REVISION RECORD

FOR THE STATE OF CALIFORNIA

ERRATA

January 1, 2026

2025 Title 24, Part 3, California Electrical Code

General Information:

1. The date of this erratum is for identification purposes only. See the History Note Appendix on the backside or accompanying page.

2. This erratum is issued by the California Building Standards Commission to correct non-substantive printing errors or omissions in the 2025 California Electrical Code, California Code of Regulations, Title 24, Part 3. Instructions are provided below.

3. Health and Safety Code Section 18938.5 establishes that only building standards in effect at the time of the application for a building permit may be applied to the project plans and construction. This rule applies to both adoptions of building standards for Title 24 by the California Building Standards Commission, and local adoptions and ordinances imposing building standards. An erratum to Title 24 is a non-regulatory correction because of a printing error or omission that does not differ substantively from the official adoption by the California Building Standards Commission. Accordingly, the corrected code text provided by this erratum may be applied on and after the stated effective date.

4. You may wish to retain the superseded material with this revision record so that the prior wording of any section can be easily ascertained.

Title 24, Part 3

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California Code of Regulations Title 24

California State Agency Contact List

The following state agencies may propose building standards for buildings, structures and applications under their authority for publication in Title 24. Notice of such proposals may be requested from each agency. See Sections 1.2 through 1.14 of the California Building Code (Part 2, T24) for detailed information on the regulatory authority of most state agencies summarized below. Note [agency acronyms] shown in banners/Matrix Adoption Tables in T24.

Board of State & Community Corrections [BSCC]
bscc.ca.gov
(916) 445-5073 BSCC-Mail@bscc.ca.gov
Local Detention Facilities

Building Standards Commission [BSC, BSC-CG]
dgs.ca.gov/bsc
(916) 263-0916 cbsc@dgs.ca.gov
State Buildings including UC & CSU, Nonresidential Green Building Standards

Department of Consumer Affairs Boards/Bureaus:

Acupuncture Board [CA]
acupuncture.ca.gov
(916) 515-5200 AcuPolicy@dca.ca.gov
Acupuncture Offices

Board of Pharmacy [CA]
pharmacy.ca.gov
(916) 518-3100 *Pharmacies*

Board of Barbering & Cosmetology [CA]
barbercosmo.ca.gov
(916) 574-7570 barbercosmo@dca.ca.gov
Barber, Cosmetology & Electrolysis Establishments

Bureau of Household Goods & Services [CA]
bhgs.dca.ca.gov
(916) 999-2041 *Insulation Testing*

Structural Pest Control Board [CA]
pestboard.ca.gov
(800) 737-8188 pestboard@dca.ca.gov
Structural Pest Control Locations

Veterinary Medical Board [CA]
vmb.ca.gov
(916) 515-5220 vmb@dca.ca.gov
Veterinary Facilities

Department of Food & Agriculture [AGR]
cdfa.ca.gov
(916) 900-5004 *Rendering & Collection Centers*
(916) 900-5064 *Meat & Poultry Packing Plants*
(916) 900-5008 *Milk & Dairy Food Safety*

Department of Health Care Access and Information
Office of Statewide Hospital Planning and Development
[OSHPD 1, 1R, 2, 3, 4, 5, 6]
hcai.ca.gov
(916) 440-8300 regsunit@hcai.ca.gov
Hospital Standards, Skilled Nursing Facility Standards & Clinic Standards

Department of Public Health [DPH]
cdph.ca.gov (Recreational Health)
(916) 449-5661 *Food Establishments, Organized Camps, Public Swimming Pools*

Department of Housing and Community Development [HCD 1, 2, 1-AC]
hcd.ca.gov
(800) 952-8356 Title24@hcd.ca.gov
Option 5 > Option 2 *State Housing Law: including Housing Accessibility, Hotels/Motels, Apartments/Condominiums, Dormitories, Single-Family Dwellings, ADUs, Permanent Structures in Mobile Home Parks*
Option 5 > Option 4 *Factory-Built Housing*
Option 5 > Option 5 *Employee Housing*

