roughing-in for ductwork to verify actual locations of connections before equipment installation.

E. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.

F. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.

G. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EQUIPMENT INSTALLATION, GENERAL

A. Clearance:

1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

1. Loose components shall be installed by manufacturer's service representative or system Installer under supervision of manufacturer's service representative.

C. Equipment Restraint Installation: Install equipment with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

3.03 INSTALLATION OF INDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.

C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.

D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.

E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

G. Provide lateral bracing if needed to limit movement of suspended units to not more than 0.25 inch.

H. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.

I. Floor-mounted units located in mechanical rooms.

3.04 INSTALLATION OF OUTDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Roof-Mounted Installations: Install outdoor units on equipment supports specified in Section 07 72 00 "Roof Accessories." Anchor units to supports with removable, stainless-steel fasteners.

3.05 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.

K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors.

L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors.

3.06 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

A. General Requirements for Drain Piping and Tubing:

1. Install a union in piping at each threaded unit connection.
2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:

    a. Details indicated on Drawings.
    b. Manufacturer's requirements.
    c. Governing codes.
    d. In the absence of requirements, comply with requirements of ASHRAE handbooks.

4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than 2 percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.07 INSTALLATION OF HYDRONIC PIPING

A. Install continuous-thread hanger rods and elastomeric hangers of size required to support equipment weight.

1. Comply with requirements for vibration isolation devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Where installing piping and tubing adjacent to equipment, allow space for service and maintenance.

3.08 INSTALLATION OF REFRIGERANT PIPING

A. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet. Minimum rod size, 1/4 inch.
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.

C. Select system components with pressure rating equal to or greater than system operating pressure.

D. Install piping as short and direct as possible, with a minimum number of joints and fittings.

E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 31 13 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

F. Install refrigerant piping and tubing in protective conduit where installed belowground.

G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.

H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.

J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

K. Joint Construction:

1. Ream ends of tubes and remove burrs.

2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

    a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
    b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.09 INSTALLATION OF METAL HANGERS AND SUPPORTS

A. Comply with requirements in Section 23 05 48 "Vibration and Seismic Controls for HVAC" for seismic restraints.

B. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Comply with MFMA-103 for metal framing system selections and applications that are not specified.

E. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
2. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel.

1. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Piping and Tubing Insulation:

1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
2. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

N. Horizontal-Piping Hangers and Supports: Install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
4. Multiple horizontal pipes located indoors may use metal framing systems with split clamp attachment for each pipe in lieu if individual clevis hangers.
5. Pipe stands for horizontal pipes located outdoors.
6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
7. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

O. Horizontal Piping Hanger Spacing and Rod Size: Install hangers for drawn-temper copper piping with the following maximum horizontal spacing and minimum rod sizes:

1. Sizes through NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

P. Plastic Pipe Hanger and Support Spacing:

1. Space hangers and supports according to pipe manufacturer's written instructions for service conditions.
2. Maximum spacing, 5 feet; minimum rod size, 1/4 inch.

Q. Vertical-Piping Clamps: Install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): If longer ends are required for riser clamps.

R. Support vertical runs at roof, at each floor, and at midpoint intervals between floors, not to exceed 5 feet.

S. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified.

T. Use hangers, supports, and attachments with galvanized coatings unless otherwise indicated.

U. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

V. Trim excess length of continuous-thread hanger and support rods to 1 inch.

W. Hanger-Rod Attachments: Install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

X. Building Attachments: Install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

3.10 INSTALLATION OF PIPING AND TUBING INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.11 INSTALLATION OF DUCT, ACCESSORIES, AND AIR OUTLETS

A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.

B. Comply with requirements for metal ducts specified in Section 23 31 13 "Metal Ducts."

C. Comply with requirements for air duct accessories specified in Section 23 33 00 "Air Duct Accessories."

D. Comply with requirements for air diffusers, registers and grilles specified in Section 23 37 13 “Diffusers, Registers, and Grilles."

3.12 ELECTRICAL INSTALLATION

A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.

B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.

1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.

C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.

D. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

E. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding connections.

F. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least 1/2 inch high.
2. Locate nameplate or label where easily visible.

G. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or revised in this Section.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
2. Flexible metal conduit shall not be used.

H. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

I. Install manufactured conduit sweeps and long-radius elbows if possible.

J. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.13 SOFTWARE

A. Cybersecurity:

1. Software:

a. Coordinate security requirements with IT department.
b. Ensure that latest stable software release is installed and properly operating.
c. Disable or change default passwords to password using a combination of uppercase and lower letters, numbers, and symbols at least eight characters in length. Record passwords and turn over to party responsible for system operation and administration.

2. Hardware:

a. Coordinate location and access requirements with IT department.
b. Enable highest level of wireless encryption that is compatible with Owner's ICT network.
c. Disable dual network connections.

3.14 INSTALLATION OF SYSTEM CONTROL CABLE

A. Comply with NECA 1.

B. Installation Method:

1. Install cables in raceways except as follows:

a. Within equipment and associated control enclosures.
b. In accessible ceiling spaces where open cable installation method may be used.
c. In gypsum board partitions where cable may be enclosed within wall cavity.

2. Conceal raceway and cables except in unfinished spaces.

C. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."

3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

D. Balanced Twisted-Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.15 FIRESTOPPING

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.16 GROUNDING INSTALLATION

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.17 IDENTIFICATION

A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

B. Identify system electrical and controls components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

1. Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3.18 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by an employee or a factory-trained and -authorized service representative of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.
2. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.

a. First Visit: Kick-off meeting.
b. Second Visit: At approximately 25 percent completion of system(s).
c. Third Visit: At approximately 50 percent completion of system(s).
d. Fourth Visit: At approximately 75 percent completion of system(s).

e. Fifth Visit: Final inspection before system startup.

3. Kick-off Meeting:

a. Meeting shall include system Installer and other related trades with sole purpose of reviewing VRF HVAC system installation requirements and close coordination required to make a successful installation.
b. Meeting shall be held at Project site and scheduled at a mutually agreed to time that occurs before the start of any part of system installation.
c. Meeting shall cover the following as a minimum requirement:

1) Review of latest issue of Contract Documents, Drawings, and Specifications, relevant to VRF HVAC systems.
2) Manufacturer's installation requirements specific to systems being installed.
3) Review of all relevant VRF HVAC system submittals, including delegated-design submittals.
4) Required field activities related installation of VRF HVAC system.
5) Project team communication protocol, contact information, and exchange of responsibilities for each party involved, including manufacturer, supplier, system Installer, and other related trades.

4. Site Visits: Activities for each site visit shall include the following:

a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.
b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
d. Advise and if necessary assist Installer with updating related refrigerant calculations and system documentation.
e. Issue a report for each visit, documenting the visit.

1) Report to include name and contact information of individual making the visit.
2) Date(s) and time frames while on-site.
3) Names and contact information of people meeting with while on-site.
4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.

5. Final Inspection before Startup:

a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.

b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
d. Inspection reports for indoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Unit airflow direction within an acceptable range.
19) If applicable, fan external static pressure setting.
20) Filter type and condition acceptable.
21) Noise level within an acceptable range.
22) Refrigerant piping properly connected and insulated.
23) Condensate drain piping properly connected and insulated.
24) If applicable, ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

e. Inspection reports for outdoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.

11) Low-voltage reading(s) within an acceptable range.
12) Condensate removal acceptable.
13) Noise level within an acceptable range.
14) Refrigerant piping properly connected and insulated.
15) Condensate drain piping properly connected and insulated.
16) Remarks.

f. Inspection reports for energy recovery ventilators shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity readings.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Fan external static pressure setting.
19) Filter type and condition acceptable.
20) Noise level within an acceptable range.
21) Automatic dampers properly installed and operating.
22) Ductwork properly connected.
23) If applicable, external interlocks properly connected.
24) Remarks.

B. Perform the following tests and inspections with the assistance of manufacturer's service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than 1.2 times VRF HVAC system operating pressure, but not less than 600 psig, using dry nitrogen.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of 24 hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
4. Prepare test report to record the following information for each test:

    a. Name of person starting test, company name, phone number, and e-mail address.
    b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
    c. Detailed description of extent of tubing tested.
    d. Date and time at start of test.
    e. Test pressure at start of test.
    f. Outdoor temperature at start of test.
    g. Name of person ending test, company name, phone number, and e-mail address.
    h. Date and time at end of test.
    i. Test pressure at end of test.
    j. Outdoor temperature at end of test.
    k. Remarks:

5. Submit test reports for Project record.

D. Refrigerant Tubing Evacuation Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of 500 microns.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of one hour(s) with no change.
4. Prepare test report to record the following information for each test:

    a. Name of person starting test, company name, phone number, and e-mail address.
    b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
    c. Detailed description of extent of tubing tested.
    d. Date and time at start of test.
    e. Test pressure at start of test.
    f. Outdoor temperature at start of test.
    g. Name of person ending test, company name, phone number, and e-mail address.
    h. Date and time at end of test.
    i. Test pressure at end of test.
    j. Outdoor temperature at end of test.

k. Remarks:

5. Submit test reports for Project record.
6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

E. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

F. Products will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.19 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

1. Service representative shall be an employee or a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit, HRCU, and outdoor unit for proper condensate removal.
5. Check sound levels of each indoor and outdoor unit.
6. .

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.

1. Installer shall correct deficiencies found during startup service for reverification.

D. System Operation Report:

1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
3. Manufacturer shall electronically record not less than two hours of continuous operation of each system and submit with report for historical reference.

    a. All available system operating parameters shall be included in the information submitted.

E. Witness:

1. Invite Owner and Commissioning Agent to witness startup service procedures.
2. Provide written notice not less than 20 business days before start of startup service.

3.20 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.

C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.21 PROTECTION

A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.

B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.

C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.

D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

3.22 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of system Installer who are manufacturer's authorized service representative. Include two service visits for preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment and system operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.23 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.24 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's employed training instructor or factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

B. Instructor:

1. Instructor shall be factory trained and certified by VRF HVAC system manufacturer with current training on the system(s), equipment, and controls that are installed.
2. Instructor's credentials shall be submitted for review by Commissioning Agent before scheduling training.
3. Instructor(s) primary job responsibility shall be Owner training.
4. Instructor(s) shall have not less than three years of training experience with VRF HVAC system manufacturer and past training experience on at least three projects of comparable size and complexity.

C. Schedule and Duration:

1. Schedule training with Owner at least 20 business days before first training session.
2. Training shall occur before Owner occupancy.
3. Training shall be held at mutually agreed date and time during normal business hours.

4. Each training day shall not exceed eight hours of training. Daily training schedule shall allow time for one-hour lunch period and 15-minute break after every two hours of training.
5. Perform not less than eight total hours of training.

D. Location: Owner shall provide a suitable on-site location to host classroom training.

E. Training Attendees: Assume three people.

F. Training Attendance: For record purposes, document training attendees at the start of each new training session. Record attendee's name, signature, phone number, and e-mail address.

G. Training Format: Individual training modules shall include classroom training followed by hands-on field demonstration and training.

H. Training Materials: Provide training materials in electronic format to each attendee.

1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
2. Video record each classroom training session and submit an electronic copy to Owner before requesting Owner acceptance of training.

I. Acceptance: Obtain Commissioning Agent or Owner written acceptance that training is complete and requirements indicated have been satisfied.

END OF SECTION 23 81 29

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Photovoltaic cable, Type PV.
3. Tray cable, Type TC.
4. Fire-alarm wire and cable.
5. Connectors and splices.

B. Related Requirements:

1. Section 27 15 13 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

1.03 DEFINITIONS

A. PV: Photovoltaic.

B. VFC: Variable-frequency controller.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Product Schedule: Indicate type, use, location, and termination locations.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer's authorized service representative.

B. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.01 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.
2. Type UF: Comply with UL 83 and UL 493.
3. Type XHHW-2: Comply with UL 44.

E. Shield:

1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.

2.02 PHOTOVOLTAIC CABLE, TYPE PV

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation: Comply with UL 44 and UL 4703.

2.03 TRAY CABLE, TYPE TC

A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in a nonmetallic jacket.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Comply with UL 1277.
4. Comply with ICEA S-73-532/NEMA WC 57 for Type TC cables used for control, thermocouple extension, and instrumentation.
5. Comply with ICEA S-95-658/NEMA WC 70 for Type TC cables used for power distribution.
6. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Ground Conductor: Bare.

E. Conductor Insulation: Type XHHW-2. Comply with UL 44.

F. Shield: Metallic.

2.04 FIRE-ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

2.05 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

E. PV Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.

F. Feeders in Cable Tray: Type THHN/THWN-2, single conductors in raceway.

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

J. Branch Circuits Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.

K. PV Circuits, Type USE-2: For PV source circuits rated at 600 V or less.

L. PV Circuits, Type PV: For PV source circuits rated at 600 V.

3.03 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.04 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 27 05 28 "Pathways for Communication Systems."

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system shall be installed in a dedicated pathway system.

    a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.

3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is not permitted.
4. Signaling Line Circuits: Power-limited fire-alarm cables may be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.05 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

D. Comply with requirements in Section 28 46 21.11 "Addressable Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.

3.06 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.07 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.08 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 84 13 "Penetration Firestopping."

3.09 FIELD QUALITY CONTROL

A. Administrant for Tests and Inspections:

1. Owner will engage qualified testing agency to administer and perform tests and inspections.
2. Engage qualified testing agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

4. Administer and perform tests and inspections with assistance of factory-authorized service representative.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors feeding the following critical equipment and services for compliance with requirements:
3. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    g. Continuity test on each conductor and cable.
    h. Uniform resistance of parallel conductors.

4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Ground rods.
2. Ground rings.
3. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:

    a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:

        1) Test wells.
        2) Ground rods.
        3) Ground rings.
        4) Grounding arrangements and connections for separately derived systems.

    b. Instructions for periodic testing and inspection of grounding features at ground rings based on NETA MTS.

        1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
        2) Include recommended testing intervals.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.03 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

K. Lay-in Lug Connector: Mechanical type, aluminum terminal with set screw.

L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

N. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.

O. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal [one] [two]-piece clamp.

P. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

Q. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.

a. Material: Tin-plated aluminum.
b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector.

2.04 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturer's recommended material.

C. Ground Plates: 1/4 inch (6 mm) thick, hot-dip galvanized.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 30 inches (750 mm) below grade.

C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

D. Isolated Grounding Conductors: Green-colored insulation with more than one continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

E. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

F. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.04 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.05 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

H. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.06 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. Use exothermic welds for all below-grade connections.
3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems" and shall be at least 12 inches (300 mm) deep, with cover.

1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet (6.0 m) long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

K. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal[, at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

F. Grounding system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Manhole Grounds: 10 ohms.

I. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Conduit and cable support devices.
2. Support for conductors in vertical conduit.
3. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
4. Fabricated metal equipment support assemblies.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in the State of California to design hanger and support system.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."
2. Component Importance Factor: 1.5.

C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

B. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

C. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for firestopping at conduit and box entrances.
2. Section 27 05 28 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.03 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. ARC: Comply with ANSI C80.5 and UL 6A.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. EMT: Comply with ANSI C80.3 and UL 797.
6. FMC: Comply with UL 1; zinc-coated steel.
7. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Fittings for EMT:

    a. Material: Steel.
    b. Type: Setscrew.

5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fiberglass:

    a. Comply with NEMA TC 14.
    b. Comply with UL 2515 for aboveground raceways.
    c. Comply with UL 2420 for belowground raceways.

3. ENT: Comply with NEMA TC 13 and UL 1653.
4. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
5. LFNC: Comply with UL 1660.
6. Rigid HDPE: Comply with UL 651A.
7. Continuous HDPE: Comply with UL 651A.
8. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D3485.
9. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings:

1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

    a. Fittings for LFNC: Comply with UL 514B.

3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Hinged type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

M. Gangable boxes are allowed.

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.05 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.

2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.".
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.06 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC and IMC.
2. Concealed Conduit, Aboveground: GRC, IMC, EMT.
3. Underground Conduit: Type EPC-40-PVC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R, unless otherwise indicated.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: IMC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.02 INSTALLATION

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches (300 mm) of enclosures to which attached.

L. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to RNC before rising above floor.

M. Stub-Ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

R. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

S. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

T. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

U. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

V. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

W. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

X. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.

5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

Y. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Z. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    d. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

AA. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

DD. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

EE. Locate boxes so that cover or plate will not span different building finishes.

FF. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

GG. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

HH. Set metal floor boxes level and flush with finished floor surface.

II. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 20 00 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 31 20 00 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.06 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.07 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Labels.
2. Bands and tubes.
3. Tapes and stencils.
4. Tags.
5. Signs.
6. Cable ties.
7. Miscellaneous identification products.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

B. Color-Coding for Phase-and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Color for Neutral: White.
4. Color for Equipment Grounds: Green.
5. Colors for Isolated Grounds: Green with two or more yellow stripes.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

E. Equipment Identification Labels:

1. Black letters on a white field.

2.03 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels:

a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
c. As required by authorities having jurisdiction.

2.04 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.05 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and are 12 inches (300 mm) wide. Stop stripes at legends.

D. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

E. Underground-Line Warning Tape:

1. Tape:

   a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   b. Printing on tape shall be permanent and shall not be damaged by burial operations.
   c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

   a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
   b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
   c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

3. Tape Type I:

   a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
   b. Width: 3 inches (75 mm).
   c. Thickness: 4 mils (0.1 mm).
   d. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
   e. Tensile according to ASTM D882: 30 lbf (133.4 N) and 2500 psi (17.2 MPa).

4. Tape Type II:

    a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, compounded for direct-burial service.
    b. Width: 3 inches (75 mm).
    c. Thickness: 12 mils (0.3 mm).
    d. Weight: 36.1 lb/1000 sq. ft. (17.6 kg/100 sq. m).
    e. Tensile according to ASTM D882: 400 lbf (1780 N) and 11,500 psi (79.2 MPa).

5. Tape Type ID:

    a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, [continuous-printed on one side with the inscription of the utility,]compounded for direct-burial service.
    b. Width: 3 inches (75 mm).
    c. Overall Thickness: 5 mils (0.125 mm).
    d. Foil Core Thickness: 0.35 mil (0.00889 mm).
    e. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
    f. Tensile according to ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

6. Tape Type IID:

    a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, compounded for direct-burial service.
    b. Width: 3 inches (75 mm).
    c. Overall Thickness: 8 mils (0.2 mm).
    d. Foil Core Thickness: 0.35 mil (0.00889 mm).
    e. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
    f. Tensile according to ASTM D882: 300 lbf (1334 N) and 12,500 psi (86.1 MPa).

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.06 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

C. Write-on Tags:

1. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
2. Marker for Tags:

    a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
    b. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.07 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches (180 by 250 mm).

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches (250 by 360 mm).

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

    a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
    b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
    c. Engraved legend with black letters on white face.
    d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.08 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

L. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

Q. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

S. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

T. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

U. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

V. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [or concrete envelope]exceeds 16 inches (400 mm) overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

W. Metal Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

X. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

Y. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

Z. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

AA. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

BB. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

CC. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.03 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags.

G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use [write-on tags] [self-adhesive labels] with the conductor or cable designation, origin, and destination.

H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.

I. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

J. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

K. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

L. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

M. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

N. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive label.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

    a. Controls with external control power connections.

O. Arc Flash Warning Labeling: Self-adhesive labels.

P. Operating Instruction Signs: Self-adhesive labels.

Q. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Switchboards.
    f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    g. Substations.
    h. Emergency system boxes and enclosures.
    i. Motor-control centers.
    j. Enclosed switches.
    k. Enclosed circuit breakers.
    l. Enclosed controllers.
    m. Variable-speed controllers.
    n. Push-button stations.
    o. Power-transfer equipment.
    p. Contactors.
    q. Remote-controlled switches, dimmer modules, and control devices.
    r. Battery-inverter units.
    s. Battery racks.
    t. Power-generating units.
    u. Monitoring and control equipment.
    v. UPS equipment

END OF SECTION 26 05 53

SECTION 26 05 73.16

COORDINATION STUDIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1. Study results shall be used to determine coordination of series-rated devices.

1.03 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.

B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

E. Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

G. SCCR: Short-circuit current rating.

H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

I. Single-Line Diagram: See "One-Line Diagram."

1.04 ACTION SUBMITTALS

A. Product Data:

1. For computer software program to be used for studies.
2. Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

    a. Coordination-study input data, including completed computer program input data sheets.
    b. Study and equipment evaluation reports.

3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power System Analysis Software Developer.
2. For Power Systems Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. The following are from the Coordination Study Report:

    a. Final one-line diagram.
    b. Final protective device coordination study.
    c. Coordination study data files.

d. List of all protective device settings.
e. Time-current coordination curves.
f. Power system data.

1.07 QUALITY ASSURANCE

A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications:

1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Comply with IEEE 242 and IEEE 399.

B. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

    a. Arcing faults.
    b. Simultaneous faults.
    c. Explicit negative sequence.
    d. Mutual coupling in zero sequence.

2.02 COORDINATION STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.
6. Any revisions to electrical equipment required by the study.
7. Study Input Data: As described in "Power System Data" Article.

D. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

    a. Phase and Ground Relays:

        1) Device tag.
        2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
        3) Recommendations on improved relaying systems, if applicable.

    b. Circuit Breakers:

        1) Adjustable pickups and time delays (long time, short time, and ground).
        2) Adjustable time-current characteristic.
        3) Adjustable instantaneous pickup.
        4) Recommendations on improved trip systems, if applicable.

    c. Fuses: Show current rating, voltage, and class.

E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation

exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

    a. Power utility's overcurrent protective device.
    b. Medium-voltage equipment overcurrent relays.
    c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    f. Cables and conductors damage curves.
    g. Ground-fault protective devices.
    h. Motor-starting characteristics and motor damage points.
    i. Generator short-circuit decrement curve and generator damage point.
    j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Maintain selectivity for tripping currents caused by overloads.
6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7. Provide adequate time margins between device characteristics such that selective operation is achieved.
8. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.02 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

B. Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
17. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:

a. Special load considerations, including starting inrush currents and frequent starting and stopping.
b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Generator thermal-damage curve.
e. Ratings, types, and settings of utility company's overcurrent protective devices.
f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves of devices indicated to be coordinated.
h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.03 COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

    a. Inrush current when first energized.
    b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
    c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.

K. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.
4. Include in the report identification of any protective device applied outside its capacity.

3.04 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.
3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.05 FIELD ADJUSTING

A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.06 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.
2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.
3. For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 26 05 73.16

SECTION 26 05 73.19

ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.03 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

G. SCCR: Short-circuit current rating.

H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

I. Single-Line Diagram: See "One-Line Diagram."

1.04 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form:

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.
2. Operation and Maintenance Procedures: In addition to items specified in Division 01 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.07 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

G. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. Comply with IEEE 1584 and NFPA 70E.

B. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.02 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.

3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 26 05 73.16 "Coordination Studies."

F. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. No AC Decrement (NACD) ratio.
    e. Equivalent impedance.
    f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
    g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

G. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

H. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.03 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.

    a. Arc-flash boundary.
    b. Restricted approach boundary.
    c. Limited approach boundary.

4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.02 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.

1. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 26 05 73.16 "Coordination Studies."

C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.

4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.

D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.

F. Calculate the limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.03 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail

that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level lll or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance or available short circuit current at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.04 LABELING

A. Apply one arc-flash label on the front cover for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below shall have an arc-flash label applied to it:

1. Low-voltage switchboard.
2. Applicable panelboard and safety switch under 250 V.
3. Control panel.

C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.05 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.06 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 26 05 73.19

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electrical equipment connected to Normal electrical systems, including the following:
   a. Transformers.
   b. Secondary service electrical systems.
   c. Distribution and branch-circuit panelboards.
   d. Grounding systems.

2. Electrical equipment connected to Essential electrical systems that provide an alternative source of power in the absence of power from the Normal electrical system, including the following:

   a. Central emergency lighting inverter.

3. Controls and instrumentation, including the following:
   a. Electrical metering and metering system.
   b. Lighting control systems.
   c. Security systems.
   d. Fire-alarm systems.

4. Systems testing and verification, including Normal and Essential electrical systems, and transitions from Normal to Essential electrical systems and back.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.

1.02 DEFINITIONS

A. BoD: Basis-of-Design Document, as defined in Section 019113 "General Commissioning Requirements."

B. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

C. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

D. OPR: Owner's Project Requirements, as defined in Section 019113 "General Commissioning Requirements."

E. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.03 INFORMATIONAL SUBMITTALS

A. Construction Checklists by CxA: Draft construction checklists will be created by CxA for Contractor review.

B. Construction Checklists by Contractor: Include the following and comply with requirements in Section 019113 "General Commissioning Requirements" for construction checklists:
   1. Instrumentation and control for lighting control systems.
   2. Electrical feeders and branch circuits.
   3. Dry-type transformers.
   4. Distribution panels.
   5. Low-voltage surge protective devices.
   6. Metering devices.
   7. Molded-case circuit breakers.
   8. Grounding systems.
   9. Panelboards.
   10. Receptacles and devices.
   11. Variable-frequency drives.
   12. Battery systems.
   13. Battery chargers.
   14. VRLA batteries.
   15. Lighting.
   16. Vehicle charging equipment.
   17. Central emergency lighting inverter.

1.04 QUALITY ASSURANCE

A. Testing Equipment and Instrumentation Quality and Calibration: For test equipment and instrumentation required to perform electrical Cx work, perform the following:

   1. Submit test equipment and instrumentation list. For each equipment or instrument, identify the following:

      a. Equipment/instrument identification number.
      b. Planned Cx application or use.
      c. Manufacturer, make, model, and serial number.
      d. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.

   2. Test equipment and instrumentation must meet the following criteria:

a. Capable of testing and measuring performance within the specified acceptance criteria.
b. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
c. Be maintained in good repair and operating condition throughout duration of use on Project.
d. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

B. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, perform the following:

a. Submit proprietary instrumentation and tools list. For each instrument or tool, identify the following:

1) Instrument or tool identification number.
2) Equipment schedule designation of equipment for which the instrument or tool is required.
3) Manufacturer, make, model, and serial number.
4) Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
c. Electrical proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 CONSTRUCTION CHECKLISTS

A. Prepare detailed construction checklists for electrical systems, subsystems, equipment, and components. Complete and submit construction checklists.

3.02 CONSTRUCTION CHECKLIST REVIEW

A. Review and provide written comments on draft construction checklists. CxA will create required draft construction checklists and provide them to Contractor.

B. Return draft Construction Checklist review comments within 10 days of receipt.

C. When review comments have been resolved, CxA will provide final construction checklists, marked "Approved for Use, (date)."

D. Use only construction checklists, marked "Approved for Use, (date)."

3.03 GENERAL TESTING REQUIREMENTS

A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved Shop Drawings and submittals.

B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

D. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria.

E. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and response according to acceptance criteria.

F. Construction Checklists: Prepare and submit detailed construction checklists for electrical systems, subsystems, equipment, and components.

1. Contributors to development of construction checklists must include, but are not limited to, the following:

    a. Electrical systems and equipment installers.
    b. Electrical instrumentation and controls installers.

G. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA, and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.

3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.

I. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

J. Coordinate schedule with, and perform Cx activities at the direction of the CxA.

K. Comply with Construction Checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Sections specifying electrical systems and equipment.

L. Provide qualified testing and inspecting agency personnel, instrumentation, tools, and equipment to complete and document the following:

1. Performance tests.
2. Demonstration of a sample of performance tests.
3. Cx tests.
4. Cx test demonstrations.

3.04 Cx TESTS FOR ELECTRICAL SYSTEMS

A. Verification of Normal Electrical System Operation:

1. Prerequisites: Acceptance of results for construction checklists for Division 26 electrical components associated with Normal electrical system.
2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
3. Test Purpose: Verify operation of Normal electrical system.
4. Test Conditions: Energize components of Normal electrical system, one at a time.
5. Acceptance Criteria: Proper operation of Normal electrical system over a 48-hour period.

B. Verification of Essential Electrical System Operation:

1. Prerequisites:

a. Acceptance of results for construction checklists for Division 26 electrical components associated with Essential electrical system.
b. Completion of "Verification of Normal Electrical System Operation" tests.

2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
3. Test Purpose: Verify operation of Essential electrical system.
4. Test Conditions:

a. Energize components of Normal electrical system.

b. Simulate a failure of Normal electrical system.

5. Acceptance Criteria: Transfer of power from Normal to Essential electrical system within OPR.

C. Verification of Control and Instrumentation:

1. Prerequisites: Acceptance of results for construction checklists.
   a. Section 260923 "Lighting Control Devices."
   b. Section 262713 "Electricity Metering."

D. Test Purpose: Verify operation of control and monitoring systems for Normal and Essential electrical systems.

E. Test Conditions:

1. Energize components of Normal electrical system.
2. Test operation of equipment.

F. Acceptance Criteria: Operation of equipment according to OPR.

END OF SECTION 260800

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Outdoor photoelectric switches, solid state, flexible mounting.
2. Daylight-harvesting dimming controls, digital.
3. Indoor occupancy and vacancy sensors.
4. Switchbox-mounted occupancy sensors.
5. Outdoor motion sensors.
6. Conductors and cables.

B. Related Requirements:

1. Section 26 27 26 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:

a. Occupancy sensors.
b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which equipment will be attached.
3. Items penetrating finished ceiling, including the following:

a. Luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Control modules.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's warranties.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.

1.06 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control software.
b. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 OUTDOOR PHOTOELECTRIC SWITCHES, SOLID STATE, FLEXIBLE MOUNTING

A. Manufactures:

1. Cooper Industries
2. Intematic
3. Leviton
4. N Si Industries

B. Description: Solid state, with DPST dry contacts rated for 1000 W incandescent, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A, and compatible with ballasts and LED lamps.

1. Listed and labeled as defined in NFPA 70, by NRTL, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen-second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with ANSI C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure from same source and manufacturer as switch.
6. Failure Mode: Luminaire stays ON.

2.02 DAYLIGHT-HARVESTING DIMMING CONTROLS, DIGITAL

A. Manufactures:

1. Cooper Industries
2. Hubbell
3. Leviton
4. Lithonia
5. Lutron

B. Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, lights are dimmed.

1. Lighting control set point is based on the following two lighting conditions:

a. When no daylight is present (target level).
b. When significant daylight is present.

2. System programming is done with two hand-held, remote-control tools.

a. Initial setup tool.

b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.

C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with integrated power pack, to detect changes in indoor lighting levels that are perceived by the eye.

D. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Sensor Output: zero- to 10-V dc to operate luminaires. Sensor is powered by controller unit.
3. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc.

E. Power Pack: Digital controller capable of accepting four RJ45 inputs with two output(s) rated for 20-A LED load at 120-V ac. Sensor has 24-V dc Class 2 power source, as defined by NFPA 70.

1. With integral current monitoring.
2. Compatible with digital addressable lighting interface.
3. Plenum rated.

2.03 INDOOR OCCUPANCY AND VACANCY SENSORS

A. Manufactures:

1. Cooper Industries
2. Hubbell
3. Leviton
4. Lithonia
5. Lutron
6. N Si Industries

B. General Requirements for Sensors:

1. Wall and Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
2. Dual technology.
3. Integrated power pack.
4. Hardwired or Wireless connection to switch and BAS and lighting control system.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:

a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A or Wireless.
8. Power: Line voltage.
9. Power Pack: Dry contacts rated for 20-A LED load at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc turn lights off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

2.04 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufactures:

1. Cooper Industries

2. Hubbell
3. Leviton
4. Lithonia
5. Lutron
6. N Si Industries

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
4. Switch Rating: Not less than 800-VA LED load at 120 V.

2.05 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF SENSORS

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.03 INSTALLATION OF CONTACTORS

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.04 INSTALLATION OF WIRING

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's written instructions.

D. Size conductors in accordance with lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.05 IDENTIFICATION

A. Identify components and power and control wiring in accordance with Section 26 05 53 "Identification for Electrical Systems.

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.07 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.08 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.09 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 26 09 23

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.
8. Mimic bus.

1.03 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.

7. Include evidence of NRTL listing for series rating of installed devices.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.
11. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

D. Delegated Design Submittal:

1. For arc-flash hazard analysis.
2. For arc-flash labels.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for switchboards, overcurrent protective devices, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:

a. Routine maintenance requirements for switchboards and all installed components.

b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.
2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Handle and prepare switchboards for installation according to [NECA 400] [NEMA PB 2.1].

1.09 FIELD CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
   b. Altitude: Not exceeding 6600 feet (2000 m).

C. Unusual Service Conditions: NEMA PB 2, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify [Architect] [Construction Manager] [Owner] no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without [Architect's] [Construction Manager's] [Owner's] written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
2. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[and the unit will be fully operational after the seismic event."

2.02 SWITCHBOARDS

A. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

1. Eaton
2. Schneider Electric
3. Siemens

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 2.

E. Comply with NFPA 70.

F. Comply with UL 891.

G. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Panel mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

H. Front- and Side-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Section Alignment: Front aligned.

I. Front- and Rear-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

J. Nominal System Voltage: 208Y/120 V.

K. Main-Bus Continuous: 800A.

L. Seismic Requirements: Fabricate and test switchboards according to IEEE 344

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

M. Indoor Enclosures: Steel, NEMA 250, Type 1.

N. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray [custom color] finish over a rust-inhibiting primer on treated metal surface.

O. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.

P. Utility Metering Compartment: Barrier compartment and section complying with utility company's requirements; hinged sealable door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

Q. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks.

R. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

S. Removable, Hinged Rear Doors and Compartment Covers: Secured by captive thumb screws, for access to rear interior of switchboard.

T. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

U. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

V. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated.
3. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
4. Copper feeder circuit-breaker line connections.
5. Tin-plated aluminum feeder circuit-breaker line connections.
6. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
7. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
8. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
9. Disconnect Links:

    a. Isolate neutral bus from incoming neutral conductors.
    b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.

10. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

W. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

X. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

2.03 SURGE PROTECTION DEVICES

A. SPDs: Comply with UL 1449, Type 1.

B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.

C. Features and Accessories:

1. Integral disconnect switch.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Indicator light display for protection status.
4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
5. Surge counter.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 208Y/120 V.
3. Line to Line: 1000 V for 208Y/120 V.

F. SCCR: Equal or exceed 100 kA.

G. Nominal Rating: 20 kA.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long and short time adjustments.
    d. Ground-fault pickup level, time delay, and I squared t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
8. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system
    e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    g. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
    h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.05 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, and the following:

1. Potential Transformers: NEMA EI 21.1; 120 V, 60 Hz, tapped secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.

2. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
d. Megawatts: Plus or minus 1 percent.
e. Megavars: Plus or minus 1 percent.
f. Power Factor: Plus or minus 1 percent.
g. Frequency: Plus or minus 0.1 percent.
h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Analog Meters:

1. Meters: 4-inch (100-mm) diameter or 6 inches (150 mm) square, flush or semiflush, with anti-parallax 250-degree scales and external zero adjustment.

D. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

E. Instrument Switches: Rotary type with off position.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.
2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.

F. Ammeters: 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for indicated feeder circuits only.

G. Watt-Hour Meters and Wattmeters:

1. Comply with ANSI C12.1.
2. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.
3. Suitable for connection to three- and four-wire circuits.
4. Potential indicating lamps.
5. Adjustments for light and full load, phase balance, and power factor.
6. Four-dial clock register.
7. Integral demand indicator.
8. Contact devices to operate remote impulse-totalizing demand meter.
9. Ratchets to prevent reverse rotation.
10. Removable meter with drawout test plug.
11. Semiflush mounted case with matching cover.
12. Appropriate multiplier tag.

H. Impulse-Totalizing Demand Meter:

1. Comply with ANSI C12.1.
2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
3. Cyclometer.
4. Four-dial, totalizing kilowatt-hour register.
5. Positive chart drive mechanism.
6. Capillary pen holding a minimum of one month's ink supply.
7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
8. Capable of indicating and recording five-minute integrated demand of totalized system.

2.06 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Control Circuits: 120-V ac, supplied from remote branch circuit.

C. Control Circuits: 24-V dc.

D. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

E. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

F. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.07 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

D. Overhead Circuit-Breaker Lifting Device: Mounted at top front of switchboard, with hoist and lifting yokes matching each draw out circuit breaker.

E. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

F. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements of manufacturer's instructions.

2.08 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on a photoengraved nameplate.

1. Nameplate: At least 0.032-inch- (0.813-mm-) thick anodized aluminum, located at eye level on front cover of the switchboard incoming service section.

B. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on an engraved laminated-plastic (Gravoply) nameplate.

1. Nameplate: At least 0.0625-inch- (1.588 mm-) thick laminated plastic (Gravoply), located at eye level on front cover of the switchboard incoming service section.

C. Mimic Bus: Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic-bus diagram.

D. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

E. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

F. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NECA 400.

1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
3. Protect from moisture, dust, dirt, and debris during storage and installation.
4. Install temporary heating during storage per manufacturer's instructions.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install switchboards and accessories according to NECA 400.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."

1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches (50-mm) above concrete base after switchboard is anchored in place.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to switchboards.
6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements per manufacturer's recommendations.

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, surge protection devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

H. Install spare-fuse cabinet.

I. Comply with NECA 1.

3.03 CONNECTIONS

A. Drawings indicate general arrangement of bus, fittings, and specialties.

B. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.

C. Support and secure conductors within the switchboard according to NFPA 70.

D. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.04 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:

1. Acceptance Testing:

    a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
    b. Test continuity of each circuit.

2. Test ground-fault protection of equipment for service equipment per NFPA 70.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
5. Perform the following infrared scan tests and inspections, and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

6. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.07 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 26 24 13

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.
2. Electronic-grade panelboards.

1.03 DEFINITIONS

A. ATS: Acceptance testing specification.

B. HID: High-intensity discharge.

C. MCCB: Molded-case circuit breaker.

D. SPD: Surge protective device.

E. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Include evidence of NRTL listing for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.

1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

A. Fabricate and test panelboards accordance with IEEE 344

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

F. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Outdoor Locations: NEMA 250, Type 3R.

2. Height: 84 inches (2.13 m) maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
7. Finishes:

    a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.
    c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

G. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

H. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.

    a. Plating shall run entire length of bus.

b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.
7. Split Bus: Vertical buses divided into individual vertical sections.

I. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: Compression type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

J. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

K. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 20 percent.

L. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

1. Panelboards rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

M. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.03 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

C. Mains: Lugs only.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices: Fused switches.

G. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: lugs only.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.05 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

a. RMS sensing.
b. Field-replaceable rating plug or electronic trip.
c. Digital display of settings, trip targets, and indicated metering displays.
d. Multi-button keypad to access programmable functions and monitored data.
e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.

f. Integral test jack for connection to portable test set or laptop computer.
g. Field-Adjustable Settings:

1) Instantaneous trip.
2) Long- and short-time pickup levels.
3) Long and short time adjustments.
4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Subfeed Circuit Breakers: Vertically mounted.
9. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
e. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system
f. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
g. Auxiliary Contacts: One, SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
h. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
j. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
k. Multipole units enclosed in a single housing with a single handle.
l. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
m. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet
2. Fused Switch Features and Accessories:

a. Standard ampere ratings and number of poles.
b. Mechanical cover interlock with a manual interlock override, to prevent the opening of the cover when the switch is in the on position. The interlock shall prevent the switch from being turned on with the cover open. The operating handle shall have lock-off means with provisions for three padlocks.
c. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.06 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.07 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407.

D. Equipment Mounting:

1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete."
2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
3. Comply with requirements per manufacturer’s recommendations.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Comply with mounting and anchoring requirements per manufacturer’s recommendations.

G. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

H. Mount panelboard cabinet plumb and rigid without distortion of box.

I. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch (16 mm) in depth. Orient steel slotted supports vertically.

K. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

M. Install filler plates in unused spaces.

N. Stub four 1-inch (25 mm) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (25 mm) empty conduits into raised floor space or below slab not on grade.

O. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

P. Mount spare fuse cabinet in accessible location.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.

2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.06 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 27 13

ELECTRICITY METERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes electricity metering.

1.03 DEFINITIONS

A. KY or KYZ Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity (kWh) that is based on a relay opening and closing in response to the rotation of the disk in the meter. Electronic meters generate pulses electronically.

1.04 ACTION SUBMITTALS

A. Product Data:

1. For each type of meter.
2. For metering infrastructure components.
3. For metering software.

B. Shop Drawings: For electricity-metering equipment.

1. Include elevation views of front panels of control and indicating devices and control stations.
2. Include diagrams for power, signal, and control wiring.
3. Wire Termination Diagrams and Schedules: Include diagrams for power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include series-combination rating data for modular meter centers with main disconnect device.
5. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data

gateways, concentrators, and other devices used. Describe characteristics of network and other data communication lines.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit evidence that meters are compatible with connected monitoring and control devices and systems specified in Section 23 09 00 “Controls and Instrumentation.”

1. Show interconnecting signal and control wiring, and interface devices to show compatibility of meters.
2. For reporting and billing interfaces and adapters, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the protocol.

B. Qualification Data: For testing agency.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:

1. Application and operating software documentation.
2. Software licenses.
3. Software service agreement.
4. Device address list.
5. Hard copies of manufacturer's operating specifications, user's guides for software and hardware, and PDF files on a USB storage device of hard-copy Submittal.
6. Meter data sheet for each meter, listing nameplate data and serial number, accuracy certification, and test results.
7. Meter installation and billing software startup report.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metering equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Damage from transient voltage surges.

2. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.
3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

1.09 COORDINATION

A. Electrical Service Connections:

1. Coordinate with utility companies and utility-furnished components.

a. Comply with requirements of utility providing electrical power services.
b. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 916.

2.02 UTILITY METERING INFRASTRUCTURE

A. Install metering accessories furnished by the utility company, complying with its requirements.

B. Utility-Furnished Meters: Connect data transmission facility of metering equipment installed by the Utility.

1. Data Transmission: Transmit pulse data over control-circuit conductors, classified as Class 1 per NFPA 70, Article 725. Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

D. Meter Sockets:

1. Comply with requirements of electrical-power utility company.

2. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

E. Modular Meter Center: Factory-coordinated assembly of a main service disconnect device, wireways, meter socket modules, and feeder circuit breakers arranged in adjacent vertical sections complete with interconnecting buses.

1. Provided and installed by switchboard manufacture
2. Comply with requirements of utility company for meter center.

    a. Comply with UL 67.

3. Housing: NEMA 250, Type 1 enclosure.
4. Meter Socket Rating: Coordinated with connected feeder circuit rating.
5. Minimum Short-Circuit Rating: 2,000 A symmetrical at rated voltage.
6. Steady-state and short-circuit current ratings shall have ratings that match connected circuit ratings.
7. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers and having an adjustable magnetic trip setting for circuit-breaker frame sizes of 250 A and larger. Circuit breakers shall be operable from outside the enclosure to disconnect the unit. Configure cover so it can be opened only when the disconnect switch is open.
8. Main Disconnect Device: Fusible switch, UL 98 Type GD, series-combination rated by fuse manufacturer to protect downstream feeder and branch circuit breakers. Switch shall be operable from outside the enclosure to disconnect the unit. Configure cover so that it can be opened only when the disconnect switch is open.
9. Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect downstream circuit breakers and to house load centers and panelboards that have 10,000-A interrupting capacity.

    a. Identification: Complying with requirements in Section 26 05 53 "Identification for Electrical Systems."
    b. Physical Protection: Tamper resistant, with hasp for padlock.

10. Surge Protection for Main Disconnect: Factory installed, integrally mounted, UL 1449 Type 1. Comply with Section 26 43 13 "Surge Protection for Low-Voltage Electrical Power Circuits."
11. Surge Protection at Main Disconnect: Field-mounted external to the device, UL 1449 Type 2, with integral disconnect and overcurrent protective device. Comply with Section 26 43 13 "Surge Protection for Low-Voltage Electrical Power Circuits."
12. Surge Protection at Main Terminal Box: Factory installed, integrally mounted, UL 1449 Type 1. Comply with Section 26 43 13 "Surge Protection for Low-Voltage Electrical Power Circuits."
13. Surge Protection at Main Terminal Box: Field-mounted external to the device, UL 1449 Type 2, with integral disconnect and overcurrent protective device. Comply with Section 26 43 13 "Surge Protection for Low-Voltage Electrical Power Circuits."

F. Arc-Flash Warning Labels;

1. Labels: Comply with requirements for "Arc-Flash Warning Labels" in Section 26 05 73.19 "Arc-Flash Studies." Apply a 3-1/2-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.
2. Labels: Comply with requirements for "Self-Adhesive Equipment Labels" and "Signs" in Section 26 05 53 "Identification for Electrical Systems." Apply a 3-1/2-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis. Labels shall be machine printed, with no field-applied markings.

    a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

        1) Location designation.
        2) Nominal voltage.
        3) Flash protection boundary.
        4) Hazard risk category.
        5) Incident energy.
        6) Working distance.
        7) Engineering report number, revision number, and issue date.

2.03 ELECTRICITY METERS

A. System Description: Able to meter designated activity loads, with or without external alarm, control, and communication capabilities, or other optional features.

B. Provided by switchboard manufacturer.

1. Comply with ANSI C12.1 and ANSI C12.20, 0.5 accuracy class.
2. Ambient Temperature: Minus 22 deg F to plus 158 deg F (Minus 30 deg C to plus 70 deg C).
3. Humidity: Zero to 95 percent, noncondensing.
4. Capacities and Characteristics:

    a. Circuit: 120/240-V ac, 100 A.
    b. Measure: kWh, onboard LED display.
    c. Remote-Reading Options: None.

C. General Requirements for Meters:

1. Billing Meters Accuracy: 1.0 percent of reading, complying with ANSI C12.20.
2. Meters Certification: Certified by California Type Evaluation Program as complying with 4 CCR 4027, Article 2.2.
3. Certify that meters comply with ANSI C12.20 requirements by a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP)

of the National Institute of Standards and Technology (NIST). The laboratory shall use test equipment that is certified annually and is traceable to NIST standards.

4. Enclosure: Supplied by meter manufacturer, NEMA 250, Type 1 minimum, with provisions for locking or sealing.
5. Identification: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
6. Onboard Nonvolatile Data Storage: kWh, until reset.
7. Sensors: Current-sensing type, supplied by electronic meter manufacturer, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.

    a. Type: Split core, complying with recommendation of meter manufacturer.

D. kWh Meter: Electronic three-phase meters, measuring electricity use.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kWh and current kilowatt load. Retain accumulated kWh in a nonvolatile memory, until reset.
3. Display: Digital electromechanical counter, indicating accumulative kWh.

E. kWhd Meter: Electronic three-phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating the following:

    a. Accumulative kWh.
    b. Current time and date.
    c. Current demand.
    d. Historic peak demand.
    e. Time and date of historic peak demand.

3. Retain accumulated kWh and historic peak demand in a nonvolatile memory, until reset.

F. Current-Transformer Cabinet: Size and configuration as recommended by metering equipment manufacturer for use with indicated connected feeder and sensors.

G. Data Transmission Cable: Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables"

H. Software: PC based, a product of meter manufacturer, suitable for calculating utility cost allocation.

1. Utility Cost Allocation: Automatically import electricity-usage records to allocate electricity costs for the following:

a. At least 15 departments.
b. At least 30 tenants or activities.
c. At least five processes.
d. At least five buildings.

2. Activity Billing Software: Automatically import electricity-usage records to automatically compute and prepare electricity-use statements[and invoices] based on electricity use and peak demand. Maintain separate directory for each allocation. Prepare summary reports in user-defined formats and time intervals.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written instructions. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to switchboard installation requirements in NECA 400.

D. Install arc-flash labels as required by NFPA 70.

E. Wiring Method:

1. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
2. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Section 27 15 13 "Communications Copper Horizontal Cabling."
3. Minimum conduit size shall be 1/2 inch (13 mm).

3.02 IDENTIFICATION

A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

1. Series Combination Warning Label: Self-adhesive labels, with text as required by NFPA 70.
2. Equipment Identification Labels: Self-adhesive labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card with occupant's name.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:

1. Equipment and Software Setup:

    a. Set meter date and time clock.
    b. Test, calibrate, and connect pulse metering system.
    c. Set and verify billing demand interval for demand meters.
    d. Report settings and calibration results.
    e. Set up reporting and billing software, insert billing location names and initial constant values and variable needed for billing computations.

2. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
3. Turn off circuits supplied by metered feeder and secure them in off condition.
4. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
5. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.
6. Generate test report and billing for each tenant or activity from the meter reading tests.

F. Electricity metering will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.04 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's clerical and maintenance personnel to use, adjust, operate, and maintain the electronic metering and billing software.

END OF SECTION 26 27 13

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 125 V, [15] [20] A.
2. GFCI receptacles, 125 V, 20 A.
3. Twist-locking receptacles.
4. Pendant cord-connector devices.
5. Toggle switches, 120/277 V, 20 A.
6. Occupancy sensors.
7. Wall plates.
8. Poke-through assemblies.
9. Prefabricated multioutlet assemblies.

1.03 DEFINITIONS

A. BAS: Building automation system.

B. EMI: Electromagnetic interference.

C. GFCI: Ground-fault circuit interrupter.

D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

E. SPD: Surge protective device.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

PART 2 - PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with requirements in this Section.

F. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

G. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

2. Wiring Devices Connected to Essential Electrical System: Red.
3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

H. Wall Plate Color: For plastic covers, match device color.

I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

B. Isolated-Ground Duplex Receptacles, 125 V, 20 A:

1. Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

C. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

D. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

E. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.

4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.03 STANDARD-GRADE RECEPTACLES, 125 V, 15 A

A. Duplex Receptacles, 125 V, 15 A:

1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Standards: Comply with UL 498 and FS W-C-596.

B. Isolated-Ground Duplex Receptacles, 125 V, 15 A:

1. Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Standards: Comply with UL 498 and FS W-C-596.

C. Tamper-Resistant Duplex Receptacles, 125 V, 15 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

D. Weather-Resistant Duplex Receptacle, 125 V, 15 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

E. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 15 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.04 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: [Feed] [Non-feed] through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: [Feed] [Non-feed] through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Type: Feed through.
4. Standards: Comply with UL 498 and UL 943 Class A.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.05 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Receptacles, 120 V, 20 A:

1. Configuration: NEMA WD 6, Configuration L5-20R.
2. Standards: Comply with UL 498.

B. Twist-Lock, Single Receptacles, 250 V, 20 A:

1. Configuration: NEMA WD 6, Configuration L6-20R.
2. Standards: Comply with UL 498.

C. Twist-Lock, Single Receptacles, 277 V, 20 A:

1. Configuration: NEMA WD 6, Configuration L7-20R.
2. Standards: Comply with UL 498.

D. Twist-Lock, Isolated-Ground, Single Receptacles, 125 V, 20 A:

1. Grounding: Equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
2. Configuration: NEMA WD 6, Configuration L5-20R.
3. Standards: Comply with UL 498.

2.06 TOGGLE SWITCHES, 120/277 V, 15 A

A. Single-Pole Switches, 120/277 V, 15 A:

1. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120/277 V, 15 A:

1. Comply with UL 20 and FS W-S-896.
2. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
3. Standards: Comply with UL 20 and FS W-S-896.

C. Key-Operated, Single-Pole Switches, 120/277 V, 15 A:

1. Description: Factory-supplied key in lieu of switch handle.
2. Standards: Comply with UL 20 and FS W-S-896.

D. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 15 A:

1. Description: For use with mechanically held lighting contactors.
2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

E. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 15 A:

1. Description: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.07 OCCUPANCY SENSORS

A. Wall Switch Sensor Light Switch, Dual Technology:

1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
2. Standards: Comply with UL 20.

3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
4. Adjustable time delay of five minutes.
5. Able to be locked to Automatic-On mode.
6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).
7. Connections: Provisions for connection to BAS.
8. Connections: RJ-45 communications outlet.
9. Connections: Integral wireless networking.

2.08 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.
3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.09 FLOOR SERVICE FITTINGS

A. Flush-Type Floor Service Fittings:

1. Description: Type: Modular, flush-type, dual-service units suitable for wiring method used, with cover flush with finished floor.
2. Compartments: Barrier separates power from voice and data communication cabling.
3. Service Plate and Cover: Rectangular, die-cast aluminum with satin finish.
4. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
5. Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for twisted pair cable, complying with requirements in Section 27 15 13 "Communications Copper Horizontal Cabling."

B. Flap-Type Service Fittings:

1. Description: Type: Modular, flap-type, dual-service units suitable for wiring method used, with flaps flush with finished floor.
2. Compartments: Barrier separates power from voice and data communication cabling.
3. Flaps: Rectangular, die-cast aluminum with satin finish.
4. Service Plate: Same finish as flaps.

5. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
6. Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for twisted pair cable, complying with requirements in Section 27 15 13 "Communications Copper Horizontal Cabling."

2.10 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Description: Two-piece surface metal raceway, with factory-wired multioutlet harness.

B. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Metal, with manufacturer's standard finish.

D. Multioutlet Harness:

1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
2. Receptacle Spacing: 18 inches.
3. Wiring: No. 12 AWG solid, Type THHN copper, single circuit.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.03 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with [black] [white] [red]-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

3.04 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. In healthcare facilities, prepare reports that comply with NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices,

or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 26 27 26

SECTION 26 27 43

ELECTRIC-VEHICLE SERVICE EQUIPMENT - AC LEVEL 1 AND LEVEL 2

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes EVSE that provides AC Level 1 and Level 2 EV charging.

1.03 DEFINITIONS

A. EV: Electric vehicle.

B. EV Cable: The off-board cable containing the conductor(s) to connect the EV power controller to the EV that provides both power and communications during energy transfer.

C. EV Charger or EV Charging Equipment: See "EVSE."

D. EV Connector: A conductive device that, when electrically coupled to an EV inlet, establishes an electrical connection to the EV for the purpose of power transfer and information exchange. This device is part of the EV coupler.

E. EV Coupler: A mating EV inlet and connector set.

F. EV Inlet: The device in the vehicle into which the EV connector is inserted, and a conductive connection is made for the transfer of power and communication. This device is part of the EV coupler.

G. EVSE: Electric-Vehicle Supply Equipment. It includes the EV charging equipment and conductors, including the ungrounded, grounded, and equipment grounding conductors and EV cables, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for transferring energy between the premise wiring and the EV.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for EV charging equipment.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For EVSE.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of mounting assemblies for EV charging equipment.
4. Include diagrams for power, signal, and control wiring.
5. Include verification of wireless communications service at each location of EVSE.