Department of Water Resources [DWR]
water.ca.gov
(916) 653-5791 DWRwebcomment@water.ca.gov
Plumbing for Recycled Water, Floodplain Construction

Division of the State Architect
dgs.ca.gov/dsa
(916) 445-8100

Access Compliance [DSA-AC]
(916) 445-5827 DSAaccess@dgs.ca.gov
Access for Persons with Disabilities

Structural Safety [DSA-SS, DSA-SS/CC]
Public Schools & Community Colleges, State Essential Services Buildings

State Historical Building Safety Board [SHBSB]
(916) 445-7627 shbsb@dgs.ca.gov
Historical Building Rehabilitation, Preservation, Restoration or Relocation

California Code of Regulations Title 24

California State Agency Contact List (continued)

Energy Commission [CEC]
energy.ca.gov
(800) 772-3300 Title24@energy.ca.gov
Building Energy Efficiency, Compliance Manual & Compliance Forms

Office of the State Fire Marshal [SFM]
osfm.fire.ca.gov
(916) 568-3800 codedevelopment@fire.ca.gov
Fire & Life Safety

State Lands Commission [SLC]
slc.ca.gov
(510) 741-4950 MOTEMS.Public@slc.ca.gov
Marine Oil Terminals

State Librarian [SL]
library.ca.gov
(916) 323-9843 csllaw@library.ca.gov
Public Library Construction & Renovation

1.2. The chief building official of the city, county, or city and county, or an authorized representative.

2. The chief of any city or county fire department or of any fire protection district, and authorized representatives, shall enforce within the jurisdiction the building standards and other regulations of the State Fire Marshal, except those described in Item 1 or 4.

3. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in areas outside of corporate cities and districts providing fire protection services.

4. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in corporate cities and districts providing fire protection services on request of the chief fire official or the governing body.

5. Any fee charged pursuant to the enforcement authority of this section shall not exceed the estimated reasonable cost of providing the service for which the fee is charged pursuant to Section 66014 of the Government Code.

89.111.2.1.2 *Pursuant to Health and Safety Code Section 13108, and except as otherwise provided in A this section, building standards adopted by the State Fire Marshal published in the California Building Standards Code relating to fire and panic safety shall be enforced by the State Fire Marshal in all state-owned buildings, state-occupied buildings, and state institutions throughout the state. Upon the written request of the chief fire official of any city, county or fire protection district, the State Fire Marshal may authorize such chief fire official and his or her authorized representatives, in their geographical area of responsibility, to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, for the purpose of enforcing the regulations relating to fire and panic safety adopted by the State Fire Marshal pursuant to this section and building standards relating to fire and panic safety published in the California Building Standards Code. Authorization from the State Fire Marshal shall be limited to those fire departments or fire districts which maintain a fire prevention bureau staffed by paid personnel.*

Pursuant to Health and Safety Code Section 13108, any requirement or order made by any chief fire official who is authorized by the State Fire Marshal to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, may be appealed to the State Fire Marshal. The State Fire Marshal shall, upon receiving an appeal and subject to the provisions of Chapter 5 (commencing with Section 18945) of Part 2.5 of Division 13 of the Health and Safety Code, determine if the requirement or order made is reasonably consistent with the fire and panic safety regulations adopted by the State Fire Marshal and building standards relating to fire and panic safety published in the California Building Code.

Any person may request a code interpretation from the State Fire Marshal relative to the intent of any regulation or provision adopted by the State Fire Marshal. When the request relates to a specific project, occupancy or building, the State Fire Marshal shall review the issue with the appropriate local enforcing agency prior to rendering such code interpretation.