C. Product Schedule: For EVSE. Use same designations indicated on Drawings.

D. Qualification Data: For factory-authorized service representative.

E. Seismic Qualification Data: Certificates, for EVSE, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control reports.

G. Sample Warranty: For manufacturer's warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For EVSE to include in operation and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating manuals.
2. Program Software Backup: On USB, CD, Cloud, or approved media, complete with configuration files.
3. Device address and password list.

4. Printout of software application and graphic screens.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.08 FIELD CONDITIONS

A. Wireless Survey: Complete wireless survey to determine if wireless provider signals meet or exceed manufacturer's recommended minimum values.

B. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not exceeding minus 22 to plus 122 deg F (minus 30 to plus 50 deg C).
2. Altitude: Not exceeding 6600 feet (2000 m).

1.09 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of EVSE that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Charge Point CT400 Level 2

B. Source Limitations: Obtain EVSE from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: EVSE shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Component Importance Factor: 1.5.

B. Ambient Temperature: 5 to 104 deg F (Minus 15 to plus 40 deg C).

C. Relative Humidity: Zero to 95 percent.

D. Altitude: Sea level to 1000 feet (300 m).

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

F. Surge Withstand: 6 kV at 3000 A.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

H. EV Charging Levels:

1. Single vehicle, AC Level 1 at up to 1.7 kW per vehicle.
2. Single vehicle, AC Level 2 at up to 19.2 kW per vehicle.
3. Dual vehicles, AC Level 2 at up to 19.2 kW per vehicle.

2.03 EVSE DESCRIPTION

A. Comply with NFPA 70.

B. Comply with:

1. UL 2231-1.
2. UL 2594.
3. SAE J1772 for SAE combo chargers.
4. CHAdeMo for CHAdeMo chargers.

C. Comply with ADA-ABA Accessibility Guidelines.

D. Metering: Nonrevenue grade meter.

E. Control Power: 20 A, 110/120-V ac, 60 Hz, single phase per charger.

F. Input Power:

1. 20 A, 110/120-V ac, 60 Hz, single phase per charger.
2. 40 A, 208/240-V ac, 60 Hz, single-phase services per charger.
3. Dual circuits shall be interlocked.

G. Integral GFCI.

H. Auto-GFCI fault retry.

I. EVSE Mounting: As indicated on Drawings.

J. Enclosures:

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.
b. Stainless steel.
c. Paint.
d. Lockable.
e. Tamper resistant.

K. EV Cable and Connectors:

1. SAE J1772 connector.
2. Single or Double connectors with locking holster as indicated on drawings.
3. 10-foot cable.
4. Field-replaceable connector and cable assembly.

L. Status Indicators:

1. LEDs to indicate power, charging, charging complete, system status, faults, and service.

M. Display Screen:

1. Daylight viewable, UV-protected display with human-machine interface capability.
2. Displays power, charging, charging complete, remote control, system status, faults, and service.

N. Networking:

1. WAN Communications: Cellular CDMA.
2. LAN Communications: 2.4GHz Wi-Fi 802.11b/g/n.
3. Capable of remote configuration and reporting.

O. Charging Network: Compatible with the Chargepoint EV charging network.

1. Multiple units shall independently connect to charging network.
2. Multiple units shall have one unit designated as a master unit that is configured as a gateway unit between the EVSE and the charging network.

2.04 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by utilizing cushioning materials or foam or by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for EVSE electrical conduit to verify actual locations of conduit connections before equipment installation.

C. Examine pavement for suitable conditions where EVSE will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 413.

B. Concrete Base Mounting:

1. Install EVSE on 6-inch (150-mm) nominal-thickness concrete base. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."

    a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
    b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
    c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    d. Install anchor bolts to elevations required for proper attachment to supported equipment.
    e. Secure EVSE to concrete base according to manufacturer's written instructions.

2. Install EVSE on 12-inch (300-mm) nominal-diameter and 48-inch- (1200-mm-) deep concrete base. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."

    a. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Install anchor bolts to elevations required for proper attachment to supported equipment.
    c. Secure EVSE to concrete base according to manufacturer's written instructions.

C. Comply with mounting and anchoring requirements of manufacturer.

D. Wiring Method: Install cables in raceways and cable trays. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

E. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

G. Disconnect: Install disconnect in a readily accessible location.

H. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking from enclosures and components.

I. Secure covers to enclosure.

J. Cybersecurity:

1. Software:

a. Coordinate security requirements with IT department.
b. Ensure that latest stable software release is installed and properly operating.
c. Disable or change default passwords to password of at least eight characters in length, using a combination of uppercase and lower letters, numbers, and symbols. Record passwords and turn over to party responsible for system operation and administration.

2. Hardware:

a. Coordinate location and access requirements with IT department.
b. Enable highest level of wireless encryption that is compatible with Owner's ICT network.
c. Disable dual network connections.

3.03 CONNECTIONS

A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Comply with grounding requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Comply with requirements for installation of conduit in Section 26 05 33 "Raceways and Boxes for Electrical Systems." Drawings indicate general arrangement of conduit, fittings, and specialties.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

E. Verify that all electrical connections have been made according to the manufacturer's instructions. Remove all burrs, shavings, and detritus from inside the enclosure.

F. After confirming all connections, install covers and tighten fasteners to according to manufacturer's instructions.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. For each unit of EVSE, perform the following tests and inspections:

    a. Unit self-test.
    b. Operation test with load bank.
    c. Operation test with EV.
    d. Network communications test.

D. EVSE will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.06 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.07 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain EV charging equipment.

END OF SECTION 26 27 43

SECTION 26 31 00

PHOTOVOLTAIC SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide a solar photovoltaic system as shown on the Drawings and as specified herein.

B. The system shall include but not be limited to:

1. Photovoltaic Crystalline Modules.
2. Solar canopy shade structure with integrated solar modules.
3. DC to AC Power Inverters.
4. Balance of System "BOS":

a. DC & AC Circuit Cable and Conduit.
b. Data Acquisition System/Solar PV System Output Monitoring
c. Weather Monitoring Equipment

1.02 REFERENCES

A. The current editions of the referenced standards are a part of this specification.

B. General

1. ANSI/NFPA 70 - National Electrical Code.
2. ANSI/IEEE C2 - National Electrical Safety Code.

C. Photovoltaic Modules

1. UL 1703 Flat Plate Photovoltaic Modules and Panels
2. California Energy Commission

D. Solar Canopy Shade Structure

1. UL 2703 Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels (Issue 2)
2. 2012 International Building Code (IBC) or approved local equivalent code

E. DC to AC Power Inverters

1. UL 1741 Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
2. California Energy Commission

3. IEEE 1547 Standard for Interconnection of Distributed Energy Resources
4. CPUC Rule 21

1.03 SUBMITTALS

A. Submit shop drawings and manufacturers' product data in accordance with the requirements of Division 01 – Submittals.

B. Manufacturer's certified shop drawings including outlines, schematics and wiring diagrams, certified test data reports, maintenance data, operating instructions and parts list with list of recommended spare parts.

C. For informational purposes only, provide manufacturer’s printed installation instructions including anchoring details to meet requirements as specified and indicated on drawings.

D. Performance Test Reports: Upon completion of installed system, submit in booklet form all field tests performed to prove compliance with specified performance criteria including final settings of devices.

1.04 QUALITY ASSURANCE:

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. Ensure that conduit size and wire quantity, size, and type are suitable for the equipment supplied. Review the proper installation of each type of device with the equipment supplier prior to installation.

C. Provide services of factory-trained Service Technicians, specifically trained on type of equipment specified.

D. Module Mounting System Installation: Inspect foundation, mounting, location of anchor bolts (if required); setting, leveling, alignment and field erection:

E. Solar Photovoltaic Module Testing: Field performance test equipment specified.

F. Solar Canopy Shade Structure: Perform construction survey and underground survey for foundation column and electrical trench location and verification. Inspection of all bolting and welding in the shop and at the site.

G. DC to AC Power Inverter Installation; Field Performance Test of Inverters and Performance Monitoring Equipment.

H. Technical services:

1. Provide to complete the initial start-up, make proper and complete adjustments of all adjustable devices, load switches, etc., and to also verify and approve all connections prior to any test operation of said equipment.
2. Confirmation in writing by the manufacturer's authorized representative of said services shall be submitted to Engineer.
3. Any additional time required of the factory trained service technician to assist in placing the equipment in operation or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
4. Service-inspections during first year of operation, for use at Owner's request, and exclusive of repair, malfunction or other trouble-shooting service calls.

PART 2 - PRODUCTS

2.01 GENERAL:

A. All material shall be new and applicable as listed, labeled, or approved by the Underwriters' Laboratories, Inc. Defective equipment or equipment damaged in the course of installation or test shall be replaced with new equipment.

2.02 MANUFACTURERS, PRE APPROVED:

A. Solar Photovoltaic Modules:

1. Mission Solar
2. Trina Solar
3. Jinko Solar
4. JA Solar
5. Hanwha Q Cells
6. Canadian Solar
7. Longi

B. Solar Canopy for Covered Parking

1. Solar Carports LLC
2. MBL Energy
3. RBI Solar Inc.
4. M Bar C
5. Approved Equal

C. DC to AC Power Inverter.

1. Fronius, USA
2. SMA Americas
3. Solar Edge

2.03 PV CRYSTALLINE MODULES:

A. All photovoltaic modules (modules) shall be tested and listed by UL 1703 or by an approved agency to ensure compliance with applicable safety standards.

B. All photovoltaic modules shall be flat plate design and shall have a minimum nameplate rating of 380 watts.

C. The module manufacturer and model shall be listed in the California Energy Commission's Eligible Solar Electric Equipment, Eligible Photovoltaic Modules list, also known as "CEC listed".

D. Modules shall have a minimum power tolerance of +3/-0 %.

E. Manufacturer shall provide factory flash test results in a spreadsheet format.

F. Manufacturers that classify modules by impedance and are willing to provide bin-matched modules will be given preference.

G. All modules cells shall be 156 mm x 156 mm and modules shall be 72 cell format.

H. The racking shall incorporate integrated NEC/UL required grounding by use of mechanical attachment or clip.

2.04 SOLAR CANOPY FOR COVERED PARKING:

A. The solar canopy for covered parking system shall be a fixed tilt with a minimum 5° to 7° measured horizontally from the ground to the plane of the modules.

B. The leading front edge of the table shall be a minimum of 10 feet clear measured from the ground to the lower edge of the canopy.

C. The solar canopy for covered parking shall incorporate integrated NEC/UL required grounding by use of mechanical attachment or clip.

D. The solar canopy for covered parking structural members shall be steel members in accordance with Section 05 12 00 Structural Steel.

E. Structural members shall be painted per 09 91 13 Exterior Painting – Ferrous Metal, non-immersion exterior painting schedule.

F. The solar canopy structure, support columns, foundations and related panel mounting system shall be designed using local environmental (wind, snow, and seismic) per the governing and/or local building codes. The solar canopy supplier shall provide structural calculations, stamped by a licensed professional structural engineer in good standing with the State of California.

G. All structural components, including array structures, shall be designed in a manner commensurate with attaining a minimum 30 year design life. Particular attention shall be given to the prevention of corrosion at the connections between dissimilar metals.

H. The solar canopy for covered parking system corrosion warranty shall be a minimum of 20 years.

2.05 DC TO AC INVERTERS:

A. The inverter manufacturer and model must be certified to UL 1741-SA, UL 1998, IEEE 1547.1-2008, ANSI/IEEE C62.41, FCC Part 15 A&B, NEC Article 690, UL1699B.

B. Certifications shall be from a recognized Nationally Recognized Testing Laboratory (NRTL). Acceptable NRTLs include UL, CSA, Intertek, MET Laboratories, TUV America, and TUV Rheinland North America.

C. The inverter manufacturer and model must be listed in the California Energy Commission's Eligible Solar Electric Equipment, Eligible Inverters list also known as "CEC listed."

D. The inverter must have a minimum DC to AC ratio of between 1.2 and 1.5.

E. Noise emissions shall not exceed 65dB.

F. Enclosures must be a minimum of NEMA 4X.

G. The inverter model must automatically reset and wake up after self-correcting faults. Reset and wake up to comply with UL1741-SA.

H. Designed for ambient operating temperature range of -40 to 140 Degree F and humidity between 0 and 100% (non-condensing)

I. Protective Devices shall be AFCI & 2014 Compliant and shall include: DC disconnect, DC reverse polarity protection and Ground Fault Protection with Isolation Monitor Interrupter.

J. Interface capability shall include USB (A Socket), RS422 (RJ45 socket), Wi-Fi /Ethernet/Serial/ Datalogger and webserver capable, minimum of 6 input and 4 digital I/Os

K. The inverter manufacturer's most complete monitoring software for the supplied inverters shall be included at no additional cost to the Owner.

2.06 BALANCE OF SYSTEM:

A. DC Circuit Cable

1. All wires shall be a minimum of #12 AWG, multi-strand, RHH/RHW-2 1000V rated, sunlight resistant, or equivalent with XLPE insulation.
2. All quick connectors shall be of the same manufacturer and type as the PV module (i.e. Multi-Contact 4 to Multi-Contact 4, Tyco to Tyco, etc.).
3. Cable shall be listed and comply with UL 44 and UL 854.

B. DC Circuit Conduit

1. All above ground DC Circuit conduit shall be Rigid PVC Conduit, Schedule 80 with screw adapters except as where otherwise noted. Plastic bushing with locking nuts shall be used for all exposed threads. All sweeps and transitions from below ground to above ground shall be Rigid Galvanized Steel (RMC). All sections of conduit shall have an inside chamfer at both ends.
2. All exposed conduit on the shade canopy structure shall be Rigid Galvanized Sch 40 Steel conduit (RMC). The conduit shall be painted to match the steel structure.
3. All below ground DC Circuit conduit shall be Rigid PVC, Schedule 40.
4. Non Metallic Liquid Tight (NMLT) flexible conduit may be used to protect RHH/RHW-2 cable (or equivalent) from abrasion or damage. The conduit shall have an inside chamfer at both ends and may not exceed 3 feet. All NMLT fittings shall be metallic with locking nuts with plastic bushings on exposed threads.
5. Electrical Metallic Tubing (EMT) or compression type fittings shall not be used for any DC circuit.
6. Wire Management

    a. Wire management of the DC string circuits shall either be of racking system integrated wire ways or listed cable trays that shall conform as follows:

        1) Protect the cabling/wire from direct sunlight by means of lids or covers in areas of exposure,
        2) Have a corrosion life of 20 years,
        3) Protect the cabling/wire from sharp edges,
        4) Do not rely solely on cable ties to keep the cabling/wire captivated inside the wire way or tray.
        5) All cable ties shall be stainless steel. No plastic ties shall be used.
        6) All module cable clips shall be stainless steel. No plastic ties or clips shall be used.

C. Weather Monitoring Equipment

1. Irradiation Sensor

    a. Operating temperature: -40°C to +85°C.
    b. Mono crystalline Si-Sensor.
    c. Case rating: NEMA 4x or IP 65.
    d. Accuracy: +/-5% average over the year.
    e. Connector rating: water tight with UV resistant cable.

f. Compatible with Fronius Sensor Box 4,240,104.
g. Mounted in the plane of the of the array (i.e. ground mount at required tilt angle and shade structure at required tilt angle).

2. Ambient Air Sensor

a. Operating temperature: -40°C to +180°C.
b. Accuracy: +/-0.8°C in the range of -40°C to +100°C.
c. Stainless steel cylindrical housing.
d. Weatherproof housing and cable connection.
e. Compatible with Fronius Sensor Box 4,240,104.

3. Cell Temperature Sensor

a. Measuring range: -4°F to +302° F.
b. Accuracy: +/-0.8°C in the range of -20°C to +100°C.
c. Sensor on adhesive film for measurement on sheets.
d. Weatherproof housing and cable connection.

4. Weather station shall be mounted at the shade canopy structure.

2.07 Warranties

A. PV Module

1. Manufacturer workmanship warranty shall be 10 years from the date of receipt unless specifically noted otherwise.
2. Manufacturer performance warranty shall be:

a. No more than 3.0% degradation of rated nameplate output during the first year.
b. No more than 0.5% degradation of rated nameplate output per year for the following 24 years.

3. Mounting Manufacturer warranty shall be 20 years without corrosion and structural failure.
4. The inverter warranty period must be a minimum of 10 years for workmanship and performance.

B. Spare parts

1. Spare parts are for owner’s use after project is complete. They shall not be used by the contractor for replacement parts,

a. PV Module: 5 spare PV modules with same characteristics as the ones installed.
b. Inverter spares as directed by the manufacturer.
c. Additional spare parts as recommended by manufacturers.

2. Package spare equipment in containers bearing labels clearly indicating contents and in what equipment used.
3. Deliver spare parts at same time as equipment. Properly store and safeguard such spare parts until completion of work, at which time deliver to Owner.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install materials in accordance with manufacturer written requirements.

B. Coordinate power outages with OWNER and schedule outage prior to turning off power.

C. The Contractor shall properly protect all materials under this contract from damage during construction. Equipment and materials shall be properly stored, adequately protected, and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored, and protected in accordance with the manufacturer's recommendations.

D. Locate and install equipment requiring maintenance and operation so it is readily accessible.

E. Install equipment in accordance with manufacturer's printed in structions and as indicated and specified. Interconnect equipment as a complete operating system.

F. After installation, field touch-up the shop painting finish on painted surfaces with a similar and compatible coating, including color.

G. Any field cutting and patching of the mounting system shall be "touched up" in accordance with the manufacturer specifications to maintain the design and corrosion lifespan.

H. Have installed equipment field-checked by manufacturer's service engineer, who performs the following services:

1. Check installed equipment for proper assembly and connections, including interwiring to external equipment.
2. Set adjustable devices.
3. Assist Contractor in conducting equipment acceptance tests.

3.02 PERFORMANCE TEST REQUIREMENTS

A. Contractor shall complete test reports as directed by the engineer and the Owner.

1. Provide the test report for each inverter for Owner review

B. Upon completion of the PV system installation and testing described above, a performance ratio (PR) test shall be conducted by the Contractor to document the performance of the system based on the weather conditions at the time of the test.

C. The theoretical PR of the system shall be agreed upon by Owner based on the modules provided by contractor and review of the contractor submitted PV Syst report by Owner prior to the authorization of any work.

D. The Performance Ratio shall be as defined by NREL, Weather-Corrected Performance Ratio.

E. Contractor shall supply 5 days' worth of uninterrupted timestamped hourly data including all weather irradiance and temperature that correlates with the energy output measurement (E grid). The data shall be supplied in an Excel worksheet (example provided) and this data will be used by the Owner to determine the weather corrected actual performance ratio (PR) versus the theoretical performance ratio that was agreed to in advance by the contractor and the Owner. The actual PR shall be within 10% of the theoretical PR.

F. The 5 days' worth of data shall be unaltered. If the data, or a portion of the data, is unusable, the Owner may request additional data for the PR analysis.

G. One data set will be required for the ground mounted array and one data set will be required for the shade canopy structure.

H. If the actual PR falls below 10% of the agreed ratio, the Contractor shall be responsible to analyze the PV system to identify installation related issues that are reducing the PR and correct the issues at no cost to the Owner.

3.03 DAS/PERFORMANCE MONITORING

A. Installation and setup of inverter performance monitoring software shall be provided at no additional cost to the Owner.

B. Integration of irradiation, air temperature and panel surface temperature data into the monitoring program shall be included at no additional cost to the Owner.

3.04 OPERATION AND MAINTENANCE MANUAL

A. Contractor shall, during the time of the contract and before final approval of the installation, submit three bound copies of descriptive literature, maintenance and operation data, and parts lists of each item of electrical equipment requiring maintenance and special operation procedures furnished and installed under this contract. Include a special section on recommended procedures to safely operate and maintain the solar system.

3.05 TRAINING:

A. Contractor will include technology specific training (both maintenance and operation of) for the solar array installed. This training will include all manufacturer suggested material as well as hands-on discussion and examples with the installed array.

3.06 CONTRACT CLOSEOUT AND RECORD DOCUMENT:

A. Provide in accordance with Division 01 sections.

END OF SECTION 26 31 00

SECTION 26 41 13

LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes lightning protection system for ordinary structures.

B. Section includes lightning protection system for the following:

1. Ordinary structures.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
2. Include raceway locations needed for the installation of conductors.
3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
4. Include roof attachment details, coordinated with roof installation.
5. Calculations required by NFPA 780 for bonding of metal bodies.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lightning protection cabling attachments to roofing systems and accessories.
2. Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.
3. Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.

D. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For lightning protection system to include in maintenance manuals.

1. In addition to items specified in Division 01 include the following:

a. Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations. Comply with requirements of Division 01 "Project Record Documents."
b. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.

B. Completion Certificate:

1. UL Master Label Certificate.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: UL-listed installer, category OWAY.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Advanced Lightning Protection

B. Heary Bros. Lighting Protection

C. ERICO

D. Approved Equal

2.02 PERFORMANCE REQUIREMENTS

A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for [Class I] [Class II] buildings.

B. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

2.03 MATERIALS

A. Air Terminals:

1. [Copper] [Stainless steel] [or] [Aluminum] unless otherwise indicated.
2. Pointed tip.
3. Integral base support.

B. Air Terminal Bracing:

1. Aluminum [Copper] [Stainless steel] [Galvanized steel].
2. 1/4-inch diameter rod.

C. Class 1 Main Conductors:

1. Stranded Copper: 57,400 circular mils in diameter.

D. Secondary Conductors:

1. Stranded Copper: 26,240 circular mils in diameter.

E. Ground Loop Conductor: Stranded copper.

F. Ground Rods:

1. Material: Copper-clad steel.
2. Diameter: 5/8 inch.
3. Rods shall be not less than 120 inches long.
4. Sectional type, with integral threads.

G. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install lightning protection components and systems according to NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet of building. Comply with requirements for concealed systems in NFPA 780.

1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
2. Install conduit where necessary to comply with conductor concealment requirements.
3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

3.02 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: bolted connectors.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.03 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Perform inspections as required to obtain a UL Master Label for system.
2. Perform inspections to obtain an LPI certification.

B. Prepare test and inspection reports and certificates.

END OF SECTION 26 41 13

SECTION 26 43 13

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:

1. Type 1 surge protective devices.
2. Type 2 surge protective devices.
3. Enclosures.
4. Conductors and cables.

B. Related Requirements:

1. Section 26 24 13 "Switchboards" for integral SPDs installed by switchboard manufacturer.
2. Section 26 24 16 "Panelboards" for integral SPDs installed by panelboard manufacturer.

1.03 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: air of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. NRTL: Nationally recognized testing laboratory.

F. OCPD: Overcurrent protective device.

G. SCCR: Short-circuit current rating.

H. SPD: Surge protective device.

I. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.

J. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

K. Type 3 SPDs: Point of utilization SPDs.

L. Type 4 SPDs: Component SPDs, including discrete components, as well as assemblies.

M. Type 5 SPDs: Discrete component surge suppressors, such as MOVs that may be mounted on a printed wiring board, connected by its leads or provided within an enclosure with mounting means and wiring terminations.

N. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include electrical characteristics, specialties, and accessories for SPDs.
2. NRTL certification of compliance with UL 1449.

a. Tested values for VPRs.
b. Inominal ratings.
c. MCOV, type designations.
d. OCPD requirements.
e. Manufacturer's model number.
f. System voltage.
g. Modes of protection.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace SPDs that fail in materials or workmanship within 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 TYPE 1 SURGE PROTECTIVE DEVICES (SPDs)

A. Provided by switchboard manufacturer.

B. Source Limitations: Obtain devices from single source from single manufacturer.

C. Standards:

1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.

D. Product Options:

1. Include integral disconnect switch.
2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include indicator light display for protection status.
4. Include audible alarm.
5. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V ac for remote monitoring of protection status.
6. Include surge counter.

E. Performance Criteria:

1. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.
2. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 160kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
3. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits must not exceed the following:

    a. Line to Neutral: 700 V for 208Y/120 V.
    b. Line to Line: 1200 V for 208Y/120 V.

4. SCCR: Not less than 100 kA.
5. Inominal Rating: 20 kA.

2.02 TYPE 2 SURGE PROTECTIVE DEVICES (SPDs)

A. Provided by switchboard manufacturer.

B. Source Limitations: Obtain devices from single source from single manufacturer.

C. Standards:

1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2.
2. Comply with UL 1283.

D. Product Options:

1. Include LED indicator lights for power and protection status.
2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V ac for remote monitoring of protection status.
4. Include surge counter.

E. Performance Criteria:

1. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.
2. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 100 kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
3. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits must not exceed the following:

   a. Line to Neutral: 700 V for 208Y/120 V.
   b. Line to Ground: 700 V for 208Y/120 V.
   c. Neutral to Ground: 700 V for 208Y/120 V.
   d. Line to Line: 1200 V for 208Y/120 V.

2.03 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.04 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's written instructions.

C. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's written instructions. Comply with wiring methods in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
2. Do not exceed manufacturer's recommended lead length.
3. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Compare equipment nameplate data for compliance with Drawings and the Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. SPDs that do not pass tests and inspections will be considered defective.

C. Prepare test and inspection reports.

3.03 STARTUP SERVICE

A. Complete startup checks in accordance with manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 26 43 13

SECTION 26 51 19

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cylinder.
2. Downlight.
3. Linear industrial.
4. Recessed, linear.
5. Strip light.
6. Surface mount, linear.
7. Surface mount, nonlinear.
8. Suspended, linear.
9. Materials.
10. Luminaire support.

B. Related Requirements:

1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

D. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.

1. Include Samples of luminaires and accessories involving color and finish selection.

E. Samples for Verification: For each type of luminaire.

1. Include Samples of luminaires and accessories to verify finish selection.

F. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which equipment and luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

    a. Other luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Ceiling-mounted projectors.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of luminaire.

E. Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

F. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance:

1. Luminaires shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
2. Luminaires and lamps shall be labeled vibration and shock resistant.
3. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified[and the luminaire will be fully operational during and after the seismic event]."

B. Ambient Temperature: 5 to 104 deg F (Minus 15 to plus 40 deg C).

1. Relative Humidity: Zero to 95 percent.

C. Altitude: Sea level to 1000 feet (300 m).

2.02 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. California Title 24 compliant.

2.03 DOWNLIGHT.

A. Nominal Operating Voltage: 120 V ac.

B. Lamp:

1. Minimum 250 lm.
2. Minimum allowable efficacy of 80 lm/W.
3. CRI of 80. CCT of 3000 K.
4. Rated lamp life of 50,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Universal mounting bracket.
3. Integral junction box with conduit fittings.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. Recessed luminaires shall comply with NEMA LE 4.

2.04 RECESSED, LINEAR.

A. Nominal Operating Voltage: 120 V ac.

B. Lamp:

1. Minimum 1,500 lm.
2. Minimum allowable efficacy of 85 lm/W.
3. CRI of 80. CCT of 3000 K.
4. Rated lamp life of 35,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.

6. Internal driver.
7. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear anodized finish.
3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. NEMA LE 4.

2.05 STRIP LIGHT.

A. Nominal Operating Voltage: 120 V ac.

B. Lamp:

1. Minimum 750 lm.
2. Minimum allowable efficacy of 75 lm/W.
3. CRI of minimum 80. CCT of 3000.
4. Rated lamp life of 35,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear anodized finish.
3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping of luminaire without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Tempered Fresnel glass[Clear, UV-stabilized acrylic].
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

F. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.06 SURFACE MOUNT, LINEAR.

A. Nominal Operating Voltage: 120 V ac.

B. Lamp:

1. Minimum 750 lm.
2. Minimum allowable efficacy of 80 lm/W.
3. CRI of 80. CCT of 3000 K.
4. Rated lamp life of 35,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear anodized finish.

3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Tempered Fresnel glass.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

F. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.07 SUSPENDED, LINEAR.

A. Nominal Operating Voltage: 120 V ac.

B. Lamp:

1. Minimum 1,500 lm.
2. Minimum allowable efficacy of 85 lm/W.
3. CRI of minimum 80. CCT of 3000 K.
4. Rated lamp life of 35,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear anodized finish.
3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Tempered Fresnel glass.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

F. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.08 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

2.09 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.10 LUMINAIRE SUPPORT

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.03 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Ceiling Mount:

   a. Two 5/32-inch-diameter aircraft cable supports adjustable to 10 feet (3 m) in length.
   b. Pendant mount with 5/32-inch- (4-mm-) diameter aircraft cable supports [adjustable to] 10 feet (3 m) in length.
   c. Hook mount.

2. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.06 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 51 19

SECTION 26 52 13

EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Emergency lighting.
2. Exit signs.
3. Materials.
4. Luminaire support components.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.

4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

    a. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each product and for each color and texture specified.

D. Samples for Initial Selection: For each type of luminaire with factory-applied finishes.

E. Samples for Verification: For each type of luminaire.

1. Include Samples of luminaires and accessories to verify finish selection.

F. Product Schedule:

1. For exit signs. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which equipment will be attached.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling including the following:

    a. Other luminaires.
    b. Air outlets and inlets.
    c. Speakers.

d. Ceiling-mounted projectors.
e. Sprinklers.
f. Access panels.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of luminaire.

D. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Provide seismic qualification certificate for each piece of equipment.

E. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.

F. Sample Warranty: For manufacturer's warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Luminaire-mounted, emergency battery pack: One for every [20] [50] emergency lighting units. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires and signs in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.02 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.

G. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.

1. Emergency Connection: Operate one LED lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Nightlight Connection: Operate lamp in a remote luminaire continuously.
4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type.
6. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the emergency power unit manufacturer, whichever is less.
7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
9. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
10. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.03 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. Emergency Luminaires: as indicated on Interior Luminaire Schedule and Drawings, with the following additional features:

a. Operating at nominal voltage of 120 V ac.
b. External emergency power unit.
c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.
d. UL 94 5VA flame rating.

2.04 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Operating at nominal voltage of 120 V ac.
2. Lamps for AC Operation:

a. Fluorescent, two for each luminaire; 20,000 hours of rated lamp life.
b. LEDs; 50,000 hours minimum rated lamp life.

3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.
4. Master/Remote Sign Configurations:

a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.05 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Tempered Fresnel glass.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:

1. Extruded aluminum housing and heat sink.
2. Clear anodized finish.

E. Conduit: Electrical metallic tubing or Flexible metallic conduit, minimum 3/4 inch (21 mm) in diameter.

2.06 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, [12 gage (2.68 mm)].

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and [tubing or rod] [wire support] for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.

2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 52 13

SECTION 26 56 19

LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Luminaire-mounted photoelectric relays.
2. Luminaire types.
3. Materials.
4. Finishes.
5. Luminaire support components.

B. Related Requirements:

1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

6. Wiring diagrams for power, control, and signal wiring.
7. Photoelectric relays.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For luminaire supports.

1. Include design calculations for luminaire supports and seismic restraints.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Structural members to which equipment and luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.

6. Existing above-grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of the following:

1. Luminaire.
2. Photoelectric relay.

E. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

F. Source quality-control reports.

G. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.

3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

E. Mockups: For exterior luminaires, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.
b. Faulty operation of luminaires and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance:

1. Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
2. Luminaires and lamps shall be labeled vibration and shock resistant.
3. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.02 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 and listed for wet location.

E. Lamp base complying with ANSI C81.61.

F. Bulb shape complying with ANSI C79.1.

G. CRI of 80. CCT of 3000 K.

H. L70 lamp life of 50,000 hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output.

J. Internal driver.

K. Nominal Operating Voltage: 120 V ac and 208 V ac.

L. In-line Fusing: On the primary for each luminaire.

M. Lamp Rating: Lamp marked for outdoor use.

N. Source Limitations:

1. Obtain luminaires from single source from a single manufacturer.
2. For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.03 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.04 LUMINAIRE TYPES

A. Area and Site:

1. Luminaire Shape: As indicated on the drawings.
2. Mounting: As indicated on the drawings.
3. Luminaire-Mounting Height: As indicated on drawings.
4. Distribution: As indicated on drawings.
5. Diffusers and Globes: Tempered Fresnel glass.
6. Housings:

a. Extruded-aluminum housing and heat sink.
b. Clear anodized finish.

B. Canopy:

1. Shape: As indicated on drawings.
2. Dimensions: As indicated on drawings
3. Diffusers and Globes: Tempered Fresnel glass.

4. Housings:

    a. Extruded-aluminum housing and heat sink.
    b. Clear anodized finish.

2.05 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

    a. "USE ONLY" and include specific lamp type.

b. Lamp diameter, shape, size, wattage and coating.
c. CCT and CRI for all luminaires.

2.06 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

a. Color: As indicated on Luminaire Schedule.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color:

1) As selected from manufacturer's standard catalog of colors.
2) As selected by Architect from manufacturer's full range.

2.07 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

1. Attached to a minimum 1/8 inch backing plate attached to wall structural members Attached using through bolts and backing plates on either side of wall.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires at height and aiming angle as indicated on Drawings.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

K. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.04 INSTALLATION OF BOLLARD LUMINAIRES

A. Align units for optimum directional alignment of light distribution.

1. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 30 00 "Cast-in-Place Concrete."

3.05 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 30 00 "Cast-in-Place Concrete."

3.06 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.07 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.08 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

a. IES LM-5.
b. IES LM-50.
c. IES LM-52.
d. IES LM-64.
e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.09 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.10 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to

suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 56 19

SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Grounding rods.
5. Grounding labeling.

1.03 DEFINITIONS

A. BCT: Bonding conductor for telecommunications.

B. TGB: Telecommunications grounding busbar.

C. TMGB: Telecommunications main grounding busbar.

D. Service Provider: The operator of a service that provides telecommunications transmission delivered over access provider facilities.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.

1.05 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:

1. Ground rods.
2. Ground and roof rings.
3. BCT, TMGB, TGBs, and routing of their bonding conductors.

B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 include the following:

a. Result of the ground-resistance test, measured at the point of BCT connection.
b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.
c. Field quality-control test results.

1.07 QUALITY ASSURANCE

A. Cabling firm must have a BICSI RCDD on staff.

B. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: Currently registered by BICSI as Technician to perform the on-site inspection.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Comply with TIA-607-B.

2.02 CONDUCTORS

A. Comply with UL 486A-486B.

B. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
2. Cable Tray Equipment Grounding Wire: No. 8 AWG.

C. Cable Tray Grounding Jumper:

1. Not smaller than No. 6 AWG and not longer than 12 inches. If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.
2. Not smaller than No. 10 AWG and not longer than 12 inches. If jumper is a wire, it shall have a crimped grounding lug with one hole and standard barrel for one crimp. If jumper is a flexible braid, it shall have a one- or two-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

D. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
4. Bonding Cable: 28 kcmils, 14 strands of No. 17 AWG conductor, and 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.03 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

C. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.

D. Busbar Connectors: Cast silicon bronze, solderless compression-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.

E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.04 GROUNDING BUSBARS

A. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with TIA-607-B.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

B. TGB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with TIA-607-B.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-607-B. Predrilling shall be with holes for use with lugs specified in this Section.

1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical Busbar: 72 or 36 inches long, with stainless-steel or copper-plated hardware for attachment to the rack.

2.05 GROUND RODS

A. Ground Rods: Copper-clad; 3/4 inch by 10 feet in diameter.

2.06 IDENTIFICATION

A. Comply with requirements for identification products in Section 27 05 53 "Identification for Communications Systems."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. The electrical contractor is responsible for all grounding between the TMGB and the TGB. The low voltage contractor will be responsible for all grounding within the Comm Rooms only. That includes cable tray and equipment racks.

B. Bonding shall include the AC utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

C. Comply with NECA 1.

D. Comply with TIA-607-B.

3.03 APPLICATION

A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

B. Underground Grounding Conductors: Install bare tinned copper conductor, No. 2 AWG minimum.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

D. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches.

E. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch intervals.
4. Install grounding and bonding conductors in 3/4-inch PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

    a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 27 05 28 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

3.04 GROUNDING ELECTRODE SYSTEM

A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than No. 1/0 AWG.

3.05 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 12 inches above finished floor unless otherwise indicated.

B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.06 CONNECTIONS

A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pretwist the conductor.
3. Apply an antioxidant compound to all bolted and compression connections.

D. Primary Protector: Bond to the TMGB with insulated bonding conductor.

E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot of conductor length, up to a maximum size of No. 3/0 AWG unless otherwise indicated.

F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install vertically mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.

G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.

H. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.

I. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA-568-C.1 and TIA-568-C.2 when grounding shielded balanced twisted-pair cables.

J. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

K. Access Floors: Bond all metal parts of access floors to the TGB.

L. Equipment Room Signal Reference Grid: Provide a low-impedance path between telecommunications cabinets, equipment racks, and the reference grid, using No. 6 AWG bonding conductors.

1. Install the conductors in grid pattern on 4-foot centers, allowing bonding of one pedestal from each access floor tile.
2. Bond the TGB of the equipment room to the reference grid at two or more locations.
3. Bond all conduits and piping entering the equipment room to the TGB at the perimeter of the room.

3.07 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

B. Comply with IEEE C2 grounding requirements.

C. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches extends above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

D. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, bonding conductor. Train conductors' level or plumb around corners and fasten to manhole walls. Connect grounding conductors to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.08 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.
2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications

equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.

3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.

a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB and in each TGB. Maximum acceptable ac current level is 1 A.

D. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 27 05 26

SECTION 27 05 28

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Metal wireways and auxiliary gutters.
3. Metallic surface pathways.
4. Tele-power poles.
5. Hooks.
6. Boxes, enclosures, and cabinets.
7. Polymer-concrete handholes and boxes for exterior underground cabling.
8. Fiberglass handholes and boxes for exterior underground cabling.

1.03 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid conduit.

C. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

A. Product data for the following:

1. Surface pathways
2. Wireways and fittings.
3. Tele-power poles.
4. Boxes, enclosures, and cabinets.
5. Underground handholes and boxes.

B. Shop Drawings: For custom enclosures and cabinets and custom underground handholes and boxes. Include plans, elevations, sections, and attachment details.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of pathway groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
3. Underground ducts, piping, and structures in location of underground enclosures and handholes.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Data: Provide seismic bracing for all pathway racks, enclosures, cabinets, equipment racks, and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
2. Comply with TIA-569-D.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

    a. Material: Steel.
    b. Type: Set screw.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

G. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.

B. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Comply with TIA-569-D.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Rigid HDPE: Comply with UL 651A.

E. Continuous HDPE: Comply with UL 651A.

F. RTRC: Comply with UL 2515A and NEMA TC 14.

G. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

C. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:

1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Comply with TIA-569-D.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

E. Solvents and Adhesives: As recommended by conduit manufacturer.

2.04 SURFACE METAL PATHWAYS

A. Description: Galvanized steel with snap-on covers, complying with UL 5.

B. Finish: Manufacturer's standard enamel finish in color selected by Architect.

C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with TIA-569-D.

2.05 SURFACE NONMETALLIC PATHWAYS:

A. Description: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC.

B. Finish: Texture and color selected by Architect from manufacturer's standard colors.

C. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

D. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

E. Comply with TIA-569-D.

2.06 TELE-POWER POLES:

A. Description: Prefabricated, finished metal pole with prewired power and communications outlets.

B. Material: Galvanized steel with ivory baked-enamel finish.

C. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

D. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

E. Comply with TIA-569-D.

2.07 HOOKS

A. Description: Prefabricated sheet metal cable supports for telecommunications cable.

B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with TIA-569-D.

D. Galvanized steel.

E. J or U shape.

2.08 BOXES, ENCLOSURES, AND CABINETS

A. Description: Enclosures for communications.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-D.
2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
5. Gangable boxes are allowed.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

I. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.09 POLYMER-CONCRETE HANDHOLES

A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.

B. General Requirements for Polymer Concrete Handholes:

1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
3. Comply with TIA-569-D and SCTE 77.

C. Configuration: Designed for flush burial with open bottom unless otherwise indicated.

D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
2. Cover Legend: Molded lettering, "COMMUNICATIONS".

E. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

F. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.01 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: GRC, IMC, EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT or innerduct.
4. Damp or Wet Locations: GRC.
5. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: Plenum-type, communications-cable pathway, EMT.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use set-screw, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 INSTALLATION

A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101
5. NECA 102.
6. NECA 105.
7. NECA 111.

B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

C. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

D. Comply with requirements in Section 27 05 29 "Hangers and Supports for Communications Systems" for hangers and supports.

E. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

F. Complete pathway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

I. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

J. Support conduit within 12 inches of enclosures to which attached.

K. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from nonmetallic conduit and fittings to GRC or IMC and fittings before rising above floor.

L. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

N. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

P. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.

Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.

R. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

S. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.

T. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inch radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

U. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

V. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surf aces. Install pathway-sealing fittings according to NFPA 70.

W. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

X. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.

2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 feet o.c.
5. Provide a hook at each change in direction.

AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

BB. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 20 00 "Earth Moving" for pipe of less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 31 20 00 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete around conduit for a minimum of 12 inches on each side of the coupling.
b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 27 05 53 "Identification for Communications Systems."

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

E. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.06 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 27 05 28

SECTION 27 05 29

HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Steel slotted support systems for communication raceways.
2. Aluminum slotted support systems for communication raceways.
3. Nonmetallic slotted support systems for communication raceways.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment supports assemblies.

1.03 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Ductwork, piping, fittings, and supports.
3. Structural members to which hangers and supports will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

B. Seismic Qualification Data: Certificates, for hangers and supports for communications equipment and systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Welding certificates.

1.04 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in the State of California to design hanger and support system.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event.
2. Component Importance Factor: 1.5.

C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories: Galvanized steel.
3. Channel Width: Selected for applicable load criteria.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
8. Channel Dimensions: Selected for applicable load criteria.

B. Aluminum Slotted Support Systems: Extruded aluminum channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Channel Material: 6063-T6 aluminum alloy.
3. Fittings and Accessories Material: 5052-H32 aluminum alloy.
4. Channel Width: Selected for applicable load criteria.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
8. Channel Dimensions: Selected for applicable load criteria.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c., in at least one surface.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Channel Width: Selected for applicable load criteria.
3. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.
6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Conduit and Cable Support Devices: Steel clamps, hangers, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored communications conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are like MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.

2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101.
5. NECA 102.
6. NECA 105.
7. NECA 111.

B. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for pathways specified in Section 27 05 28 "Pathways for Communications Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, according to NFPA 70.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten communications items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Use approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Use expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated-driven threaded studs, provided with lock washers and nuts, may be used in existing standard-weight concrete 4

inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor communications materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 27 05 29

SECTION 27 05 53

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Color and legend requirements for labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes.
5. Signs.
6. Cable ties.
7. Fasteners for labels and signs.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for communications identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule:

1. Outlets: Scaled drawings indicating location and proposed designation.
2. Backbone Cabling: Riser diagram showing each communications room, backbone cable, and proposed backbone cable designation.
3. Racks: Scaled drawings indicating location and proposed designation.
4. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and TIA 606-B.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Black letters on a white field.

2.03 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceway or cable they identify, that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: [Preprinted] [Write-on], 3-mil- thick, polyester flexible labels with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Permanent, waterproof black ink marker recommended by tag manufacturer.
3. Marker for Labels: Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches for raceway and conductors
b. 3-1/2 by 5 inches for equipment.
c. As required by authorities having jurisdiction.

2.04 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, and ANSI Z535.4.
2. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL-FIBER CABLE".

C. Tag: Type I :

1. Pigmented polyolefin, bright colored, [continuous-printed on one side with the inscription of the utility,]compounded for direct-burial service.
2. Width: 3 inches.
3. Thickness: 4 mils.
4. Weight: 18.5 lb/1000 sq. ft..
5. Tensile according to ASTM D882: 30 lbf and 2500 psi.

D. Tag: Type II:

1. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, [continuous-printed on one side with the inscription of the utility,]compounded for direct-burial service.
2. Width: 3 inches.
3. Thickness: 12 mils.
4. Weight: 36.1 lb/1000 sq. ft..
5. Tensile according to ASTM D882: 400 lbf and 11,500 psi.

E. Tag: Type ID:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, [continuous-printed on one side with the inscription of the utility,]compounded for direct-burial service.
2. Width: 3 inches.
3. Overall Thickness: 5 mils.
4. Foil Core Thickness: 0.35 mil.

5. Weight: 28 lb/1000 sq. ft..
6. Tensile according to ASTM D882: 70 lbf and 4600 psi.

F. Tag: Type IID:

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, [continuous-printed on one side with the inscription of the utility,]compounded for direct-burial service.
2. Width: 3 inches.
3. Overall Thickness: 8 mils.
4. Foil Core Thickness: 0.35 mil.
5. Weight: 34 lb/1000 sq. ft..
6. Tensile according to ASTM D882: 300 lbf and 12,500 psi.

2.05 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
3. Provide label 6 inches from cable end.

I. Snap-Around Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches from cable end.

J. Self-Adhesive Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches from cable end.

K. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

L. Snap-Around, Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

M. Underground-Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [or concrete envelope]exceeds 16 inches overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

N. Cable Ties: General purpose, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.03 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.

1. System legends shall be as follows:

a. Telecommunications.

D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation[, numbered clockwise when entering room from primary egress], composed of the following, in the order listed:

1. Wiring closet designation.
2. Colon.

3. Faceplate number.

E. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels[containing equipment designation].
2. Patch Panels: [Label individual rows in each rack, starting at top and working down, with self-adhesive labels.] [Label individual rows and outlets, starting at to left and working down, with self-adhesive labels.]
3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:

a. Port number starting at 1, 2., 3… etc.

F. Backbone Cables: Label each cable with a [vinyl-wraparound label] [snap-around label] [self-adhesive wraparound label] indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.

G. Horizontal Cables: Label each cable with a [vinyl-wraparound label] [snap-around label] [self-adhesive wraparound label] indicating the following, in the order listed:

a. Port number starting at 1, 2., 3… etc.

H. Locations of Underground Lines: Underground-line warning tape for copper, coaxial, hybrid copper/fiber, and optical-fiber cable.

END OF SECTION 27 05 53

SECTION 27 11 16

COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. 19-inch equipment racks.
2. 23-inch equipment racks.
3. Power strips.
4. Grounding.
5. Labeling.

1.03 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. LAN: Local area network.

D. RCDD: Registered communications distribution designer.

E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

F. TGB: Telecommunications grounding bus bar.

G. TMGB: Telecommunications main grounding bus bar.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.

2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.

B. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of TGB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
2. Installation Supervision: Installation shall be under direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined according to Telcordia GR-63-CORE requirements for Zone 4 Seismic Earthquake Environments.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.

B. UL listed.

C. RoHS compliant.

D. Compliant with requirements of the Payment Card Industry Data Security Standard.

2.02 19-INCH EQUIPMENT RACKS

A. Description: Two-post and Four-post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting with an opening of 17.72-inches between rails.

B. CPI-46353-703 (Two-Post), CPI-15053-703 (Four-Post) Per DMV Standards

C. General Requirements:

1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Extruded aluminum.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

D. Floor-Mounted Racks:

1. Overall Height: 84 inches.
2. Upright Depth: 3 inches.
3. Two-Post Load Rating: 400lb.
4. Number of Rack Units per Rack: 45.

    a. Numbering: Every rack units, on interior of rack.

5. Threads: 10-32.
6. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
7. Base shall have a minimum of four mounting holes for permanent attachment to floor.
8. Top shall have provisions for attaching to cable tray or ceiling.
9. Self-leveling.

E. Cable Management:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.03 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.

6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
8. Cord connected with 15-foot line cord.
9. Rocker-type on-off switch, illuminated when in on position.
10. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330.

2.04 GROUNDING

A. Comply with requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Rack and Cabinet TGBs: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.

1. Cabinet-Mounted TGB: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
2. Rack-Mounted Horizontal TGB: Designed for mounting in 19 inches equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical TGB: 72 or 36 inches long, with stainless-steel or copper-plated hardware for attachment to rack.

2.05 LABELING

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.

1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.02 GROUNDING

A. Comply with NECA/BICSI 607.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.

C. Locate TGB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind TGB. Connect TGB with a minimum No. 4 AWG grounding electrode conductor from TGB to suitable electrical building ground. Connect rack TGB to near TGB or the TMGB.

1. Bond the shield of shielded cable to patch panel, and bond patch panel to TGB or TMGB.

3.03 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 27 05 53 "Identification for Electrical Systems."

B. Comply with requirements in Section 09 91 23 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.

D. Labels shall be machine printed. Type shall be 1/8 inch in height.

END OF SECTION 27 11 16

SECTION 27 15 13

COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Category 5e twisted pair cable.
2. Twisted pair cable hardware, including plugs and jacks.
3. Multiuser telecommunications outlet assembly.
4. Cable management system.
5. Cabling identification products.
6. Grounding provisions for twisted pair cable.
7. Source quality control requirements for twisted pair cable.

1.03 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. LAN: Local area network.

H. Jack: Also commonly called an "outlet," it is the fixed, female connector.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

M. S/FTP: Overall braid screened cable with foil screened twisted pair.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.04 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft, and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration Drawings and printouts.
4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:

a. Telecommunications rooms plans and elevations.
b. Telecommunications pathways.
c. Telecommunications system access points.
d. Telecommunications grounding system.
e. Telecommunications conductor drop locations.
f. Typical telecommunications details.
g. Mechanical, electrical, and plumbing systems.

C. Twisted pair cable testing plan.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

D. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Connecting Blocks: one of each type.
2. Faceplates: One of each type.
3. Jacks: Ten of each type.
4. Multiuser Telecommunications Outlet Assemblies: One of each type.
5. Patch-Panel Units: One of each type.
6. Plugs: Ten of each type.

1.09 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and cabling administration Drawings, cabling administration Drawings, and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.13 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.02 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated: Type CMP complying with UL 1685.
2. Communications, Plenum Rated: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
3. Communications, Non-plenum: Type CMR complying with UL 1666 and ICEA S-103-701.
4. Communications, Non-plenum: Type CMP or Type CMR in listed plenum or riser communications raceway.
5. Communications, Non-plenum: Type CMP or Type CMR in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.03 CATEGORY 5e TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 5e cable at frequencies up to 100 MHz.

B. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 5e cables.

C. Conductors: 100-ohm, 24 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP) or Shielded twisted pairs (FTP) as required.

E. Cable Rating: Plenum.

F. Jacket: White thermoplastic.

2.04 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 5e.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

C. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer. Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.

D. Connecting Blocks:

1. 110-style IDC for Category 5e.
2. 66-style IDC for Category 5e.
3. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

F. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
3. Number of Jacks per Field: One for each four-pair cable indicated.

G. Patch Cords: Factory-made, four-pair cables as scheduled in Exhibit B; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.

2. Patch cords shall have color-coded boots for circuit identification.

H. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.

I. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

J. Faceplate:

1. One, Tow and Four port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Eight port, vertical double gang faceplates designed to mount to double gang wall boxes.
3. Plastic Faceplate: High-impact plastic. Coordinate color with Section 26 27 26 "Wiring Devices."
4. Metal Faceplate: Stainless steel, complying with requirements in Section 26 27 26 "Wiring Devices."
5. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

    a. Flush mounting jacks, positioning the cord at a 45-degree angle.

K. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.05 CABLE MANAGEMENT SYSTEM

A. Description: Computer-based cable management system, with integrated database graphic capabilities.

B. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.

C. Information shall be presented in database view, schematic plans, or technical drawings.

1. Microsoft Visio Professional drawing software shall be used as drawing and schematic plans software.

D. System shall interface with the following testing and recording devices:

1. Direct upload tests from circuit testing instrument into the personal computer.
2. Direct download circuit labeling into labeling printer.

2.06 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.07 GROUNDING

A. Comply with requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.08 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA-568-C.1.

C. Factory test twisted pair cables according to TIA-568-C.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters. Conceal raceway and cables, except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 27 05 28 "Pathways for Communications Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 INSTALLATION OF PATHWAYS

A. Comply with Section 27 05 28 "Pathways for Communications Systems."

B. Comply with Section 27 05 29 "Hangers and Supports for Communications Systems."

C. Drawings indicate general arrangement of pathways and fittings.

3.03 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. MUTOA shall not be used as a cross-connect point.
7. Consolidation points may be used only for making a direct connection to equipment outlets:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for twisted-pair cables at least 49 feet from communications equipment room.

8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.

11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
12. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
13. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.04 FIRESTOPPING

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.05 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.06 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 27 05 53 "Identification for Communications Systems."

1. Administration Class: Class 2.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

F. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

G. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

H. End-to-end cabling will be considered defective if it does not pass tests and inspections.

I. Prepare test and inspection reports.

3.08 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

END OF SECTION 27 15 13

SECTION 28 20 00

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes a video surveillance system consisting of cameras, network video recorder, data transmission wiring, and a control station with its associated equipment.

1.03 DEFINITIONS

A. AGC: Automatic gain control.

B. BNC: Bayonet Neill-Concelman - type of connector.

C. B/W: Black and white.

D. CCD: Charge-coupled device.

E. FTP: File transfer protocol.

F. IP: Internet protocol.

G. LAN: Local area network.

H. MPEG: Moving Picture Experts Group.

I. NTSC: National Television System Committee.

J. PC: Personal computer.

K. PTZ: Pan-tilt-zoom.

L. RAID: Redundant array of independent disks.

M. TCP: Transmission control protocol - connects hosts on the Internet.

N. UPS: Uninterruptible power supply.

O. WAN: Wide area network.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Fixed CCTV Day/Night Color Camera
2. Network Video Recorder

B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.

1. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
2. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
3. UPS: Sizing calculations.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Design Data: Include an equipment list consisting of every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

1.05 INFORMATIONAL SUBMITTALS

A. Product Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cameras, network video recorders, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SYSTEM REQUIREMENTS

A. All components to be new.

B. Products shall work together seamlessly without special programming requirements and must be an open architecture solution to allow multiple vendor cameras to operate.

C. Completes system must be provided include: Network Video Recorder with built-in video management solution, CCTV cameras, security monitoring workstation with two 24-inch monitors, cabling, UPS unit and equipment rack, at a minimum.

2.02 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NECA 1.

C. Comply with NFPA 70.

2.03 FIXED CAMERAS

A. Full HD Network Camera (or approved equivalent: Axis, Bosch)

B. The network camera shall offer 2M resolution (1,920 x 1,080) minimum.

C. The cameras shall support multi-streaming technologies, transferring real-time high-resolution images. It shall support 60fps at all available resolution when using H.264.