89.111.2.1.3 *Pursuant to Health and Safety Code Section 13112, any person who violates any order, rule or regulation of the State Fire Marshal is guilty of a misdemeanor punishable by a fine of not less than $100.00 or more than $500.00, or by imprisonment for not less than six months, or by both. A person is guilty of a separate offense each day during which he or she commits, continues or permits a violation of any provision of, or any order, rule or regulation of, the State Fire Marshal as contained in this code.*

Any inspection authority who, in the exercise of his or her authority as a deputy State Fire Marshal, causes any legal complaints to be filed or any arrest to be made shall notify the State Fire Marshal immediately following such action.

89.111.2.2 Right of Entry.

The fire chief of any city, county or fire-protection district, or such person's authorized representative, may enter any state institution or any other state-owned or state-occupied building for the purpose of preparing a fire-suppression preplanning program or for the purpose of investigating any fire in a state-occupied building.

The State Fire Marshal, his or her deputies or salaried assistants, the chief of any city or county fire department or fire protection district and his or her authorized representatives may enter any building or premises not used for dwelling purposes at any reasonable hour for the purpose of enforcing this chapter. The owner, lessee, manager or operator of any such building or premises shall permit the State Fire Marshal, his or her deputies or salaried assistants and the chief of any city or county fire department or fire-protection district and his or her authorized representatives to enter and inspect them at the time and for the purpose stated in this section.

89.111.2.3 More Restrictive Fire and Panic Safety Building Standards.

89.111.2.3.1 *Any fire-protection district organized pursuant to Health and Safety Code Part 2.7 (commencing*

with Section 13800) of Division 12 may adopt building standards relating to fire and panic safety that are more stringent than those building standards adopted by the State Fire Marshal and contained in the California Building Standards Code. For these purposes, the district board shall be deemed a legislative body and the district shall be deemed a local agency. Any changes or modifications that are more stringent than the requirements published in the California Building Standards Code relating to fire and panic safety shall be subject to 101.8.1.

89.111.2.3.2 *Any fire protection district that proposes to adopt an ordinance pursuant to this section shall, not less than 30 days prior to noticing a proposed ordinance for public hearing, provide a copy of that ordinance, together with the adopted findings made pursuant to Section 89.111.2.3.1, to the city, county, or city and county where the ordinance will apply. The city, county, or city and county, may provide the district with written comments, which shall become part of the fire protection district's public hearing record.*

89.111.2.3.3 *The fire-protection district shall transmit the adopted ordinance to the city, county, or city and county where the ordinance will apply.*

The legislative body of the city, county, or city and county, may ratify, modify or deny an adopted ordinance and transmit its determination to the district within 15 days of the determination. Any modification or denial of an adopted ordinance shall include a written statement describing the reasons for any modifications or denial. No ordinance adopted by the district shall be effective until ratification by the city, county, or city and county where the ordinance will apply. Upon ratification of an adopted ordinance, the city, county, or city and county, shall file a copy of the findings of the district, and any findings of the city, county, or city and county, together with the adopted ordinance expressly marked and identified to which each finding refers, in accordance with Section 101.8.1.3.

89.111.2.4 Request for Alternate Means of Protection. *Requests for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment, or means of protection shall be made in writing to the enforcing agency by the owner or the owner's authorized representative and shall be accompanied by a full statement of the conditions. Sufficient evidence or proof shall be submitted to substantiate any claim that may be made regarding its conformance. The enforcing agency may require tests and the submission of a test report from an approved testing organization as set forth in Title 19, California code of Regulation, to substantiate the equivalency of the proposed alternative means of protection.*

The authority having jurisdiction may consider implementation of the findings and recommendations identified in a Risk Management Plan (RMP) as developed in accordance with Title 19, Division 2, Chapter 3, when evaluating requests for alternative means of protection.

Approval of a request for use of an alternative material, assembly of materials, equipment, method of construction, method of installation of equipment, or means of protection made pursuant to these provisions shall be limited to the particular case covered by request and shall not be construed as establishing any precedent for any future request.

89.111.2.5 Appeals. *When a request for an alternate means of protection has been denied by the enforcing agency, the applicant may file a written appeal to the State Fire Marshal for consideration of the applicant's proposal. In considering such appeal, the State Fire Marshal may seek the advice of the State Board of Fire Services. The State Fire Marshal shall, after considering all of the facts presented, including any recommendations of the State Board of Fire Services, determine if the proposal is for the purposes intended, at least equivalent to that specified in these regulations in quality, strength, effectiveness, fire resistance, durability and safety, and shall transmit such findings and any recommendations to the applicant and to the enforcing agency.*

89.111.3 Construction Documents. *In addition to the provisions of this Section, see Title 24, Part 2, California Building Code, Chapter 1, Section 107 for additional requirements.* >

89.111.3.1 Public Schools. *Plans and specifications for the construction, alteration or addition to any building owned, leased or rented by any public school district shall be submitted to the Division of the State Architect.*

89.111.3.2 Movable Walls and Partitions. *Plans or diagrams shall be submitted to the enforcing agency for approval before the installation of, or rearrangement of, any movable wall or partition in any occupancy. Approval shall be granted only if there is no increase in the fire hazard.*

89.111.3.3 New Construction High-Rise Buildings.

1. Complete plans or specifications, or both, shall be prepared covering all work required to comply with new construction high-rise buildings. Such plans and specifications shall be submitted to the enforcing agency having jurisdiction.

2. All plans and specifications shall be prepared under the responsible charge of an architect or a civil or structural engineer authorized by law to develop construction plans and specifications, or by both such architect and engineer. Plans and specifications shall be prepared by an engineer duly qualified in that branch of engineering necessary to perform such services. Administration of the work of construction shall be under the charge of the

ARTICLE 100 — DEFINITIONS

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article								X	X		X					X	
Adopt entire Article as amended (amended sections listed below)	X		X	X	X					X		X	X	X	X		
Adopt only those sections that are listed below						X											
Article/Section																	
Accessory Dwelling Unit				X	X												
Ballasted Solar Photovoltaic System	X		X	X	X												
Building (Exception)				X	X	X											
Coordination										X		X	X	X	X		
Life-Saving Equipment												X					
Oxygen-Generating Devices												X					
Patient Care Space Category, *Category 1 Space (Category 1)*										X		X	X	X	X		
Patient Care Space Category, *Category 2 Space (Category 2)*										X		X	X	X	X		

ARTICLE 110 — REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article								X	X	X	X	X	X	X	X	X	
Adopt entire Article as amended (amended sections listed below)	X		X	X	X												
Adopt only those sections that are listed below																	
Article/Section																	
110.2										X	X	X	X	X	X		
110.13(A) Exception	X		X	X	X												
110.26(C)(3)										X	X	X	X	X	X		

Chapter 1 General

ARTICLE 100 Definitions

Δ **Scope.** This article contains only those definitions essential to the application of this *Code*. It is not intended to include commonly defined general terms or commonly defined technical terms from related codes and standards. An article number in parentheses following the definition indicates that the definition only applies to that article.

Informational Note: A definition that is followed by a reference in brackets has been extracted from one of the following standards. Only editorial changes were made to the extracted text to make it consistent with this *Code*.

(1) NFPA 30A-2021, *Code for Motor Fuel Dispensing Facilities and Repair Garages*
(2) NFPA 33-2021, *Standard for Spray Application Using Flammable or Combustible Materials*
(3) NFPA 75-2020, *Standard for the Fire Protection of Information Technology Equipment*
(4) NFPA 79-2021, *Electrical Standard for Industrial Machinery*
(5) NFPA 99-2021, *Health Care Facilities Code*
(6) NFPA *101*®-2022, *Life Safety Code*®
(7) NFPA 110-2019, *Standard for Emergency and Standby Power Systems*
(8) NFPA 303-2021, *Fire Protection Standard for Marinas and Boatyards*
(9) NFPA 307-2021, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*
(10) NFPA 499-2021, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*
(11) NFPA 501-2022, *Standard on Manufactured Housing*
(12) NFPA 790-2021, *Standard for Competency of Third-Party Field Evaluation Bodies*
(13) NFPA 1192-2021, *Standard on Recreational Vehicles*