D. The camera shall provide video compression dual codec, H.264 and MJPEG.

E. The camera shall support P-iris and Simple Focus.

F. The camera shall provide Defog and WDR.

G. The camera shall provide Audio, Face and Motion detection.

H. The camera shall provide memory slot for SD, SDHC and SDXC.

I. The camera shall provide Multi-crop streaming.

J. The camera shall be powered via PoE.

1. Use appropriate camera mount and housing at locations shown on drawings.

2.04 SYSTEM DESCRIPTION

A. The intent of this specification is to provide to the owner a networked IP Video System supplied by the Electronic Security Contractor Integrator (ESCI) and shall be a complete and operational system per the performance requirements and objectives of these specifications. Contractor shall be responsible for the coordination of related work with other trades affecting his work or the work of others.

B. The Video Management System (VMS) software will be an integrated solution with the Network Video Recorder (NVR). The ESCI is required to procure and install a new Network Video Recorder (NVR) in the equipment rack in the Telecom Room. The VMS must allow for the use of IP cameras from multiple open network video interface (ONVIF) compliant camera manufacturers.

C. The IP video system shall be an IP network-based, fully distributed digital video system. The video system will utilize a dedicated local area networks (LAN) as a transmission medium for video, configuration, as well as storage of all data.

D. The VMS shall provide full video control, with additional full selection capability at any point within the network from a workstation or a video display workstation (VDW). The security video system shall provide for expansion capability for the addition or modification of video inputs. The system shall be designed such that when future expansions are added to the system the ½ second response requirement will be maintained.

E. The contractor shall furnish and install all security fixed video cameras, cameras, mounts, housings, power supply systems, network cables, network switches, UPS, connectors, equipment cabinet, NVR and all other hardware to provide a fully operational system.

F. The VMS shall permit normal and event monitoring of all secured areas on digital monitors as required or shown in the specifications and drawings. In all cases, the equipment shall be state of the art, standardized commercial off-the-shelf, and modular and shall meet the high-performance standards for the video software.

G. The system shall be installed by a certified integrator. Certification for installation shall be conducted by the manufacturer and shall provide all necessary knowledge to fulfill the systemization and deployment across diverse networks and infrastructures, as well as provide commissioning abilities at the integrator level.

H. The NVR to be procured and installed by the integrator shall meet/exceed the system requirements of the VMS manufacturer. Network storage is to be calculated for storage of 30 days at 15 frames per second in HD format, or as otherwise directed by the Owner. The NVR shall be the UnixCCTV Model NVST-IP5832E-32 to comply with other DMV installations

I. All requisite device and system licenses are to be provided by the integrator, if required.

2.05 LOCAL AREA NETWORK PoE EDGE SWITCHES

A. Use a Layer 3 PoE switches on the edge with the required buffer size such that the system shall operate as specified for the overall video system functionality. All switches must be set up with multicasting.

B. Edge switches

C. Model: Cisco 9300 series (or approved equal)

D. Provide enterprise-class stackable Layer 3 edge switches with 24 or 48 ports in compact 1U form factor.

E. Provide 24 or 48 port POE switches as required with 10/100/1000 ports.

F. Provide single fiber optic uplinks at each switch location. Uplinks to be 10 Gigabit Ethernet.

G. Provide SFPs as required to the nearest fiber optic core switches.

H. Optional hot swappable onboard load sharing redundant power supply capability.

I. Support automatic QOS, VLANS and auto-negotiation on all ports.

J. Layer 3 routing support for static or dynamic routing using EIGRP.

K. High availability stacking with hitless failover and hot insertion/removal of stacked units.

L. Cooling Requirements

1. 1,232 BTU/hr maximum. 2,464 BTU/hr total for one device with 20% overhead (9300 Cisco switch)

2.06 UNINTERRUPTABLE POWER SUPPLY

A. A UPS is required to be installed in the telecom room rack to provide 30 minutes of power backup to the network server and switch(s).

PART 3 - EXECUTION

3.01 SYSTEM OPERATION

A. CCTV IP VIDEO Camera locations:

1. Camera locations on the plans are the desired locations. They are provided as a guide for the contractor.
2. Submit coordinated camera enclosure types, lens types, mounting locations, heights and view angles during the submittal drawing phase.
3. No conduit or cameras are to be installed until all locations and view angles have been verified and signed off on by the owner / architect / engineer.
4. Any adjustments necessary such as relocating camera, replacement of lenses, etc. due to the installation of cameras without written approval of the final installation location shall be made at the cost of this contractor.

B. CCTV IP VIDEO Camera Call-Up:

1. The CCTV IP VIDEO system shall be integrated/linked with the access control system, allowing the generated system alarms to be communicated directly to the CCTV IP VIDEO system. The CCTV IP VIDEO System programming shall handle the alarm information accordingly to call-up the proper camera alarm view.
2. A called-up camera shall be automatically displayed within 1/2 second on the designated SOC monitor.

3.02 INSTALLATION

A. The ESCI shall install the Network Video Recorder in the telecom equipment rack. The Owner shall supply all required software to the ESCI to install and configure on the server. The integrator will provide all operating system and associated software as part of the server procurement and configuration.

B. The ESCI will coordinate with the Owner where the VMS workstation shall reside. The workstation shall be provided by the ESCI to view, replay, actively monitor, and copy video. The workstation shall be located with the access control workstation. The workstation shall consist of a PC, keyboard, mouse, 24-in color monitor, operating system, internet, and VMS portal, at a minimum. The ESCI shall coordinate with the Owner IT department for standard workstation software and configuration information.

C. The ESCI shall procure, install, and configure the network switch(s) in the equipment rack.

D. The ESCI shall procure, install, and configure the UPS in the equipment cabinet.

E. All video signals from cameras in the system shall be home run to the equipment rack terminating location. Video signal cable shall be CAT 6 cable. The contractor shall ensure video signal integrity without packet loss or attenuation and provide clean roll free

switching. The site will not connect externally from the building. The contractor shall ensure the signal integrity without packet loss or attenuation.

F. Video and control data cable shall not be contained in any conduits with high voltage.

G. Final code and local requirements for all security related equipment is the responsibility of the contractor and vendors. This includes but is not limited to National Electric Code, ANSI standards, ADA requirements, state and local codes and others required. Client has no responsibility for these issues or their correction.

H. All CCTV IP VIDEO components require a clean, centralized and independent power circuit fed from the UPS. Supply circuit shall be indicated in the breaker panel.

I. The security vendor will be responsible for final calculations of power and signal runs to insure the wiring supplies a non-degraded signal and power requirements that meets manufactures specifications for the equipment.

J. Bending and pulling tensions shall not be exceeded per the cable manufacturer specifications. Contact manufacturer for specific requirements of the cable to be pulled.

3.03 NETWORK DISTRIBUTION

A. All cable runs, and any IP transmission shall be of CAT 6 cable with matching crimp type connectors, and shall be installed with a control crimp tool, specified by the connectors' manufacturer.

3.04 CABLE TESTING

A. The following tests will be performed to ensure that the cable is installed correctly:

B. Wire Map

C. Length

D. Insertion loss (Attenuation)

E. NEXT loss (Near-End Crosstalk)

F. PSNEXT loss (Power Sum Near-End Crosstalk)

G. ELFEXT loss

H. PSELFEXT loss (Power Sum Equal Level Far-End Crosstalk)

I. Return loss

J. ACR (Attenuation to Crosstalk Ratio)

K. PSACR (Power Sum Version of ACR)

L. Propagation Delay

M. Delay Skew

N. Provide test report to A/E for approval

3.05 SYSTEM INITIALIZING AND PROGRAMMING

A. The system shall be turned on and adjustments made to meet requirements of the specification and on-site conditions.

B. Provide the CCTV system startup and test plan, procedure, blank forms, tester qualifications, and schedule sequence.

3.06 COMMISSIONING

A. Provide a commissioning plan to the Owner 30 days prior to testing and commissioning.

B. Perform commissioning with Owner present.

C. Correct and recommission those parts of the systems that were not operable during the commissioning exercise.

D. Provide all configuration and setup information in documented format and provide to Owner for review.

E. Integrator is to leave the Owner with a fully operational and configured system to meet the client expectations.

END OF SECTION 28 20 00

SECTION 28 31 00

INTRUSION DETECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Intrusion detection with communication links to perform monitoring, alarm, and control functions.
2. Integration of other electronic and electrical systems and equipment.

B. Related Sections:

1. Section 27 15 13 "Communications Copper Horizontal Cabling" for Category 6 (general use, riser-, and plenum-rated) cabling.

1.03 DEFINITIONS

A. CCTV: Closed-circuit television.

B. PIR: Passive infrared.

C. RFI: Radio-frequency interference.

D. UPS: Uninterruptible power supply.

E. Control Unit: System component that monitors inputs and controls outputs through various circuits.

F. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.

G. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.

H. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.

I. Standard Intruder: A person who weighs 100 lb or less and whose height is 60 inches or less; dressed in a long-sleeved shirt, slacks, and shoes.

J. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.

K. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.

L. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.04 ACTION SUBMITTALS

A. Product Data: Components for sensing, detecting, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.

1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify networks and control interface devices and media to be used. Describe characteristics of network and other data communication lines.

    a. Indicate methods used to achieve systems integration.
    b. Indicate control, signal, and data communication paths and identify PLCs, networks, control interface devices, and media to be used.
    c. Describe characteristics of network and other data communication lines.
    d. Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.

2. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection and for systems integration. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
3. UPS: Sizing calculations.
4. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building. Include room layout for master control-unit console, terminal cabinet, racks, and UPS.

5. Master Control-Unit Console Layout: Show required artwork and device identification.
6. Device Address List: Coordinate with final system programming.
7. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
8. Details of surge-protection devices and their installation.
9. Sensor detection patterns and adjustment ranges.

C. Design Data: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:

1. Data for each type of product, including features and operating sequences, both automatic and manual.
2. Master control-unit hardware and software data.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Intrusion Detection Devices: Furnish quantity equal to five percent of the number of units of each type installed, but no fewer than one of each type.
2. Fuses: Three of each kind and size.
3. Tool Kit: Provide six sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.
4. Security Fasteners: Furnish no fewer than 1 box for every 50 boxes or fraction thereof, of each type and size of security fastener installed.

1.08 QUALITY ASSURANCE

A. Installer Qualifications:

1. An employer of workers, at least one of whom is a Certified Alarm Technician, Level 1.
2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
3. Layout Responsibility: Preparation of Shop Drawings and cabling administration Drawings, cabling administration Drawings, and field-testing program development by an RCDD.
4. Installation Supervision: Installation shall be under the direct supervision of Level 2 Commercial Installer, who shall be present at all times when Work of this Section is performed at Project site.
5. Testing Supervisor: Currently certified by BICSI as a Technician to supervise on-site testing.

B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier and Installer who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

1. At least one of whom is a Certified Systems Integrator.

C. Testing Agency Qualifications: Certified by BICSI.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.09 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Altitude: Sea level to 4000 feet.
2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.
3. Interior, Controlled Environment: System components, except master control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Description: Multiplexed, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

B. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.
2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.
3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or control unit.

C. System Control: Master control unit shall directly monitor intrusion detection units and connecting wiring.

D. System Control: Master control unit shall directly monitor intrusion detection devices, perimeter detection units and connecting wiring in a multiplexed distributed control system or as part of a network.

E. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

F. Operator Commands:

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.

5. Protected Zone Test: Initiate operational test of a specific protected zone.
6. System Test: Initiate system-wide operational test.
7. Print reports.

G. Timed Control at Master Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.

H. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When master control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.

I. Response Time: Two seconds between actuation of any alarm and its indication at master control unit.

J. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

K. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

L. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.02 SYSTEM COMPONENT REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.

C. FM Global Compliance: FM-Approved and -labeled intrusion detection devices and equipment.

D. Comply with NFPA 70.

E. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:

1. Door hardware specified in Section 08 71 00 "Door Hardware."
2. Fire alarm system specified in Section 28 46 21.11 "Addressable Fire-Alarm Systems."
3. Video surveillance system specified in Section 28 20 00 "Video Surveillance."

F. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Section 26 43 13 "Surge Protection for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

G. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

H. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

I. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.

J. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or another operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.

K. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.

L. Remote-Controlled Devices: Individually and remotely adjustable for sensitivity and individually monitored at master control unit for calibration, sensitivity, and alarm condition.

2.03 ENCLOSURES

A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.

B. Interior Electronics: NEMA 250, Type 12.

C. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.04 KEYPAD

A. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.

B. Manufacturer: DMP Keypad Model DMP 7060-W

2.05 DOOR CONTACTS

A. Integrated contact switches in steel doors. Refer to Door Hardware Schedule

B. Manufacturer: GE 1078 or approved equivalent.

2.06 INFRARED DETECTOR

A. Listed and labeled by a qualified testing agency for compliance with SIA.

B. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.

1. Wall-Mounted Unit Maximum Detection Range: 125 percent of indicated distance for individual units and not less than 50 feet.
2. Ceiling-Mounted Unit Spot-Detection Pattern: Full 360-degree conical.
3. Ceiling-Mounted Unit Pattern Size: 84-inch diameter at floor level for units mounted 96 inches above floor; 18-foot diameter at floor level for units mounted 25 feet above floor.

C. Device Performance:

1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps across two adjacent segments of detector's field of view.
2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.
3. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm

D. Manufacturer:

1. Optex FX360 or approved equivalent

2.07 WIRELESS PANIC BUTTONS

A. Listed and labeled by a qualified testing agency for compliance with SIA.

B. Manufacturer: DMP Model 1144-D

2.08 WIRELESS PANIC BUTTON RECEIVER

A. Listed and labeled by a qualified testing agency for compliance with SIA.

B. Manufacturer: DMP Model 1100XH High Gain Receiver

2.09 HARDWIRED EXPANDER

A. Listed and labeled by a qualified testing agency for compliance with SIA.

B. Manufacturer: DMP Model 714-16

2.10 MASTER CONTROL UNIT

A. To be wall mounted in the Communications Room.

B. Manufacturer: DMP Model XR150 Control Panel connected to DMV network with analog backup (Use two 12V/7AH batteries)

C. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.

1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
2. Include a real-time clock for time annotation of events on the event recorder and printer.
3. Addressable initiation devices that communicate device identity and status.
4. Control circuits for operation of mechanical equipment in response to an alarm.

D. Construction: Freestanding equipment rack, modular, with separate and independent alarm and supervisory system modules. Alarm-initiating protected zone boards shall be plug-in cards. Arrangements that require removal of field wiring for module replacement are unacceptable.

E. Comply with UL 609.

F. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: LCD, one line(s) of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
5. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:

    a. Acknowledge alarm.
    b. Silence alarm.
    c. System reset.
    d. LED test.

6. Timing Unit: Solid state, programmable, 365 days.
7. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
8. Alarm Indication: Audible signal sounds and an LED lights at master control unit identifying the addressable detector originating the alarm.
9. Alarm Indication protected zone originating the alarm appears on LED display at master control unit.
10. Alarm activation sounds a siren and strobe.

G. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of 25 percent.

H. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a 25 percent increase in load.

I. UPS: UPS shall be sized to provide a minimum of six hours of master control-unit operation.

J. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single

cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch high. Identify, with permanent labels, individual components and modules within cabinets.

K. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.

L. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

D. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

B. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.

C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

3.03 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceways according to Section 27 05 28 "Pathways for Communications Systems." Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring Method: Install wiring in metal raceways according to Section 27 05 28 "Pathways for Communications Systems," except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

C. Wiring Method: Cable, concealed in accessible ceilings, walls, and floors when possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
2. 120-V Power Wiring: Install according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
4. Data and Television Signal Transmission Cables: Install according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

G. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

H. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 27 05 53 "Identification for Communications Systems."

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Section 27 05 53 "Identification for Communications Systems."

B. Install instructions frame in a location visible from master control unit.

3.05 GROUNDING

A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.

B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.

D. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems."

3.06 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

E. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."

1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
2. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."

F. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."

G. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.07 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose. Visits for this purpose shall be in addition to any required by warranty.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the intrusion detection system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."

END OF SECTION 28 31 00

SECTION 28 46 21.11

ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Existing fire-alarm system to be modified.
2. Addressable fire-alarm system.
3. Fire-alarm control unit (FACU).
4. System smoke detectors.
5. Duct smoke detectors.
6. Fire-alarm notification appliances.
7. Exit-marking audible notification appliances.
8. Firefighters' two-way telephone communication service.
9. Emergency responder radio coverage system.
10. Fire-alarm addressable interface devices.
11. Digital alarm communicator transmitters (DACTs).
12. Fire-alarm radio transmitters.

B. Related Requirements

1. Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables"

1.03 DEFINITIONS

A. DACT: Digital alarm communicator transmitter.

B. EMT: Electrical metallic tubing.

C. FACU: Fire-alarm control unit.

D. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.

E. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the 2007 Energy Independence and Security Act (EISA).

F. NICET: National Institute for Certification in Engineering Technologies.

G. PC: Personal computer.

H. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:

1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.04 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. When new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.05 ACTION SUBMITTALS

A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, and details, including details of attachments to other Work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations.

Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.

4. Annunciator panel details as required by authorities having jurisdiction.
5. Detail assembly and support requirements.
6. Include voltage drop calculations for notification-appliance circuits.
7. Include battery-size calculations.
8. Include input/output matrix.
9. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
10. Include performance parameters and installation details for each detector.
11. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
12. Provide program report showing that air-sampling detector pipe layout balances pneumatically within airflow range of air-sampling detector.
13. Provide control wiring diagrams for fire-alarm interface to HVAC; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
    c. Locate detectors in accordance with manufacturer's written instructions.
    d. Show air-sampling detector pipe routing.

14. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
15. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. Delegated Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1. Drawings showing location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of device.
2. Design Calculations: Calculate requirements for selecting spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.06 INFORMATIONAL SUBMITTALS

A. Certificates

1. Seismic Performance Certificates: For FACU, accessories, and components, from manufacturer. Include the following information:

a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
c. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.

B. Field quality-control reports.

C. Qualification Statements: For Installer.

D. Sample Warranty: Submittal must include line item pricing for replacement parts and labor.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
g. Record copy of site-specific software.
h. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.

4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.
j. Abbreviated operating instructions for mounting at FACU and each annunciator unit.

B. Software and Firmware Operational Documentation

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media and approved online or cloud solution.
3. Device address list.
4. Printout of software application and graphic screens.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Fire Detectors: Quantity equal to 2 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to one each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in system. Provide in box or cabinet with compartments marked with fuse types and sizes.

1.09 QUALITY ASSURANCE

A. Installer Qualifications

1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
2. Installation must be by personnel certified by NICET as fire-alarm Level III technician.
3. Obtain certification by NRTL in accordance with NFPA 72.
4. Licensed or certified by authorities having jurisdiction.

1.10 FIELD CONDITIONS

A. Seismic Conditions: Unless otherwise indicated on Contract Documents, specified Work in this Section must withstand the seismic hazard design loads determined in accordance with ASCE/SEI 7 for installed elevation above or below grade.

1. The term "withstand" means "unit must remain in place without separation of parts from unit when subjected to specified seismic design loads and unit must be fully operational after seismic event."

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 ADDRESSABLE FIRE-ALARM SYSTEM

A. Description

1. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn-and-strobe notification for evacuation.

B. Performance Criteria

1. Regulatory Requirements

a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.

2. General Characteristics

a. Automatic sensitivity control of certain smoke detectors.
b. Fire-alarm signal initiation must be by one or more of the following devices:

1) Smoke detectors.
2) Duct smoke detectors.
3) Automatic sprinkler system water flow.
4) Dry system pressure flow switch.

c. Fire-alarm signal must initiate the following actions:

1) Continuously operate alarm notification appliances.

2) Identify alarm and specific initiating device at FACU remote annunciators.
3) Transmit alarm signal to remote alarm receiving station.
4) Activate voice/alarm communication system.
5) Switch HVAC equipment controls to fire-alarm mode.
6) Close smoke dampers in air ducts of designated air-conditioning duct systems.
7) Activate emergency lighting control.
8) Activate emergency shutoffs for gas and fuel supplies
9) Record events in system memory.
10) Record events by system printer.

d. System trouble signal initiation must be by one or more of the following devices and actions:

1) Open circuits, shorts, and grounds in designated circuits.
2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3) Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4) Loss of primary power at FACU.
5) Ground or single break in internal circuits of FACU.
6) Abnormal ac voltage at FACU.
7) Break in standby battery circuitry.
8) Failure of battery charging.
9) Abnormal position of switch at FACU or annunciator.
10) Voice signal amplifier failure.
11) Hose cabinet door open.

e. System Supervisory Signal Actions

1) Initiate notification appliances.
2) Identify specific device initiating event at FACU and remote annunciators.
3) Record event on system printer.
4) After time delay of 200 seconds, transmit trouble or supervisory signal to remote alarm receiving station.
5) Transmit system status to building management system.
6) Display system status on graphic annunciator.

f. Network Communications

1) Provide network communications for fire-alarm system in accordance with fire-alarm manufacturer's written instructions.
2) Provide network communications pathway per manufacturer's written instructions and requirements in NFPA 72 and NFPA 70.
3) Provide integration gateway using BACnet or Modbus for connection to building automation system.

g. System Printer

1) Printer must be listed and labeled as integral part of fire-alarm system.

2.02 FIRE-ALARM CONTROL UNIT (FACU)

A. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.

B. Performance Criteria

1. Regulatory Requirements: Comply with NFPA 72 and UL 864.
2. General Characteristics

a. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.
b. Include real-time clock for time annotation of events on event recorder and printer.
c. Provide communication between FACU and remote circuit interface panels, annunciators, and displays.
d. FACU must be listed for connection to central-station signaling system service.
e. Provide nonvolatile memory for system database, logic, and operating system and event history. System must require no manual input to initialize in the event of complete power down condition. FACU must provide minimum 500-event history log.
f. Addressable Initiation Device Circuits: FACU must indicate which communication zones have been silenced and must provide selective silencing of alarm notification appliance by building communication zone.

1) Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: FACU must be listed for releasing service.

g. Fire-Alarm Annunciator: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.

1) Annunciator and Display: LCD, 80 characters, minimum.
2) Keypad: Arranged to permit entry and execution of programming, display, and control commands.

h. Alphanumeric Display and System Controls: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.

1) Annunciator and Display: LCD, two line(s) of 40 characters, minimum.

2) Keypad: Arranged to permit entry and execution of programming, display, and control commands.

i. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits

1) Pathway Class Designations: NFPA 72, Class B.
2) Pathway Survivability: Level 1.
3) Install no more than 50 addressable devices on each signaling-line circuit.
4) Install fault circuit isolators to comply with circuit performance requirements of NFPA 72 or with manufacturer's written instructions, whichever is more conservative.

j. Serial Interfaces

1) One dedicated RS 485 port for central-station operation using point ID DACT.
2) One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
3) One USB port for PC configuration.
4) One RS 232 port for air-aspirating smoke detector connection.
5) One RS 232 port for voice evacuation interface.

k. Smoke-Alarm Verification

1) Initiate audible and visible indication of "alarm-verification" signal at FACU.
2) Activate approved "alarm-verification" sequence at FACU and detector.
3) Record events by system printer.
4) Sound general alarm if alarm is verified.
5) Cancel FACU indication and system reset if alarm is not verified.

l. Notification-Appliance Circuit

1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.
2) Where notification appliances provide signals to sleeping areas, alarm signal must be 520 Hz square wave with intensity 15 dB above average ambient sound level or 5 dB above maximum sound level, or at least 75 dB(A-weighted), whichever is greater, measured at pillow.
3) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.

m. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of central-control microphone. Amplifiers must comply with UL 1711.

1) Allow application of, and evacuation signal to, indicated number of zones and simultaneously allow voice paging to other zones selectively or in combination.
2) Programmable tone and message sequence selection.
3) Standard digitally recorded messages for "Evacuation" and "All Clear."
4) Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of FACU.

n. Status Annunciator: Indicate status of various voice/alarm speaker zones and status of firefighters' two-way telephone communication zones.
o. Preamplifiers, amplifiers, and tone generators must automatically transfer to backup units, on primary equipment failure.
p. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate printing of list of existing alarm, supervisory, and trouble conditions in system and historical log of events.
q. Primary Power: 24 V(dc) obtained from 120 V(ac) service and power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and digital alarm radio transmitters must be powered by 24 V(dc) source.
r. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.
s. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.
t. Batteries: Sealed lead calcium.

C. Accessories

1. Instructions: Computer printout or typewritten instruction card mounted behind plastic or glass cover in stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe functional operation of system under normal, alarm, and trouble conditions.
2. Preaction System Functionality:

a. Initiate Presignal Alarm: This function must cause audible and visual alarm and indication to be provided at FACU. Activation of initiation device connected as part of preaction system must be annunciated at FACU only, without activation of general evacuation alarm.

2.03 SYSTEM SMOKE DETECTORS

A. Photoelectric Smoke Detectors

1. Performance Criteria:

a. Regulatory Requirements

1) NFPA 72.
2) UL 268.

b. General Characteristics

1) Detectors must be four-wire type.
2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
4) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5) Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
6) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
7) Operator at FACU, having designated access level, must be able to manually access the following for each detector:

a) Primary status.
b) Device type.
c) Present average value.
d) Present sensitivity selected.
e) Sensor range (normal, dirty, etc.).

8) Detector must have functional humidity range within 10 to 90 percent relative humidity.
9) Color: White.
10) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F per minute.
11) Multiple levels of detection sensitivity for each sensor.
12) Sensitivity levels based on time of day.

2.04 DUCT SMOKE DETECTORS

A. Description: Photoelectric-type, duct-mounted smoke detector.

B. Performance Criteria

1. Regulatory Requirements

a. NFPA 72.
b. UL 268A.

2. General Characteristics

a. Detectors must be four-wire type.
b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
d. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
e. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
f. Operator at FACU, having designated access level, must be able to manually access the following for each detector:

1) Primary status.
2) Device type.
3) Present average value.
4) Present sensitivity selected.
5) Sensor range (normal, dirty, etc.).

g. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
h. Each sensor must have multiple levels of detection sensitivity.
i. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
j. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.05 FIRE-ALARM NOTIFICATION APPLIANCES

A. Fire-Alarm Audible Notification Appliances

1. Description: Horns, bells, or other notification devices that cannot output voice messages.
2. Performance Criteria

a. Regulatory Requirements

1) NFPA 72.

b. General Characteristics

1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
2) Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
3) Chimes, Low-Level Output: Vibrating type, 75 dB(A-weighted) minimum rated output.
4) Chimes, High-Level Output: Vibrating type, 81 dB(A-weighted) minimum rated output.
5) Sounders, High Volume 24 V(dc): Less than 6 mA of alarm current.
6) Sounders, Low Volume 24 V(dc): Less than 4 mA of alarm current.
7) Audible notification appliances must have functional humidity range of 10 to 95 percent relative humidity.
8) ISO Temporal 3 Evacuation Tone: 90 plus or minus 4 dB(A-weighted) at 24 V.
9) ISO Temporal 3 Alert Tone: 95 plus or minus 5 dB(A-weighted) at 24 V.
10) AS2220 Evacuation Tone: 93 plus or minus 4 dB(A-weighted) at 24 V.
11) AS2220 Alert Tone: 93 plus or minus 5 dB(A-weighted) at 24 V.
12) Horns: Electric-vibrating-polarized type, 24 V(dc); with provision for housing operating mechanism behind grille. Comply with UL 464. Horns must produce sound-pressure level of 90 dB(A-weighted), measured 10 ft. (3 m) from horn, using coded signal prescribed in UL 464 test protocol.
13) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Fire-Alarm Visible Notification Appliances

1. Performance Criteria

a. Regulatory Requirements

1) NFPA 72.
2) UL 1971.

b. General Characteristics

1) Rated Light Output

a) 75 cd.
b) 15/30/75/110 cd, selectable in field.

2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
3) Mounting: Wall mounted unless otherwise indicated.

4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
5) Flashing must be in temporal pattern, synchronized with other units.
6) Strobe Leads: Factory connected to screw terminals.
7) Mounting Faceplate: Factory finished, red.

2.06 FIRE-ALARM REMOTE ANNUNCIATORS

A. Performance Criteria

1. Regulatory Requirements

a. NFPA 72.

2. General Characteristics

a. Annunciator functions must match those of FACU for alarm, supervisory, and trouble indications. Manual switching functions must match those of FACU, including acknowledging, silencing, resetting, and testing.

1) Mounting: Surface cabinet, NEMA 250, Type 1.

b. Display Type and Functional Performance: Alphanumeric display and LED indicating lights must match those of FACU. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.07 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

A. Performance Criteria

1. Regulatory Requirements

a. NFPA 72.

2. General Characteristics

a. Include address-setting means on module.
b. Store internal identifying code for control panel use to identify module type.
c. Listed for controlling HVAC fan motor controllers.
d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.
e. Control Module:

1) Operate notification devices.
2) Operate solenoids for use in sprinkler service.

2.08 DIGITAL ALARM COMMUNICATOR TRANSMITTERS (DACTs)

A. Performance Criteria

1. Regulatory Requirements

a. NFPA 72.

2. General Characteristics

a. DACT must be acceptable to remote central station and must be listed for fire-alarm use.
b. Functional Performance: Unit must receive alarm, supervisory, or trouble signal from FACU and automatically capture one telephone line(s) and dial preset number for remote central station. When contact is made with central station(s), signals must be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter must initiate local trouble signal and transmit signal indicating loss of telephone line to remote alarm receiving station over remaining line. Transmitter must automatically report telephone service restoration to central station. If service is lost on both telephone lines, transmitter must initiate local trouble signal.
c. Local functions and display at DACT must include the following:

1) Verification that both telephone lines are available.
2) Programming device.
3) LED display.
4) Manual test report function and manual transmission clear indication.
5) Communications failure with central station or FACU.

d. Digital data transmission must include the following:

1) Address of alarm-initiating device.
2) Address of supervisory signal.
3) Address of trouble-initiating device.
4) Loss of ac supply.
5) Loss of power.
6) Low battery.
7) Abnormal test signal.
8) Communication bus failure.

e. Secondary Power: Integral rechargeable battery and automatic charger.
f. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.09 FIRE-ALARM RADIO TRANSMITTERS

A. Performance Criteria

1. Regulatory Requirements

a. NFPA 72.
b. NFPA 1221.
c. 47 CFR 90.

2. General Characteristics

a. Must be factory assembled, wired, and tested; ready for installation and operation.
b. Packaging: Single, modular, NEMA 250, Type 1 metal enclosure with tamper-resistant flush tumbler lock.
c. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of established remote alarm receiving station designated by Owner.
d. Normal Power Input: 120 V(ac).
e. Secondary Power: Integral-sealed, rechargeable, 12 V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.

1) Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports must withstand 100 mph with gust factor of 1.3 without failure.
2) Antenna Cable: Coaxial cable with impedance matched to transmitter output impedance.
3) Antenna-Cable Connectors: Weatherproof.
4) Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to transmitter, matching fire-alarm and other system outputs to message-generating inputs of transmitter that produce required message transmissions.

f. Functional Performance: Unit must receive alarm, supervisory, or trouble signal from FACU or from its own internal sensors or controls and must automatically transmit signal along with unique code that identifies transmitting station to remote alarm receiving station. Transmitted messages must correspond to standard designations for fire-reporting system to which signal is being transmitted and must include separately designated messages in response to the following events or conditions:

1) Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2) System Test Message: Initiated manually by test switch within transmitter cabinet, or automatically at optionally preselected time, once every 24 hours, with transmission time controlled by programmed timing device integral to transmitter controls.

3) Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of transmitter normal power source, derangement of wiring of transmitter, or alarm input interface circuit or device connected to it.
4) Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause trouble signal to be indicated on building system.
5) Local Fire-Alarm-System Alarm Message: Actuated when building system goes into alarm state. Identifies device that initiated alarm.
6) Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when building alarm system indicates supervisory alarm.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF EQUIPMENT

A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before other trades have completed cleanup must be replaced.
2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.

B. Equipment Floor Mounting: Install FACU on concrete base with seismic bracing. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch centers around full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Equipment Floor and Wall Mounting: Install FACU on finished floor with seismic-restraint devices.

D. Install wall-mounted equipment, with tops of cabinets not more than 78 inch above finished floor with seismic-restraint devices.

E. Smoke- and Heat-Detector Spacing

1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing must not exceed 30 ft.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex A in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inch from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inch from lighting fixture and not directly above pendant mounted or indirect lighting.

F. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch long must be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

H. Air-Sampling Smoke Detectors: If using multiple pipe runs, runs must be pneumatically balanced.

I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within dwelling or suite, they must be connected so that operation of smoke alarm causes alarm in smoke alarms to sound.

J. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

K. Audible Alarm-Indicating Devices: Install not less than 6 inch below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.

L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch below ceiling. Install devices at same height unless otherwise indicated.

M. Device Location-Indicating Lights: Locate in public space near device they monitor.

N. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists wind load of 100 mph with gust factor of 1.3 without damage.

3.03 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate must be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
2. Nameplate must be laminated acrylic or melamine plastic signs with black background and engraved white letters at least 1/2 inch high.

3.04 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with Section 26 05 23 "Control-Voltage Electrical Power Cables."

C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

3.05 PATHWAYS

A. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inch above floor must be installed in EMT.

B. Pathways must be installed in EMT.

C. Exposed EMT must be painted red enamel.

3.06 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08 71 00 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
2. Smoke dampers in air ducts of designated HVAC duct systems.
3. Magnetically held-open doors.
4. Electronically locked doors and access gates.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Data communication circuits for connection to building management system.
10. Data communication circuits for connection to mass notification system.
11. Supervisory connections at fire-extinguisher locations.
12. Supervisory connections at fire-pump power failure including dead-phase or phase-reversal condition.
13. Supervisory connections at fire-pump engine control panel.

3.07 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 27 05 53 "Identification for Communications Systems."

B. Install framed instructions in location visible from FACU.

3.08 GROUNDING

A. Ground FACU and associated circuits in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Ground shielded cables at control panel location only. Insulate shield at device location.

3.09 FIELD QUALITY CONTROL

A. Field tests must be witnessed by authorities having jurisdiction.

B. Administrant for Tests and Inspections

1. Owner will engage qualified testing agency to administer and perform tests and inspections.
2. Engage qualified testing agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections with assistance of factory-authorized service representative.

C. Tests and Inspections

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.

2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.
4. Test audible appliances for private operating mode in accordance with manufacturer's written instructions.
5. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.
6. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

3.11 MAINTENANCE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections in accordance with "Visual Inspection Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in "Test Methods" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per "Testing Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.12 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement must include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software must include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

END OF SECTION 28 46 21.11

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Clearing and grubbing.
2. Stripping and stockpiling topsoil.
3. Temporary erosion and sedimentation control.

1.03 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.05 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Call Before You Dig for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.03 CLEARING AND GRUBBING

A. Remove obstructions and other vegetation to permit installation of new construction.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.04 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

3.05 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Base course for concrete walks and pavements.
6. Base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Division 01 "Photographic Documentation" for recording preexcavation and earth-moving progress.
2. Section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 32 90 00 "Landscaping" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.03 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subgrade and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D1586.

I. Structures: Buildings, footings, foundations, slabs, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below base, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.
b. Coordination of Work with utility locator service.
c. Extent of trenching by hand or with air spade.
d. Field quality control.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Controlled low-strength material, including design mixture.
2. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Warning Tape: 12 inches (300 mm) long; of each color.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D1557.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.07 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Division 01 "Temporary Facilities and Controls" and Section 31 10 00 "Site Clearing" are in place.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SC, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Plasticity Index: Less than 20
2. Expansion Index: Less than 50

C. Unsatisfactory Soils: Soil Classification Groups GC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.

H. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.

I. Sand: ASTM C33/C33M; fine aggregate.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C150/C150M, Type II.
2. Fly Ash: ASTM C618, Class C or F.
3. Normal-Weight Aggregate: ASTM C33/C33M, 3/8-inch (10-mm) nominal maximum aggregate size.
4. Water: ASTM C94/C94M.
5. Air-Entraining Admixture: ASTM C260/C260M.

B. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C495/C495M.

2.03 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Engineer. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

3.08 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.09 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 6-inch thick, concrete-base slab support for piping or conduit less than 24 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 6 inches of concrete before backfilling or placing roadway base course. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of material specified on drawings, free of particles larger than ¾-inch in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

H. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D1557.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D1557.
2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

3.18 BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:

1. Place base course material under hot-mix asphalt pavement.
2. Shape base course to required crown elevations and cross-slope grades.
3. Place base course 6 inches (150 mm) or less in compacted thickness in a single layer.
4. Place base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
5. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

C. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 90 percent of maximum dry unit weight according to ASTM D1557.

3.20 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.

B. Related Requirements:

1. Section 31 20 00 "Earth Moving" for subgrade preparation, fill material, aggregate base courses, and aggregate pavement shoulders.
2. Section 32 13 13 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
3. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.04 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Joint sealant.

B. Hot-Mix Asphalt Designs:

1. Certification, by authorities having jurisdiction, of approval of each hot-mix asphalt design proposed for the Work.
2. For each hot-mix asphalt design proposed for the Work.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For paving-mix manufacturer and testing agency.

B. Material Certificates: Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.

1. Aggregates.
2. Asphalt binder.
3. Asphalt cement.
4. Cutback prime coat.
5. Emulsified asphalt prime coat.
6. Tack coat.
7. Fog seal.
8. Undersealing asphalt.

C. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of California or local DOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D3910.

4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.02 ASPHALT MATERIALS

A. Asphalt Binder: ASTM D6373 or AASHTO M 320 binder designation PG 64-22.

B. Asphalt Cement: ASTM D3381/D3381M for viscosity-graded material ASTM D946/D946M for penetration-graded material.

C. Cutback Prime Coat: ASTM D2027/D2027M, medium-curing cutback asphalt, MC-250.

D. Emulsified Asphalt Prime Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

F. Fog Seal: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

G. Water: Potable.

H. Undersealing Asphalt: ASTM D3141/D3141M; pumping consistency.

2.03 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: ASTM D1073 or AASHTO M 29, Grade No. 2 or No. 3.

D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

E. Joint Sealant: ASTM D6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.

2.04 MIXES

1. Surface Course Limit: Recycled content no more than 10 percent by weight.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes designed in accordance with procedures in AI MS-2, "Asphalt Mix Design Methods"; and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

C. Emulsified-Asphalt Slurry: ASTM D3910, Type 2.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.03 SURFACE PREPARATION

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Herbicide Treatment: Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.04 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.05 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.06 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.07 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.08 SURFACE TREATMENTS

A. Slurry Seals: Apply slurry coat in a uniform thickness in accordance with ASTM D3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.

    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 WASTE HANDLING

A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION 32 12 16

SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes Concrete Paving. Including the Following:

1. Curbs and gutters.
2. Walks.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete"
2. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
3. Section 32 17 13 "Parking Bumpers."
4. Section 32 17 23 "Pavement Markings."
5. Section 32 17 26 "Tactile Warning Surfacing" for detectable warning mats

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete paving Subcontractor.
    e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.07 QUALITY ASSURANCE

A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches. Include full-size detectable warning.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.09 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.02 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.03 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from galvanized-steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

C. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.

D. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A767/A767M, Class I coating. Cut bars true to length with ends square and free of burrs.

E. Tie Bars: ASTM A615/A615M, Grade 60; deformed.

F. Hook Bolts: ASTM A307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

H. Zinc Repair Material: ASTM A780/A780M.

2.04 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, gray portland cement Type I.
2. Fly Ash: ASTM C618, Class C.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, portland blast-furnace slag, Type IP, portland-pozzolan, Type IL, Portland-limestone, Type IT, ternary blended, cement.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. H&C Semi-Transparent Decorative Stains
2. Color: Dahila Red or approved equal.

F. Water: Potable and complying with ASTM C94/C94M.

2.05 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 2, Class B, dissipating.

2.06 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

F. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.07 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 4-1/2 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use high-range, water-reducing admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

H. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 3500 psi.
2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.

2.08 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared base surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct base with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 31 20 00 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose material from compacted base surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feetunless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when

cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from base surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten base to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do

not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.

c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.09 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.11 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 73

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Joint-sealant backer materials.
4. Primers.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of joint sealant and accessory.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.07 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.02 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D5893/D5893M, Type NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D5893/D5893M, Type SL.

C. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.

D. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.

E. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade P, Class 25, for Use T.

2.03 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type I, II, or III.

2.04 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

2.05 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written

instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.04 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If,

despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 32 13 73

SECTION 32 17 13

PARKING BUMPERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Precast concrete wheel stops.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Precast concrete wheel stops.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For wheel stops, 6 inches long, showing color and cross section; with mounting hardware.

PART 2 - PRODUCTS

2.01 PARKING BUMPERS

A. Precast Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete; 4000-psiminimum compressive strength; manufacturer's standard height and width by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of three factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.

1. Source Limitations: Obtain wheel stops from single source from single manufacturer.
2. Surface Appearance: Smooth, free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
3. Surface Sealer: Manufacturer's standard salt-resistant, clear sealer, applied at precasting location.

4. Mounting Hardware: hardware as standard with wheel-stop manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation in accordance with manufacturer's written instructions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install wheel stops in accordance with manufacturer's written instructions unless otherwise indicated.

B. Install wheel stops in bed of adhesive before anchoring to substrate.

C. Securely anchor wheel stops to substrate with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION 32 17 13

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.
2. Painted markings applied to concrete surfaces.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking asphalt paving or concrete surfaces including, but not limited to, the following:

    a. Asphalt-paving or concrete-surface aging period before application of pavement markings.
    b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.04 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Pavement-marking paint, alkyd.
2. Pavement-marking paint, solvent-borne.
3. Pavement-marking paint, acrylic.
4. Pavement-marking paint, latex.
5. Glass beads.

B. Shop Drawings:

1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.

2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of California Code local DOT for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials, 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.03 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Alkyd: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type S; colors complying with FS TT-P-1952F.

1. Color: White, Yellow, Blue.

B. Pavement-Marking Paint, Solvent-Borne: MPI #32, solvent-borne traffic-marking paint.

1. Color: White, Yellow, Blue.

C. Pavement-Marking Paint, Acrylic: Acrylic, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952F, Type II, with drying time of less than 45 minutes.

1. Color: White, Yellow, Blue.

D. Glass Beads: AASHTO M 247, Type 1 or FS TT-B-1325D, Type 1

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.02 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal..

3.03 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 17 23

SECTION 32 17 26

TACTILE WARNING SURFACING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cast-in-place detectable warning tiles

B. Related Requirements:

1. Section 32 13 13 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.07 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds.

B. Weather Limitations for Adhesive Application:

1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering and wear.
b. Separation or delamination of materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing, joint material, setting material, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.02 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles with replaceable surface configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

1. Material: Cast-fiber-reinforced polymer concrete tile.
2. Color: Safety yellow.
3. Shapes and Sizes:

    a. Rectangular panel, 24 by 36 inches.

4. Dome Spacing and Configuration: Manufacturer's standard compliant spacing manufacturer's standard pattern.
5. Mounting:

    a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.
    b. Detectable warning tile set into formed recess in concrete and adhered with mortar.
    c. Replaceable detectable warning tile wet-set into freshly poured concrete and surface-fastened to permanently embedded anchors.

2.03 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 304 stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.

C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.03 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 32 17 26

SECTION 32 31 19

SECURITY STEEL FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Steel security fences.
2. Pedestrian gates.
3. Horizontal-slide gates.
4. Gate operators, including controls.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for concrete bases for gate operators, drives, and controls and post concrete fill.
2. Division 26 Sections for electrical service and connections for system disconnect switches and powered devices including, but not limited to, motor operators, controls, and limit switches.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and mounting attachment details, and grounding details.
2. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
3. Wiring Diagrams: Include diagrams for power, signal, and control wiring.

C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches in length for linear materials.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Wind Loading:

1. Fence Height: 7 feet.
2. Wind Exposure Category: C.
3. Design Wind Speed: 94 mph.

B. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

C. STEEL SECURITY FENCES

D. Steel Security Fences:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Ameristar Fence Products; an ASSA ABLOY company.

E. Posts:

1. Line, End, and Corner Posts: 2-1/2-by-2-1/2-inch square tubes formed from 14 gauge, metallic-coated steel sheet or 14 gauge nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
2. Posts at Horizontal-Slide Gate Openings: Square steel tubing 6 by 6 inches with 0.1875-inch wall thickness, hot-dip galvanized.

F. Post Caps: Steel.

G. Rails: 1-3/4-by-1-3/4-inch square tubes.

1. Metal and Thickness: 0.079-inch nominal-thickness, metallic-coated steel sheet or 0.075-inch nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.

H. Pickets: 3/4-by-3/4-inch

1. Metal and Thickness: 14 gauge nominal-thickness, metallic-coated steel sheet or 14 gauge nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
2. Extend pickets beyond top rail as indicated and terminate with flat edge.
3. Picket Spacing: 4 inches o.c., maximum.

I. Fasteners: Stainless-steel carriage bolts with tamperproof nuts.

J. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc, alloy-coated steel sheet.

K. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior.

L. Galvanizing: For components indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

M. Finish: Organic coating complying with requirements in ASTM F2408.

2.02 PERFORATED PANELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. McNICHOLS, Item 1411332241
2. Or approved equal

B. Product Type: Perforated Metal

C. Hole Type: Round

D. Primary Material: Galvanized Steel

E. Alloy, Grade or Type: G90

F. Material Finish: Mill finish

G. Thickness: 22 gauge

H. Hole Pattern: 1/16” round holes on 3/32” staggered centers

I. Hole Arrangement: 60 degrees staggered centers

J. Percent Open Area: 40%

K. HORIZONTAL-SLIDE GATES

L. Gate Configuration: Single leaf.

1. Type: Cantilever slide, with suspension rollers for enclosed track.

M. Gate Frame Height: 84 inches.

N. Gate Opening Width: As indicated.

O. Automated vehicular gates shall comply with ASTM F2200, Class II.

P. Galvanized-Steel Frames and Bracing: Fabricate members from square tubing.

1. Frame Members: Square tubes 1-inch by 1-inch formed from 0.125-inch nominal-thickness, metallic-coated steel sheet or formed from 0.125-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
2. Bracing Members: Square tubes 2 by 2 inches formed from 0.25-inch nominal-thickness, metallic-coated steel sheet or formed from 0.25-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.

Q. Frame Corner Construction:

1. Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider.

R. Additional Rails: Provide as indicated, complying with requirements for fence rails.

S. Infill: Comply with requirements for adjacent fence.

T. Hardware: Latches permitting operation from both sides of gate, locking devices hangers, roller assemblies and stops fabricated from galvanized steel.

U. Finish exposed welds to comply with NOMMA Guideline 1, Finish #4 - good-quality, uniform undressed weld with minimal splatter.

V. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

W. Metallic-Coated-Steel Finish: Galvanized finish.

X. Steel Finish: Shop painted.

2.03 GATE OPERATORS

A. Gate Operators:

1. All-O-Matic SL 100 or approved equal.

B. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.

1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
2. Provide operator with UL approval.
3. Provide electronic components with built-in troubleshooting diagnostic feature.
4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

C. Comply with NFPA 70.

D. UL Standard: Manufacturer and label gate operators to comply with UL 325.

E. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.

F. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:

1. Voltage: 120 V.
2. Horsepower: Not less than 1/2.
3. Enclosure: Manufacturer's standard.
4. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
5. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
6. Phase: One.

G. Gate Operators: Concrete base mounted and as follows:

1. Mechanical Slide Gate Operators:

a. Duty: Heavy duty, commercial/industrial.
b. Gate Speed: Minimum 60 feet per minute.
c. Maximum Gate Weight: 1000 lb.
d. Frequency of Use: Continuous duty.
e. Drive Type: Enclosed worm gear and chain-and-sprocket reducers, roller-chain drive.

H. Control Station: Keyed, three-position switch with open, stop, and close function; located remotely from gate. Provide two keys per station.

1. Control Station: Momentary-contact, three-button-operated with open, stop, and close function; located remotely from gate. Key switch to lock out open and close buttons.
2. Card Reader: Functions only when authorized card is presented. Programmable, multiple-code system, permitting four different access periods; face-lighted unit fully visible at night.

    a. Reader Type: Proximity.
    b. Features: Limited-time usage.

3. Digital Keypad Entry Unit: Programmable, multiple-code capability of not less than 2500 possible individual codes, consisting of 1- to 7-digit codes.

    a. Features: Limited-time usage.
    b. Face-lighted unit with keypad fully visible at night.

4. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide two programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than 10,000 codes per channel configured for the following functions:

    a. Transmitters: Three-button operated, with open and close function.
    b. Channel Settings: Four independent channel settings controlling separate receivers for operating more than one gate from each transmitter.

I. Vehicle Loop Detector: System includes automatic closing timer with adjustable time delay, timer cutoff switch, and loop detector designed to open and close gate, and hold gate open until traffic clears. System includes electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. System includes number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement, as recommended in writing by detection system manufacturer for function indicated, at location indicated on Drawings.

J. Vehicle Presence Detector: System includes automatic closing timer with adjustable time delay, timer cutoff switch, and presence detector designed to open and close gate and hold gate open until traffic clears. System includes retroreflective detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.

K. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:

1. Action: Reverse gate in both opening and closing cycles, and hold until clear of obstruction.
2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.

3. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using gate edge transmitter and operator receiver system.

    a. Across entire gate leaf bottom edge.
    b. Along entire length of gate posts.

4. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

L. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.

M. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.

1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

N. Operating Features:

1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
3. Automatic Closing Timer: With adjustable time delay before closing and timer cutoff switch.
4. Open Override Circuit: Designed to override closing commands.
5. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
6. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
7. Clock Timer: Seven-day programmable for regular events.

O. Accessories:

1. Warning Module: Visual,-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving; compliant with the United States Access Board's ADA-ABA Accessibility Guidelines.
2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.

    a. Fail-Safe: Gate opens and remains open until power is restored.
    b. Fail-Secure: Gate cycles on battery power, then fail-safe when battery is discharged.

3. External electric-powered solenoid lock with delay timer allowing time for lock to release before gate operates.
4. Fire box.
5. Fire strobe sensor.
6. Instructional, Safety, and Warning Labels and Signs: According to UL 325.
7. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

2.04 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A36/A36M.

B. Tubing: ASTM A500/A500M, cold-formed steel tubing.

C. Uncoated Steel Sheet: Hot-rolled steel sheet, ASTM A1011/A1011M, Structural Steel, Grade 45 or cold-rolled steel sheet, ASTM A1008/A1008M, Structural Steel, Grade 50.

D. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 50, with G90 coating.

E. Castings: Either gray or malleable iron unless otherwise indicated.

1. Gray Iron: ASTM A48/A48M, Class 30.
2. Malleable Iron: ASTM A47/A47M.

2.05 COATING MATERIALS

A. Shop Primer for Steel: Manufacturer's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Epoxy Primer for Galvanized Steel: Epoxy primer recommended in writing by topcoat manufacturer.

C. Polyurethane Intermediate Coat and Topcoat: Complying with MPI #72 and compatible with undercoat.

2.06 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 03 30 00 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

2.07 GROUNDING MATERIALS

A. Comply with requirements of Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1-5/8 inch wide and 1/16 inch thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Grounding Connectors and Grounding Rods: Comply with UL 467.

1. Grounding Rods: Copper-clad steel.

a. Size: 5/8 by 96 inches.

2.08 STEEL FINISHES

A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

B. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.

C. High-Performance Coating: Apply intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

2.09 METALLIC-COATED-STEEL FINISHES

A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Engineer.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 300 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 SECURITY FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 36 inches plus 3 inches.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete.
2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
    b. Concealed Concrete: Top 3 inches below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.

    a. Extend posts at least 5 inches into sleeve.

b. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.

5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch larger than outside diagonal dimension of post.

   a. Extend posts at least 5 inches into concrete.
   b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.

6. Space posts uniformly at 8 feet o.c.

3.04 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.05 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.

C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions.

D. Vehicle Loop Detector System: bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.06 GROUNDING AND BONDING

A. Comply with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

D. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. FIELD QUALITY CONTROL

G. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Engineer promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.07 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, and limit switches.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operators, and other moving parts.

2.17 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 32 31 19

SECTION 32 80 00

IRRIGATION

PART 1 - GENERAL

Construction Documents and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, tools, equipment, and transportation required to perform and complete the installation of an automatic sprinkler irrigation system, including all piping, sprinkler heads, controls, connections, testing, etc. aas shown on the Drawings and as specified herein. The water source for this project is potable water.

B. Utilize and accept as standards manufacturer's recommendations and/or installation details for any information not specifically detailed on the Drawings.

1.02 RELATED SECTIONS

A. SUBMITTAL PROCEDURES: Section 01 33 00.

B. EXECUTION AND CLOSEOUT REQUIREMENTS: Section 01 70 00.

C. SUSTAINABLE DESIGN REQUIREMENT: Section 01 81 13.

D. CONCRETE FORMING: Section 03 11 00.

E. CAST-IN-PLACE CONCRETE: Section 03 30 00.

F. ELECTRICAL: Division 26.

G. FINISH GRADING: Section 31 10 00.

H. EARTH MOVING: Section 31 20 00.

I. LANDSCAPING: Section 32 90 00.

1.03 GUARANTEE

A. Guarantee all workmanship and materials hereunder against defective workmanship and materials, including damage by leaks and settlement of irrigation trenches, for the duration specified in Division 01 of these Specifications. (The Contractor is not responsible for vandalism or theft after date of final acceptance.)

1.04 QUALITY CONTROL

A. Qualifications of Contractor: Work must be completed by a licensed Landscape Contractor. Provide proof of five years of continuous experience in landscaping and irrigation of projects of similar size (+\- 20% of the construction cost) and scope. Contractor to have a minimum of two projects either completed or in construction in the last five years.

B. Work Force: Ensure that an experienced foreman is present at all times during installation. Keep the same foreman and workers on the job from commencement to completion.

C. Reviews: Specifically request reviews of all items listed below in “Inspection Requirements” prior to progressing to the next level of work.

D. Certification: Ensure that the contractor installing the irrigation controller is trained and certified in the installation of the irrigation controller. The training and certification must have been completed within two years prior to the installation date.

E. Standards:

1. Provide work and material in full accordance with the rules and regulations of the National Electric Code; the Uniform Plumbing Code; and other applicable state or local laws or regulations.

2. Furnish, without extra charge, additional material and labor required to comply with these rules and regulations, though the work may not be specifically indicated in the Specifications or Drawings.

1.05 Where the Specification requirements exceed those of the above-mentioned codes and regulations, comply with the requirements in the Specifications.

A. Delivery, Storage, and Handling:

1. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect related work and material.

2. Handle plastic pipe carefully, especially protecting it from prolonged exposure to sunlight. Store pipe on beds that are the full length of the pipe, and keep pipe flat and off the ground with blocks.

B. Comply with the requirements of Section 01 70 00 – EXECUTION AND CLOSEOUT REQUIREMENTS.

1.06 INSPECTION REQUIREMENTS

A. Request and hold a pre-construction meeting prior to beginning the work of this Section. Parties required to be in attendance are the Landscape Contractor, Project Inspector,

Owner's Representative, and the Landscape Architect.

B. Prior to commencement of the work of this Section, obtain written verification from the project Civil Engineer that the rough grade in landscape areas is in conformance with Section 31 20 00 - EARTH MOVING.

C. Obtain verification from Project Inspector for the following at the appropriate times during construction and prior to further progression of work in this Section:

1. Pressure testing of all mainlines and lateral lines (See "Hydrostatic Tests – Open Trench" in Part 3.18 of this Section),

2. Trench depth,

3. Sleeves under pavement,

4. Flushing of all mainlines and lateral lines,

5. Installation of mainline thrust blocks,

6. Backfill and pipe bedding,

7. Layout of heads,

8. Installation of subsurface inline drip tubing (with Landscape Architect),

9. Operation of system and coverage adjustments (with Landscape Architect) after system is fully automated and operational, backfill of trenching is completed, and surface has been restored to original grades.

D. In case of failure to obtain any verification by the Project Inspector as required above, remove and replace work as necessary to obtain the verification at no additional cost to the Owner.

1.07 SUBMITTALS AND SUBSTITUTIONS

A. Comply with requirements of Section 01 33 00 – SUBMITTAL PROCEDURES.

B. Product names are used as standards; provide proof as to equality of any proposed material and do not use other materials or methods unless approved in writing by the Owner's Representative. Submit no more than one request for substitution for each item. The decision of the Owner's Representative is final.

C. Use equipment capacities specified herein as the minimum acceptable standards.

D. List materials in the order in which they appear in Specifications; include substitutions. Submit the list for approval by the Owner's Representative.

E. Make any mechanical, electrical, or other changes required for installation of any

approved, substituted equipment to satisfaction of Owner's Representative and without additional cost to Owner. Approval by Owner's Representative of substituted equipment and/or dimensional drawing does not waive these requirements.

F. Do not construe approval of material as authorization for any deviations from Specifications unless attention of Owner's Representative has been directed to specified deviations.

1.08 PROJECT CONDITIONS, AND PROTECTION

A. Information on Drawings relative to existing conditions is approximate. During progress of construction, make deviations necessary to conform to actual conditions, as approved by Owner's Representative, without additional cost to Owner. Accept responsibility for any damage caused to existing services. Promptly notify Owner's Representative if services are found which are not shown on Drawings.

B. Protect existing trees-to-remain as specified in "Existing Tree Protection" in Part 3.02 of this Section.

C. Protect existing utilities within construction area. Repair damages to utility lines that occur as a result of operations of this work.

D. Verify dimensions at building site and check existing conditions before beginning work. Make changes necessary to install work in harmony with other crafts after receiving approval by Owner's Representative.

1.09 MAINTENANCE AND OPERATING INSTRUCTIONS

A. Furnish three complete sets of operating maintenance instructions bound in a hardback binder and indexed. Start compiling data upon approval of list of materials. Do not request final inspection until booklets are approved by Owner's Representative.

B. Incorporate the following information in these sets:

1. Complete operating instructions for each item of irrigation equipment.

2. Typewritten maintenance instructions for each item of irrigation equipment.

3. Manufacturer's bulletins which explain installation, service, replacement parts, and maintenance.

4. Service telephone numbers and/or addresses posted in an appropriate place as designated by Owner's Representative.

1.10 RECORD DRAWINGS

Upon completion of work, and as a precedent to final payment, deliver to Owner's Representative one complete set of reproducible originals of Drawings showing work

exactly as installed. (See “Record Drawings” in Part 3.21 of this Section)

PART 2 **- PRODUCTS**

2.01 GENERAL

Use materials as specified; any deviation from the Specifications must first be approved by the Owner’s Representative in writing. All material containers or certificates shall be clearly marked by manufacturer as to contents for inspection.

2.02 MATERIALS

A. Automatic Controller: As indicated on Drawings.

B. Master Valves and Flow Sensors: As indicated on Drawings.

C. Automatic Control Valves: As indicated on Drawings.

D. Gate Valve: As indicated on Drawings.

E. Pipe and Fittings:

1. PVC pipe: As indicated on Drawings.

2. PVC fittings three-inch (3”) size and smaller: High impact, standard weight, Schedule 40, molded PVC as manufactured by George Fischer, Lasco, Spears, or approved equal.

3. PVC fittings four-inch (4”) size and larger: High impact, standard weight, Class 200 gasketed, molded PVC as manufactured by George Fischer, Lasco, Spears, or approved equal.

4. All plastic pipe and fittings: Continuously and permanently marked with manufacturer's name, type of material, IPS size, schedule, NSF approval, and code number.

5. Threaded PVC pipe and nipples: IPS Schedule 80 when necessary to use threaded connections to gauges, valves, or control valves. Threaded adapters may be used in place of nipples when making pipe to valve connections.

6. Use 45-degree fittings for changes in depth of pipe, and at transition from main line to automatic control valves.

7. Piping above ground: Schedule 40 galvanized steel with cast-iron fittings.

8. Piping used for electrical purposes to be Schedule 40 PVC Rigid Nonmetallic Conduit electrical conduit.

F. PVC Primer: Weld-On P-70 Purple Primer or approved equal.

G. PVC Glue: Weld-On 711 Gray heavy bodied PVC Cement or approved equal.

H. Quick Coupler Valves: As indicated on Drawings.

I. Sleeves: As indicated on Drawings.

J. All Valve Boxes and Covers: Manufactured, green with “Irrigation – Non-Potable” permanently embossed on cover. Carson, Rainbird or approved equal.

K. Sub-surface Inline Drip Tubing:

1. Tubing: As indicated on Drawings. Make all tubing connections with manufacturer-approved fittings. See Drawings for emitter flow rates and spacing.

2. Soil Staple: Hold tubing in place with soil staples spaced evenly every three to five feet (3’ - 5’) on center, and with two staples at each change of direction.

3. Line Flushing Valve: As indicated on Drawings.

4. Pressure Regulator: As indicated on Drawings.

5. Disc Filter/Screen Filter: As indicated on Drawings.

L. Shrub Bubbler: As indicated on Drawings.

M. Shrub Bubbler Tubing: As indicated on Drawings

N. Tree Bubbler: As indicated on Drawings.

O. Reduced Pressure Backflow Preventer: As indicated on Drawings.

P. Automatic Sprinkler Control Wire:

1. Connections between remote control valves and controller: UF-14 direct burial plastic coated wire. Common wire to be white, and lead wire to be colored. If multiple controllers are used, a different color is to be used for each controller's lead wire. (Use red for the first controller). Spare wires are to be yellow.

2. UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.

3. Provide adequate working space around electrical equipment in compliance with local codes and ordinances.

4. Electrical, other than low voltage, such as power wiring, conduit, fuses, thermal overloads and disconnect switches, is included under Division 26 of these Specifications.

Q. Trace Wire:

1. Direct burial #12 AWG Solid, steel core soft drawn tracer wire, 250# average tensile break load, 30 mil high molecular-high density polyethylene jacket complying with ASTM-D-1248, 30-volt rating. Color shall be green.

2. Connectors: UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.

R. Master Valve and Flow Sensor Wire:

1. Master valve wires are to be UF-14 direct burial plastic-coated wire. Wire color to be blue for the lead and white for the common. If there are two master valves, the second master valve wire is to be blue/white striped for the lead and white for the common.

2. Flow sensor wires are to be UF 14. If there are two flow sensors, the wires leading to each flow sensor is be a different color.

S. Unions And Flanges:

1. Steel unions and flanges two inches (2”) and smaller: 150 lb. screwed black (brass to iron seat) or galvanized malleable iron (ground joint).

2. Steel unions and flanges two and one-half inches (2 ½”) and larger: 150 lb. black flange union, flat-faced, full gasket.

3. Gaskets: One-sixteenth inch (1/16”) thick rubber Garlock No. 122, Johns-Manville or approved equal.

4. Flange Bolts: Open-hearth bolt steel, square heads with cold pressed hexagonal nuts, cadmium plated in ground. Provide copper-plated steel bolts and nuts or brass bolts and nuts for brass flanges.

T. Pipe Supports: Adjustable saddle support type support.

U. Valve Identification Tags: Christy’s irrigation ID tags, standard yellow color or approved equal.

V. Sand for Trench Backfill: Natural sand, free of roots, bark, sticks, rags, or other extraneous material.

PART 3 **- EXECUTION**

3.01 SITE CONDITIONS

Locations of existing utilities and other improvements shown on the Drawings are approximate. Verify existing conditions and, should any utilities be encountered that are

not indicated on the plans, notify the Owner's Representative immediately. Accept responsibility for any damages caused to existing services.

3.02 PREPARATION

A. Scheduling: Notify the Project Inspector prior to commencing and/or continuing the work of this Section. Remove and replace, at no cost to Owner, any work required as a result of failure to give the appropriate notification.

B. Examination: Examine conditions of work in place before beginning work; report defects.

C. Measurements: Take field measurements; report variance between plan and field dimensions.

D. Protection: Maintain warning signs, shoring and barricades as required. Prevent injury to, or defacement of, existing improvements. At no additional cost to Owner, repair or replace items damaged by installation operations.

E. Existing Tree Protection:

1. Avoid unnecessary root disturbance, compaction of soils within drip line, or limb breakage.

2. Do not store material or dispose of any material other than clean water within the drip line.

3. Provide adequate irrigation during construction.

4. Replace any tree damaged during construction with a tree of equal size and value at no additional cost to Owner.

5. Adjust trench locations in field to minimize damage to existing elements and plant roots of trees-to-remain at no additional cost to Owner.

F. Surface Preparation: Prior to beginning sprinkler irrigation work, complete placement of topsoil as specified in Section 31 20 00 – EARTH MOVING. Notify Project Inspector of irregularities if any.

3.03 AUTOMATIC CONTROLLER

A. Install system and components as per Drawings and manufacturer's recommendations. All wiring connections shall be neatly accomplished within the controller cabinet. Connect Ethernet and grounding system as per manufacturer's recommendations.

B. Connect automatic control valves to controller(s) in sequence as shown on Drawings.

C. Install all exposed wires to a minimum of twenty-four inches (24") beyond controller within a UL approved rigid conduit.

3.04 MASTER VALVES AND FLOW SENSOR

A. Master Valve: Install as per manufacturer's recommendation. Connect master valve wiring to the automatic controller. Install wire in a conduit. Wire is not to have any splices between the valve and the controller.

B. Connect Master Valve to decoder cable using a single-station line decoder.

C. Flow Sensor: Install as per manufacturer's recommendation. When using a "saddle" installation, install at the correct depth in the pipe and orientate the paddle properly for accurate reading of flow. Connect flow sensor wire to the automatic controller. Install wire in a conduit. The wire is not to have any splices between the valve and the controller.

D. Connect Flow Sensor to decoder cable using a sensor decoder.

3.05 REDUCED-PRESSURE BACKFLOW-PREVENTION DEVICE

A. Install where shown, per code, and per manufacturer's specification and written instructions.

B. Provide pipe supports and accessories as necessary to properly secure the assembly.

3.06 PIPE SUPPORTS

A. Layout:

B. Quantity:

C. Mounting:

3.07 GRADING

Install all irrigation features to their finished grade and at depths indicated. Complete and /or accommodate all rough grading and/or finish grading before commencing with trenching. See Section 31 00 00 – FINISH GRADING for more information.

3.08 LAYOUT

A. Lay out work as accurately as possible to Drawings. Drawings are generally diagrammatic to extent that swing joint offsets and fittings are not shown. Record all changes on the Record Drawings.

B. Do not willfully install the irrigation system as shown on Drawings when it is obvious, in the field, that obstructions or other discrepancies exist which may not have been considered in the design. Notify Owner's Representative of discrepancies before proceeding.

3.09 EXCAVATING AND TRENCHING

A. General: Perform excavations as required for installation of work included under this Section, including shoring of earth banks to prevent cave-ins. Restore surfaces, existing underground installations, etc., damaged or cut as result of this work to their original condition and in a manner approved by the Landscape Architect.

B. Width:

1. Make trenches wide enough to allow a minimum of six inches (6”) between parallel pipelines and three inches (3”) between side of pipe and side of trench. Do not allow stacking of pipe within trench.

2. Allow a minimum clearance of twelve inches (12”) in any direction from parallel pipes of other trades.

C. Preparation of Excavations: Remove rubbish and rocks from trenches. Bed pipe on a minimum of three inches (3”) of clean, rock-free soil to provide a firm, uniform bearing for entire length of pipeline. Cover pipe with a minimum of three inches (3”) of clean, rock-free soil. If clean, rock-free soil is not available, use sand for pipe bedding and three inches (3”) of backfill above the pipe. The remainder of the trench backfill material can be native soil. Do not allow wedging or blocking of pipe.

D. Minimum depth of cover: Unless shown otherwise, provide the following minimums:

1. Mainline: twenty-four inches (24”) cover.

2. Lateral line: twelve inches (12”) cover for spray heads, and eighteen inches (18”) cover for rotor heads.

3. Sub-surface inline drip tubing: five inches (4”) cover.

E. Conflicts with other trades:

1. Hand-excavate trenches where potential conflict with other underground utilities exist.

2. Where other utilities interfere with irrigation trenching and piping work, adjust the trench depth as instructed by Owner’s Representative.

3.10 THRUST BLOCKS

A. To resist system pressure on ring-tite pipe and fittings, provide thrust blocks at any change of direction, change of size, dead end, and/or valves at which thrust develops when closed. See thrust block details for examples.

B. Use cast-in-place concrete and size thrust blocks based on an average soil-safe bearing load of 700 lbs. per square foot.

C. Form thrust blocks in such a manner that concrete comes in contact only with the fittings. Place thrust block between adequately compacted soil and the fitting.

D. Thrust blocks are to be constructed of concrete with a minimum of 2500psi.

E. Thrust blocks are to be free, separate, and independent of adjacent or nearby thrust blocks.

3.11 BACKFILL AND COMPACTING

A. General: Do not begin until hydrostatic tests are completed. When system is operating and after required tests and inspections have been made, backfill trenches under paving areas to the compaction rate specified in Section 31 20 00 – EARTH MOVING.

B. Place backfill in six-inch (6”) layers and compact with an acceptable mechanical compactor.

1. Compact backfill material in landscape areas to eighty-five percent (85%) maximum dry density of the soil.

2. If settlement occurs along trenches, make adjustments in pipes, valves, and sprinkler heads, soil, sod or paving as necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, without additional cost to the Owner.

C. Excess Soil: Remove all rocks, debris, and excess soil that results from sprinkler irrigation trenching operations, landscape planting, and soil preparation operations off site at no additional cost to the Owner. If soil meets topsoil requirements in Section 31 20 00 – EARTH MOVING, it may be used for finish grading.

D. Finishing: Dress-off areas to eliminate construction scars.

3.12 CONTROL WIRES

A. General: Install control wires beneath sprinkler main line whenever possible; tape wires to mainline pipe. Provide one spare wire for each controller.

B. Slack Wire: Provide eighteen inches (18”) of slack wire for each wire connected to automatic control valve. Slack wire shall be coiled and left in the valve box. Tape wires in bundles every ten feet (10’); do not tape wires in sleeves.

C. Expansion and Contraction: Snake wire in trench to allow for contraction of wire.

D. Wire Passing Under Existing or Future Paving or Construction: Encase in PVC Schedule 40 or galvanized steel conduit extending at least twelve inches (12”) beyond edges of paving or construction.

E. Wire Connections: Install wire connections in a waterproof sealing pack.

F. Wire Splicing: Permit splicing only on runs exceeding 500 feet. Locate all splices within valve boxes.

G. Wire Termination: Install wire in a valve box with eighteen inches (18”) of slack wire coiled and individually capped with approved waterproof sealing pack.

3.13 TRACE WIRE

A. General: Install control wires above sprinkler main line whenever possible; tape wire to mainline pipe at 10’ intervals to ensure the wire remains adjacent to the pipe.

B. Wire Connections: Install wire connections in a waterproof sealing pack.

C. Trace wire access points shall be accessible at all automatic control valves.

D. At all mainline end caps, a minimum of six feet (6’) of tracer wire shall be coiled and secured to the cap for future connections. The end of the tracer wire shall be spliced to the wire of a six-pound zinc anode and is to be buried at the same elevation as the irrigation mainline.

E. Testing: The contractor shall perform a continuity test on all trace wires in the presence of the State. If the trace wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of the wire.

3.14 FLUSHING LINES

Thoroughly flush lines prior to installing valves, performing hydrostatic testing, or installing sprinklers. Divert water to prevent washouts.

3.15 AUTOMATIC CONTROL AND QUICK COUPLER VALVES

A. Install where shown and where practical; place no closer than twelve inches (12”) to walk edges, building walls, or fences. Refer to detail for example.

B. Thoroughly flush mainline before installing valve.

C. Install valves in ground cover areas where possible.

3.16 PIPING

A. General: Install in conformance with reference standards, manufacturer’s written directions, as shown on Drawings and as herein specified.

B. Workmanship:

1. General: Install sprinkler irrigation equipment in planted areas throughout the site.

2. Coordination: Organize location of sleeves with other trades as required.

C. Pipe Line Assembly:

1. General:

a. Cutting: Cut pipe square; remove rough edges or burrs.

b. Solvent-welded Connections: Use materials and methods recommended by the pipe manufacturer.

c. Brushes: Use non-synthetic brushes to apply solvents and primer.

d. Cleaning: Clean pipe and fittings of dirt, moisture, and debris prior to applying solvent or primer.

e. Assembly: Allow pipe to be assembled and welded on the surface or in the trench.

f. Expansion and Contraction: Snake pipe from side to side of trench to allow for expansion and contraction.

g. Location: Locate pipes as shown on Drawings except where existing supply valves, utilities or obstructions prohibit or where slight changes are approved to better suit field conditions.

2. Flexible Elastometric Seal Joints:

a. General: Assemble in strict conformance with the pipe manufacturer's instruction.

b. Rubber Rings: Use rubber rings specific for water service systems.

c. Cleaning: Thoroughly clean ring and groove of dirt, moisture and debris using a clean, dry cloth. Do not use solvents, lubricants, cleaning fluids or other material for cleaning.

d. Seating: Properly seat ring in groove.

e. Spigot:

1.) General: Clean spigot-end of pipe as in "Cleaning" above prior to applying lubricant recommended by pipe manufacturer.

2.) Seating: Insert spigot into bell and seat to full depth required.

3. Connections:

a. Threaded Plastic Pipe Connection:

1.) Use Teflon tape or pipe joint compound.

2.) When assembling to threaded pipe, take up joint no more than one full turn beyond hand-tight.

b. Metal Valves and Plastic Pipe: Use threaded plastic male adapters.

c. Metal to Metal Connections:

1.) Use specific joint compound or gasket material for type of joint made. Where pipe of dissimilar metals are connected, use dielectric fittings.

2.) Where assembling, do not allow more than three full threads to show when joint is made up.

d. Where assembling soft metal (brass or copper) or plastic pipe, use strap-type friction wrench only; do not use a metal-jawed wrench.

e. Threading:

1.) Do not permit the use of field-threading of plastic pipe or fittings. Use only factory-formed threads.

2.) Use factory-made nipples wherever possible. Permit the use of field-cut threads in metallic pipe only where absolutely necessary. When field-threading, cut threads accurately on axis with sharp dies.

3.) Use pipe joint compound for all threaded joints. Apply compound to male thread only.

4. Sleeves and conduits:

a. Use sleeves of adequate size to accommodate retrieval for repair of wiring or piping and extend a minimum of twelve inches (12”) beyond edges of walls or paving.

b. Provide removable, non-decaying plug at end of sleeve to prevent entrance of soil.

5. Unions: Locate unions for easy removal of equipment or valve.

6. Joint Restraints: Install per manufacturer’s recommendations.

7. Capping: Plug or seal opening as lines are installed to prevent entrance materials that would obstruct pipe. Leave in place until removal is necessary for completion of installation.

D. Sub-surface Inline Drip Tubing:

1. Install as per Drawings and as per manufacturer’s recommendations. Prior to installation of tubing, obtain approval of finish grade in all planters where tubing is

to be installed. (See inspection requirements.)

2. After tubing is installed, operate system for coverage test. Obtain approval of the Project Inspector and/or Landscape Architect prior to backfill.

E. Drip Irrigation Tubing: Install as per Drawings.

3.17 SPRINKLER HEADS

A. Sprinkler heads: Locate as shown on the Drawings except where existing conditions prohibit, or slight changes are approved to achieve as good or better coverage under the same conditions. Do not allow sprinkler head spacing to exceed the maximum shown on the Drawings. Plumb heads.

B. Handling, Assembly of Pipe, Fittings, and Accessories: Allow only skilled tradesmen to handle and assemble pipe, fittings and equipment. Keep interior of pipes, fittings and accessories clean at all times. Close ends of pipe immediately after installation; leave closure in place until removal is necessary for completion of installation. Do not permit bending of pipe.

C. Flushing: Remove end heads and operate system at full pressure until all rust, scale, and sand is removed. Divert water to prevent ponding or damage to finished work.

D. Coverage: Accept responsibility for full and complete coverage of irrigated areas to satisfaction of Landscape Architect and make necessary adjustments to better suit field conditions at no additional costs to Owner.

3.18 CONCRETE WORK

Underground anchors and pads for valves boxes are included under this Section of Specifications. Concrete shall have a minimum strength of 2500 psi. The slump test shall be a four inch (4”) maximum slump. At twenty-eight days, the concrete shall have a minimum strength of 2500 psi. Use materials and mix in accordance with ASTM C 94. Refer to Section 03 30 00 – CAST-IN-PLACE CONCRETE.

3.19 FIELD QUALITY CONTROL

A. Visual Inspection: Verify that all pipe is homogenous throughout and free from visual cracks, holes, or foreign materials. Inspect each length of pipe. All materials are subject to impact test at the discretion of the Landscape Architect.

B. Hydrostatic Tests – Open Trench:

1. Center-load piping with a small amount of backfill to prevent arching or slipping under pressure.

2. Request the presence of the Project Inspector in writing at least forty-eight hours in advance of testing.

3. At no additional cost to Owner, test in the presence of the Project Inspector.

4. Apply continuous static water pressure of 100 psi when welded plastic joints have cured at least twenty-four hours, and with the risers capped, as follows: test main lines and submains for four hours; test lateral lines for two hours.

5. Repair leaks resulting from tests; and repeat tests.

6. Test to determine that all sprinkler heads function according to manufacturer's data and give full coverage according to intent of Drawings. Replace any sprinklers not functioning as specified with ones that do, or otherwise correct system to provide satisfactory performance.

C. Continuity Testing: Test locating device and control wires for continuity prior to and after back-filling operations.

3.20 CLEAN-UP

Remove debris resulting from work of this Section.

3.21 ADJUSTMENTS AND MAINTENANCE

A. Adjusting System: Prior to acceptance, satisfactorily adjust and regulate entire system. Set watering schedule on controller appropriate to types of plants and season of year. Adjust remote control valves to operate sprinkler heads at optimum performance based on pressure and simultaneous demands through supply lines.

B. System Layout: Provide reduced prints of Record Document irrigation plans, laminated in four (4) mil. plastic, of size to fit controller door. Enlarge remote-control valve designations as necessary for legibility. Color-code areas covered by each station. Affix plans to inside of controller door.

C. Instructions: Upon completion of work, instruct maintenance personnel on operation and maintenance procedures for entire system.

D. Flow Charts: Record and prepare an accurate flow-rate chart for each automatic control valve.

3.22 RECORD DRAWINGS

A. Regularly update plans of the system and any changes made to the system throughout the project. Record all changes on this plan before trenches are back-filled.

B. Record the as-built information on reproducible plans provided by the Architect. Complete and submit the Record Drawings to the Architect before applying for payment for work installed.

C. As-built drawings are to be completed electronically with a pdf editing software or

computer aided drafting software. As-built drawing done by hand will not be accepted for final submittal.

D. Show the following on the Record Drawings accurately to scale and dimensioned from two permanent points of reference:

1. Distance of mainline from nearby hardscape.

2. Location of automatic control valves, quick couplers, and gate valves.

3. Location and size of all sleeves.

4. Location of automatic control wires and spares.

3.23 OPERATION MANUALS

Deliver two complete sets of manufacturer's warranties, Contractor guarantees, instruction sheets, parts lists and operation manuals to the Architect before requesting final acceptance of the project. Do not request final inspection until the sets are approved.

END OF SECTION

SECTION 32 90 00

LANDSCAPING

PART 1 - GENERAL

Construction Documents and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to this section.

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, tools, equipment, and transportation required to perform and complete the following work as specified herein:

1. Soil Preparation and Fertilization
2. Planting
3. Hydroseeding and/or Sodding
4. Weed Control
5. Decomposed Granite
6. Mulch
7. Clean-up
8. Landscape Maintenance Period
9. Guarantee

B. Work not included in this Section: Landscape elements such as concrete walks, fencing, outdoor lighting, rough grading, and clearing are not a part of this Section unless shown on the landscape Drawings.

1.02 RELATED SECTIONS

A. SUBMITTAL REQUIREMENTS: Section 01 33 00.

B. EXECUTION AND CLOSEOUT REQUIREMENTS: Section 01 70 00.

C. SUSTAINABLE DESIGN REQUIREMENT: Section 01 81 13

D. FINISH GRADING: Section 31 10 00.

E. EARTH MOVING: Section 31 20 00.

F. IRRIGATION: Section 32 80 00.

1.03 GUARANTEE

A. The guarantee period for lawn and plant material shall be the duration of the landscape maintenance period, from commencement until final acceptance of the work of this Section. See Division 01 for other applicable guarantee requirements.

B. During the guarantee period, repair and/or replace plants and lawn not in satisfactory growing condition, as determined by Owner's Representative, without additional cost to Owner. Plants are to be replaced as per "Landscape Maintenance" in Part 3.12 of this Section, using plants of the same kind and size specified in plant list.

1.04 QUALITY CONTROL

A. Qualifications: Work must be completed by a licensed Landscape Contractor. Provide proof of five years of continuous experience in landscaping and irrigation of projects of similar size (+\- 20% of the construction cost) and scope for education campuses. Contractor to have a minimum of two projects either completed or in construction in the last five years.

B. Work Force: Ensure that an experienced foreman is present at all times during installation. Keep the same foreman and workers on the job from commencement to completion.

C. Reviews: Specifically request reviews of all items listed below in "Inspection Requirements" prior to progressing to the next level of work. The Owner's Representative reserves the right to inspect and reject material, both at place of growth and at site, before and/or after planting, for compliance with requirements for name, variety, size and quality.

D. Reference Standards: Meet or exceed Federal, State and County laws requiring inspection of all plants and planting materials for plant disease and insect control.

E. Delivery, Storage, and Handling:

1. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

2. Bulk Materials:

a. Do not dump or store bulk materials near structures, utilities, walkways or pavements, or on existing turf areas or plants.

b. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

c. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

F. Plant Material:

1. Conform to the current edition of Horticultural Standards for quality of Number 1 grade nursery stock as adopted by the American Association of Nurserymen. Conform to sizes specified on plant legend. Select plants which have a natural shape and appearance.

2. Select only plants that are true to name, and tag one of each bundle or lot with the name of the plant in accordance with the standards of practice of the American Association of Nurserymen. In all cases, botanical names shall take precedence over common names.

3. Tag each plant of a patented variety with the variety and identification number, where applicable, as it is delivered to the job site.

4. Select only plants which have been nursery-grown in accordance with good horticultural practices and which have been grown under climatic conditions similar to those in the locality of the project for at least one year.

5. Select only plants which are typical of their species or variety; have normal habits of growth; are sound, healthy, vigorous, well-branched and densely-foliated when in leaf; are free of disease, insect pests, eggs or larvae; and have a healthy and well-developed root system.

6. Select only container stock that has been grown in the containers in which delivered for at least six (6) months, but not over two (2) years. Provide samples to show that there are no root-bound conditions.

7. Do not use plants that are severely pruned or headed-back to meet size requirements.

8. Do not plant container-grown plants that have cracked or broken balls of earth when taken from the container. Remove canned stock carefully from cans after containers have been cut on two sides with tin snips or other approved cutter.

9. Coordinate a time for the Landscape Architect to inspect the plants upon their delivery to the project site.

10. At any time prior to final acceptance, be prepared to replace any plants that are rejected by the Owner’s Representative because of physical damage to the plant.

11. Do not remove container-grown stock from containers before time of planting.

12. Be prepared to replace plants which are rejected by the Owner’s Representative for the following reasons:

a. Trunk bark damage caused by sunburn,

b. Trunk bark wounds caused by rubbing stakes or ties,

c. Trunk bark damage caused by ties that have girdled the tree,

d. Tree head development that is lopsided and not symmetrical in form,

e. Tree branches that cross or touch,

f. Tree branches with double leaders (unless multi-trunk trees are specified).

13. Stake shrubs with one-inch by one-inch by eighteen-inch (1”x1”x18”) stakes in such manner that the stakes are not visible, and tie to upright position if they lean and/or are not growing in a vertical position.

14. Furnish quantities necessary to complete the work as shown on the Drawings and, if necessary, make up for any discrepancies in the quantities given in the Plant List at no additional cost to Owner.

G. Decomposed Granite with Binder Mock-up:

1. Install 4 ft wide x 10 ft long mock-up of decomposed granite with Stabilizer additive at location as directed by owner’s representative for review and acceptance prior to placement of decomposed granite.

H. Comply with the requirements of Section 01 70 00 – EXECUTION AND CLOSEOUT REQUIREMENTS.

1.05 INSPECTION REQUIREMENTS

A. Landscape Architect reserves the right to examine and reject plant material both at place of growth and at site, before and after planting, for compliance with requirements of name, variety, size, and quality.

B. Request and hold a pre-construction meeting prior to beginning the work of this Section. Parties required to be in attendance are the Landscape Contractor, Project Inspector, Owner’s Representative, and Landscape Architect.

C. Obtain verification from Project Inspector for the following at the appropriate times during construction and prior to further progression of work in this Section:

1. Rough grading is to tolerances specified in Section 31 20 00 – EARTH MOVING.

2. The placement of landscape backfill material is as specified in this Section.

3. Prior to the commencement of the work specified in this Section, the coverage and operation of the sprinkler irrigation system are as specified in Section 32 80 00 - IRRIGATION.

4. The soil amendment does not include any metal fragments. (Obtain a letter from the manufacturer stating that the material submitted for use on this project has no metal or foreign objects. Submit this letter as part of the Data Sheet submittal package [see “Submittals and Substitutions” in this Section])

5. Required Test: For each load of soil amendment delivered to the site, spread at least two cubic yards (2 cy) of material onto a paved surface approximately two inches (2”) deep. Pass a magnetic rake over the material in two directions. If any metal is found, test the entire load in the same manner. Perform all testing in the presence of the Project Inspector.

6. Soil amendments, fertilizer, bark mulch and materials used for hydroseeding have been delivered to the site by the supplier, the invoices from the supplier indicate the project name and quantities delivered, and the Project Inspector has received copies of all such documents.

7. Prior to planting, amendments and conditioners have been incorporated as per pre-planting recommendations, and planting areas have been made ready to receive planting.

D. In case of failure to obtain any verification by the Project Inspector as required above, remove and replace work as necessary to obtain the verification at no additional cost to the Owner.

E. Beginning of Maintenance Period: Verify all work is complete, then request and hold a meeting to include the Landscape Architect, Project Inspector, Architect and Owner’s Representative for authorization to begin the landscape maintenance period.

F. End of Maintenance: Verify that all work is complete and acceptable, and that the maintenance has been completed per specifications; and continue to provide landscape maintenance until the Owner’s Representative has accepted the work.

1.06 SUBMITTALS AND SUBSTITUTIONS

A. See Section 01 33 00 – SUBMITTAL PROCEDURES for additional requirements.

B. Plant Material: Within fifteen (15) days after award of contract, locate plant materials required for construction. Ensure that trees and shrubs are contract- grown from a certified nursery. Notify Owner’s Representative of plant material “tied off” for review at selected nursery. If specified material is not obtainable, submit the following to Owner’s Representative: proof of non-availability, proposal for use of equivalent material, photographs of alternative choices of plant material. Include clear, written description of type, size, condition, and general character of plant material.

C. Data Sheets: Provide product data for each type of landscape material indicated in the Drawings and Specifications.

D. Samples: Submit samples of the following materials to Landscape Architect for approval:

1. Soil amendment: (3) one-quart zip-locked plastic bags.

2. Decomposed Granite: (3) one-quart zip-locked plastic bags.

3. Pea Gravel: (3) one-quart zip-locked plastic bags.

4. Imported Topsoil: (3) one-quart zip-locked plastic bags. (if needed)

5. Decomposed Granite: (3) one-quart zip-locked plastic bags.

E. Provide soils analysis reports prepared by a qualified soils laboratory in compliance with the Soil Testing Requirements under “Soil Testing” in Part 3.02 of this Section.

F. Prior to planting, submit copies of all trucking or packaging tags for all soil amendment, fertilizer and other additives to Landscape Architect so the quantities can be verified.

1.07 PROTECTION AND CLEAN-UP

A. Provide protection for persons and property throughout progress of work. Use temporary barricades as required. Proceed with work in such manner as to minimize spread of dust and flying particles and to provide safe working conditions for personnel. Store materials and equipment where directed.

B. Existing Construction: Execute work in an orderly and careful manner to protect paving, work of other trades, and other improvements.

C. Existing Utilities: Provide protection for existing utilities within construction area. At no additional cost to Owner, repair any damages to utility lines that occur as a result of this work.

D. Landscaping: Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods.

E. Paving: Maintain cleanliness of paving areas and other public areas used by equipment, and immediately remove spillage; remove rubbish, debris, and other material resulting from landscaping work, leaving site in a safe and clean condition.

1.08 PLANTING SCHEDULE / ENVIRONMENTAL REQUIREMENTS

A. Install, establish, and maintain all lawn areas for a minimum of ninety (90) days prior to date of substantial completion. Coordinate schedule with other work and overall project schedule. Failure to install lawn areas by this date shall result in assessment of liquidated damages.

B. Proceed with work in an orderly and timely manner to complete installation of landscaping within contract limits.

C. Planting Season Limits: Do not plant when grounds are wet or temperature is below 25°

F. Do not proceed with any soil preparation and fertilization if all planting cannot be completed within Planting Season Limit.

1.09 LANDSCAPE MAINTENANCE PERIOD REQUIREMENTS

A. Beginning of Landscape Maintenance Period:

1. General: Landscape Maintenance Period does not begin until all work is installed and lawn has evenly germinated to an approximated blade height of one and one-half inches (1 ½"), as determined by Landscape Architect, in writing.

2. Booster Pump: Upon successful completion of testing by the booster pump technician, request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.

3. Automatic Controller: Upon successful completion of testing by the technician, request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.

4. On-site Inspection: When all work is complete, request and hold a meeting to include the Landscape Architect, Project Inspector, Architect and Owner's Representative who must together authorize and determine the start date for the landscape maintenance period. Coordinate and give notice of the date and time of the on-site meeting to all parties at least forty-eight (48) hours in advance.

5. Acceptability: In cases where the lawn has reached adequate fullness and germination in some areas but not all, and authorization has not been given to begin the maintenance period, proceed with mowing, trimming, spraying, etc., as necessary prior to the beginning of the maintenance period.

B. Duration of Landscape Maintenance Period:

The Landscape Maintenance Period shall continue for a minimum of ninety (90) calendar days. During this time, continuously maintain all areas involved until final acceptance of the work by the Owner's Representative. See Landscape Maintenance Period procedure in Part 3.12 of this Section.

C. Final Acceptance of the Landscape Maintenance Period:

Request the final inspection forty-eight (48) hours in advance. If items require attention, hold on-site meetings until Landscape Architect can certify, in writing, and in concurrence with the Owner's Representative, the successful completion of the Landscape Maintenance Period.

1.10 RECORD DRAWINGS

Upon completion of work, and as a precedent to final payment, deliver to Owner's Representative one complete set of reproducible originals of Drawings showing work exactly as installed.

PART 2 PRODUCTS

2.01 GENERAL

Use material in new and perfect condition as specified. Any deviations or substitutions from the Specification and Drawings must first be approved by Owner's Representative in writing prior to use.

2.02 SOIL PREPARATION MATERIALS

A. Topsoil: Fertile; friable; natural loam surface soil; reasonably free of subsoil, clay lumps, brush, weeds and other litter; and free of roots, stumps, stones/rocks, and other extraneous or toxic matter harmful to plant growth.

B. Soil Amendment: One-percent nitrogen-impregnated bark product with a ninety-percent (90%) bark base and zero to one-quarter inch (0-1/4") particle size, or approved equivalent. **Do not spread until testing requirements have been satisfied.**

C. Fertilizer/Soil Conditioner: Gro-Power Plus or approved equal.

D. Fertilizer for Trees and Shrubs: Seven-gram Gro-Power Planting Tablets (12-8-8 NPK) or approved equal.

E. Vitamin B-1: "Superthrive", "Liquinox Start", "Cal-Liquid", or approved equal.

2.03 MISCELLANEOUS LANDSCAPE MATERIALS

A. Tree-staking System: As indicated on Drawings.

B. Pre-Emergent Weed Control: Oxadiazon, "Treeflan", "Ronstar 2G", "Surflan" (Elano Products Company), or approved equal.

C. Decomposed Granite:

1. Gold color.

2. A mixture of fines to three-eighths inch (3/8") size particles with no clods.

3. Free of vegetation, other soils, debris and rocks, and of such nature that it can be compacted readily under watering and rolling.

D. Decomposed Granite Binder: Shall be Stabilizer by Stabilizer Solutions.

E. Pea Gravel: As indicated on Drawings.

F. Fieldstones: As indicated on Drawings.

G. Weed Fabric: Woven, needle-punched, polypropylene fabric, five ounces per square yard (5 oz/sq.yd) minimum.

H. Header Boards: As indicated on Drawings.

I. Root Barrier: As indicated on Drawings.

2.04 PLANT MATERIAL:

A. Nursery Plant Stock:

1. As indicated on Drawings. Do not remove container-grown stock from containers until planting time. Plants shall be true to name.

2. Healthy, shapely, well-rooted, not pot-bound, free from insect pests or plant diseases and properly "hardened off" before planting. Replace plants that are not alive or are not in satisfactory growing condition, as determined by the Landscape Architect, without additional cost to Owner. The Landscape Architect may reject plants before and/or after planting.

3. Labeled. Label at least one tree and one shrub of each species with a securely-attached, waterproof tag bearing legible designation of botanical and common name.

PART 3 EXECUTION

3.01 SITE CONDITIONS

A. Examine the site, verify grade elevations, and observe conditions under which work is to be performed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner’s Representative.

B. Proceed with complete landscape work as rapidly as portions of the site become available, working within seasonal limitations for each kind of landscape work required.

C. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand-excavate, as required, to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

D. When conditions detrimental to sod or plant growth are encountered, such as rubble fill, adverse drainage condition, or other obstructions, notify the Owner’s Representative before planting.

3.02 SOIL TESTING

A. Coordinate soil testing in an expeditious and timely manner as required for on-site topsoil materials. Contract with a soil laboratory and include cost of sampling and testing in contract price. Take one (1) sample for every 5,000 square feet of landscape area up to a maximum of six (6) samples under the direction of and in the presence of the Owner's Representative.

B. Submit each sample, according to the quantity of soil required by testing laboratory, to a competent laboratory approved by the Owner's Representative.

C. Provide analysis of soil samples for pH, salinity, ammonia, phosphate, potassium, calcium, magnesium, boron, and sodium levels. Provide appraisal of chemical properties, including particle size determination, and recommendations for types and quantities of amendments and fertilizers.

3.03 PREPARATION

A. Clearing of Vegetation:

1. If live perennial weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least 15 days.

2. Clear and remove existing weeds by mowing or grubbing off all plant parts at least one-quarter inch (¼") inch below surface of soil over entire areas to be planted.

B. Soil preparation:

1. Loosen soil in all planting areas, and on slopes flatter than 3:1 gradient, to a depth of six to eight inches (6" - 8") below finish grade. All debris, foreign matter, and stones shall be removed prior to the placing of any fertilizers or conditioners. Soil preparation is for all shrub planting beds, lawn hydroseeded areas and sodded lawn areas.

2. Conduct the required soil tests and instruct the lab to include a minimum of the following soil improvements in the recommendation on the soils report.

a. Soil Amendment: Two cubic yards (2 cy) per 1,000 square feet.

b. Gro-Power Plus: One hundred fifty pounds (150 lbs) per 1,000 square feet.

c. If the lab recommends less than six cubic yards (6 cy) of soil amendment, the excess bid amount shall be applied to the cost of any additional recommended soil improvements, or returned to the Owner as a credit

3. Apply amendments as follows, using rates recommended by the soils testing

laboratory (the rates of amendments shown below are for bidding purposes only):

a. Fertilizer/Soil Conditioner: Broadcast 150 pounds of Gro Power Plus per 1,000 square feet in all planting areas and rototill to a depth of six to eight inches (6" - 8"). Remove from the site any rock and debris brought to the surface by cultivations. "Cultipack" all areas to receive sod or hydroseed.

b. Apply soil amendment to all planting areas at the rate of six cubic yards (6 cy) per 1,000 sf and rototill into the top six to eight inches (6" – 8").

4. Upon completion of finish grading, request a review and obtain approval of Landscape Architect prior to commencement of planting or hydroseeding.

C. Finish Grading for all Planting areas

1. Refer to Earthwork Specification Section for Rough Grading.

2. Grade to elevations and contours shown on Drawings. Fill low spots with landscape backfill material and grade to surface drain in manner indicated on Drawings.

3. Finish-grade so that the entire area within the contract lines has a natural and pleasing appearance as specified and as directed by Landscape Architect.

4. Adjust sprinkler heads flush to finish grade in preparation to receive hydroseeding or one-half inch above finish grade in preparation to receive sod. Reset sprinkler heads flush to grade after turf has germinated.

5. Flag the sprinkler heads and valve markers.

D. Planting Pits for Trees:

1. Excavate pits with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage.

2. Set container-grown stock in center of pit on earth pedestal. Separate roots and/or prune roots as directed by Landscape Architect. In hot weather, pre-wet pit. Loosen outside roots from sides and bottom of root ball. When set, place additional backfill around base and sides of root ball. Work each layer to settle backfill and eliminate voids and air pockets. Water after placing final layer of backfill.

3. Loosen hard subsoil in bottom of excavation. Extend excavation as required to insure proper drainage from plant pits.

4. Fill excavated planting pits with water to half the depth of pit. Pits should drain within four hours (4 hrs). If planting pits do not drain, notify Project Inspector immediately. Do not proceed with planting until Landscape Architect has resolved a method to provide drainage.

E. Planting Pits for Shrubs/Groundcover:

1. Excavate pits and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage.

2. Loosen hard subsoil in bottom of excavation. Extend excavation as required to insure proper drainage from plant pits.

3. Fill excavated planting pits with water to half the depth of pit. Pits should drain within four hours (4 hrs). If planting pits do not drain, notify Project Inspector immediately. Do not proceed with planting until Landscape Architect has resolved a method to provide drainage.

3.04 ROOT BARRIER INSTALLATION

A. Install root barrier as shown on the tree planting plan. Root barrier typically to be installed along hardscape elements, such as walls, curbs, and walkways, unless otherwise shown on Drawings.

B. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously as shown on the plans.

1. Position top of root barrier one half inch (1/2”) above finish grade.

2. Do not distort or bend root barrier during construction activities.

3. Do not install root barrier surrounding the root ball of tree.

3.05 PLANTING

A. Trees, Shrubs, and Groundcover:

1. Lay out individual tree and shrub locations and areas for multiple plantings. Stake the locations, outline the areas, and secure the Owner’s Representative's acceptance before beginning the planting work. Make minor adjustments as requested.

2. Scarify root ball prior to planting. Plant in holes twice the diameter of the root ball and to a depth equal to the container’s height. Place the shrub and/or groundcover so the top of the root ball is one inch (1”) higher than the surrounding grade; place the tree so that the crown of the trunk is two inches (2") higher than the surrounding grade. Set container-grown stock in center of pit. In hot weather, pre-wet the pit. When set, place additional backfill around base and sides of root ball. Work each layer to settle backfill and eliminate voids and air pockets. Thoroughly compact lower half of backfill in plant pit. See staking or guying detail. Water after planting. Provide a berm or watering basin for each tree. Add Vitamin B-1, in the proper

solution as recommended by the manufacturer, to the second watering of the basin.

3. Place fertilizer planting tablets in root zone and alongside each plant. Follow manufacturer's instructions for number of tablets to use for each container size.

4. See Drawings for additional information.

5. Grooming and Staking of Trees:

   a. Prune, thin-out and shape trees in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Landscape Architect, do not cut tree leaders, and remove only injured or dead branches from flowering trees.

   b. Paint cuts over one-half inch (½") in size with standard tree paint or compound, covering exposed, living tissue. Use paint that is waterproof, antiseptic, adhesive, elastic and free of kerosene, coal tar, creosote, and other substances harmful to plants. Do not use shellac.

   c. Stake or guy trees immediately after planting, as indicated on Drawings.

6. Grooming of Shrubs:

   a. Prune, thin-out and shape shrubs in accordance with standard horticultural practice. Prune shrubs to retain natural character and to accomplish their use in landscape design. The required plant size is its size after pruning.

   b. Remove and replace excessively pruned or malformed new plants resulting from improper pruning.

B. Request review by the Landscape Architect after locating, but prior to planting all trees. Under the direction of the Landscape Architect, make slight adjustments to plant material location as necessary to reflect original intention of Drawings.

3.06 WEED CONTROL

A. Pre-Emergent: Apply pre-emergent weed control to all planting areas (except lawn) after completion of all planting and one complete watering. Follow manufacturer's directions. To prevent washing away of weed control, do not over-water after its application. Do not allow any weed control into lawn areas. Treat any existing noxious weeds, such as Johnson grass, with Roundup in successive treatments until all roots are destroyed, then remove all grass and roots. Notify Owner's Representative of time of installation for verification of application.

B. Weed Fabric: Install per manufacturers recommendations stapling down the fabric along the edges and throughout the. For planting, cut an X in the fabric and fold the under the fabric under, install the plant and then fold the fabric back over the root ball and staple

the fabric down to the root ball.

3.07 DECOMPOSED GRANITE

A. Prepare all areas to receive decomposed granite, and treat sub-grade with weed control.

B. Install a two-inch (2") lift, and wet and roll to compact to ninety percent (90%).

C. Install the remaining material to achieve the required thickness when it is wet and rolled.

D. Remove all weed grass and re-compact the surface by the end of the landscape maintenance period.

3.08 DECOMPOSED GRANITE WITH BINDER

A. General: Prepare all areas to receive decomposed granite, and treat sub-grade with weed control.

B. Placement:

1. Do not install during rainy conditions or below 40 degree Fahrenheit and falling.

2. After pre-blending, place the Stabilized decomposed granite on prepared sub-grade. Level to desired grade and cross section.

3. Water heavily for full-depth moisture penetration of the Stabilized pathway profile, 25 to 45 gallons of water per 1-ton must be applied. During water application randomly test for depth using a probing device, which reaches full depth.

C. Compaction:

1. Upon thorough moisture penetration, compact aggregate screening to 85% relative compaction by equipment such as; a 2 to 4-ton double drum roller or a 1,000-lb. single drum roller. The roller size will depend on the depth of the pathway. DO NOT use a vibratory plate compactor or vibration function on roller as vibration separates large aggregate particles. Do not begin compaction for 6 hours after placement and up to 48 hours.

2. If surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction.

3. Take care in compacting decomposed granite when adjacent to planting and irrigation systems. Hand tamping with an 8” or 10” hand tamp recommended.

D. Inspection:

1. Finished surface of pathway shall be smooth, uniform and solid. There shall be no

evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material will not be present on the surface after installation, but may appear after use and according to environmental conditions. Pathway should remain stable underneath the loose granite on top. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

E. Repairs:

1. Excavate damaged area to the depth of the stabilized decomposed granite and square off sidewalls.

2. If area is dry, moisten damaged portion lightly.

3. Pre-blend the dry required amount of Stabilizer powder with the proper amount of decomposed granite in a concrete mixer.

4. Add water the pre-blended decomposed granite and stabilizer. Thoroughly moisten mix with 25 to 45 gallons per 1-ton of pre-blended material or to approximately 10% moisture content.

5. Apply moistened pre-blended decomposed granite to excavated area to finish grade.

6. Compact with an 8”-10” hand tamp or 250 to 300-pound roller. Keep traffic off area for 12 to 48 hours after repair has been completed.

F. Upon end of landscape maintenance period, all weed/grass shall have been removed and surface re-compacted.

3.09 EROSION CONTROL BLANKET

When planting operations have been completed and finish-grade has been re-established, request review of surface grade, and obtain approval of Landscape Architect before installation of blanket. Install material as per Drawings.

3.10 JUTE MESH

A. Jute mesh shall be installed at the locations shown on the plans.

B. Jute mesh shall be placed after cultivation and before planting. Jute mesh sall be placed loosely on the finish grade up and down the slope in a manner to fit the soil surface contour and shall be held in place staples driven vertically into the soil at approximately 24” spacing. Jute mesh strips shall be overlap along the sides by at least 6”. Ends of strips shall be tucked into the soil by at least 6”.

3.11 CLEAN-UP

A. During construction, keep the site free of rubbish and debris, and clean up the site promptly when notified to do so. Take care to prevent spillage on streets from hauling and immediately clean up any such spillage and/or debris deposited on streets due to the work of this Section.

B. During all phases of the construction work, take all precautions to abate dust nuisance by clean-up, sweeping, sprinkling with water, or other means as necessary.

3.12 LANDSCAPE MAINTENANCE

A. The Landscape Maintenance Period will begin when all the Landscape Maintenance Period Requirements have been met (See Part 1 of these Specifications).

B. Cleaning: Maintain cleanliness on paving areas and other public areas used by equipment and immediately remove all spillage. Remove from project site all rubbish and debris found thereon and all material and debris resulting from landscaping work, leaving the site in a safe and clean condition.

C. Maintenance:

1. Sprinkler Irrigation System:

a. Check system weekly for proper operation. Flush lateral lines out after removing last sprinkler head or two at each end of lateral. Adjust all heads as necessary for unimpeded coverage.

b. Set and program automatic controllers for seasonal water requirements. Provide the Owner’s Representative with keys to the controllers and instructions on how to turn off system in case of emergency.

c. Repair all damages to sprinkler irrigation system as part of the contract work. Make repairs within one watering period or one week, whichever is the least amount of time.

2. Trees and Shrubs:

a. Water enough that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.

b. Construct and/or remove water basins around each plant, depending on the time of the year and as directed.

c. Do not prune unless directed by the Landscape Architect.

d. Re-stake and re-tie trees as needed and as directed by the Landscape Architect. Do not allow tops of tree stakes to protrude into head of tree.

e. Replace any dead, dying or vandalized plant material on a weekly basis throughout the Landscape Maintenance Period.

3. Insecticide and Herbicide Application:

   a. If needed, control weeds with selective herbicides and sprays. In areas where crabgrass has infested the lawn, apply pre-emergent herbicides such as Dacthal by Amvac, Balan, or Betasan by Gowan for control prior to crabgrass germination. Control insect pests if necessary.

   b. Use only a licensed Pest Control Operator to apply herbicides and sprays and to maintain a log for applications indicating material, timing, and rate.

4. Decomposed Granite with Binder:

   a. Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed.

   b. During the first year, a minor amount of loose aggregate will appear on the paving surface (1/16” to 1/4”). If this material exceeds a ¼”, redistribute the material over the entire surface. Water thoroughly to the depth of 1”. Compact with power roller of no less than 1,000 lbs. This process should be repeated as needed.

   c. If cracking occurs, sweep fines into the crack, water thoroughly and hand tamp with an 8”-10” hand tamp plate.

5. Pre-scheduled On-site Meetings: Hold regularly-scheduled (monthly or bimonthly as determined by the Landscape Architect) on-site meetings with the Landscape Architect, Project Inspector and Owner’s Representative. Dates and times will be jointly agreed upon.

6. Request, forty-eight hours (48 hrs.) in advance, on-site visits by the Landscape Architect to determine the end of the Landscape Maintenance Period.

END OF SECTION

SECTION 33 42 00

STORMWATER CONVEYANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. PE pipe and fittings.
2. PVC pipe and fittings.
3. Cleanouts.
4. Stormwater inlets.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Storm water inlets. Include plans, elevations, sections, details, frames, covers, and grates.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle stormwater inlets in accordance with manufacturer's written rigging instructions.

1.07 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.01 CORRUGATED-PE PIPE AND FITTINGS

A. Source Limitations: Obtain corrugated-PE pipe and fittings from single manufacturer.

B. Corrugated-PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.

C. Corrugated-PE Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.02 PVC PIPE AND FITTINGS

A. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.

B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

C. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

2.03 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
2. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Shielded, Flexible Couplings:

1. Source Limitations: Obtain shielded, flexible couplings from single manufacturer.
2. Description: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings:

1. Source Limitations: Obtain ring-type, flexible couplings from single manufacturer.
2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.04 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Source Limitations: Obtain cast-iron cleanouts from single manufacturer.
2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

1. Source Limitations: Obtain PVC cleanouts from single manufacturer.

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.
3. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

2.05 STORMWATER INLETS

A. Designed Precast Concrete Inlet: ASTM C913, precast, reinforced concrete; designed in accordance with ASTM C890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: ASTM C990, bitumen or butyl rubber.
2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
4. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping in accordance with the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with 36- inch- minimum cover.
4. Install PE corrugated sewer piping in accordance with ASTM D2321.
5. Install PVC profile gravity sewer piping in accordance with ASTM D2321 and ASTM F1668.

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:

1. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
2. Join PVC profile gravity sewer piping in accordance with ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.
3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.04 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.05 STORMWATER INLET INSTALLATION

A. Construct inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.06 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

    a. Shielded flexible couplings for same or minor difference OD pipes.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.07 IDENTIFICATION

A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.08 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping in accordance with ASTM F1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.09 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 33 42 00