Accessible (as applied to equipment). Capable of being reached for operation, renewal, and inspection. (CMP-1)

Accessible (as applied to wiring methods). Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in or blocked by the structure, other electrical equipment, other building systems, or finish of the building. (CMP-1)

Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth. (CMP-1)

Informational Note: Use of keys is a common practice under controlled or supervised conditions and a common alternative to the ready access requirements under such supervised conditions as provided elsewhere in the *NEC*.

Accessory Dwelling Unit. [HCD 1 & HCD 2] *An attached or detached residential dwelling unit that provides complete independent living facilities for one or more persons and is located on a lot with a proposed or existing primary residence. Accessory dwelling units shall include permanent provisions for living, sleeping, eating, cooking, and sanitation on the same parcel as the single-family or multifamily dwelling is or will be situated.*
(See Government Code Section 66313)

N **Adapter.** A device used to adapt a circuit from one configuration of an attachment plug or receptacle to another configuration with the same current rating. (520) (CMP-15)

Adjustable Speed Drive. Power conversion equipment that provides a means of adjusting the speed of an electric motor. (CMP-11)

Informational Note: A variable frequency drive is one type of electronic adjustable speed drive that controls the rotational speed of an ac electric motor by controlling the frequency and voltage of the electrical power supplied to the motor.

Adjustable Speed Drive System. A combination of an adjustable speed drive, its associated motor(s), and auxiliary equipment. (CMP-11)

Aircraft Painting Hangar. An aircraft hangar constructed for the express purpose of spraying, coating, and/or dipping applications and provided with dedicated ventilation supply and exhaust. (CMP-14)

N **Alternate Power Source.** One or more generator sets, or battery systems where permitted, intended to provide power during the interruption of the normal electrical service; or the public utility electrical service intended to provide power during interruption of service normally provided by the generating facilities on the premises. [**99:**3.3.4] (517) (CMP-15)

N **Ambulatory Health Care Occupancy.** An occupancy used to provide services or treatment simultaneously to four or more patients that provides, on an outpatient basis, one or more of the following:

(1) Treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

(2) Anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.
(3) Treatment for patients who, due to the nature of their injury or illness, are incapable of taking action for self-preservation under emergency conditions without the assistance of others.

[*101*:3.3.198.1] (517) (CMP-15)

Ampacity. The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating. (CMP-6)

N **Amplifier (Audio Amplifier) (Pre-Amplifier).** Electronic equipment that increases the current or voltage, or both, of an audio signal intended for use by another piece of audio equipment. Amplifier is the term used to denote an audio amplifier. (640) (CMP-12)

Appliance. Utilization equipment, generally other than industrial, that is fastened in place, stationary, or portable; is normally built in a standardized size or type; and is installed or connected as a unit to perform one or more functions such as clothes washing, air-conditioning, food mixing, deep frying, and so forth. (CMP-17)

N **Applicator.** The device used to transfer energy between the output circuit and the object or mass to be heated. (665) (CMP-12)

Approved. Acceptable to the authority having jurisdiction. (CMP-1)

Arc-Fault Circuit Interrupter (AFCI). A device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected. (CMP-2)

N **Array.** A mechanically and electrically integrated grouping of modules with support structure, including any attached system components such as inverter(s) or dc-to-dc converter(s) and attached associated wiring. (690) (CMP-4)

Askarel. A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media. (CMP-9)

Informational Note: Askarels of various compositional types are used. Under arcing conditions, the gases produced, while consisting predominantly of noncombustible hydrogen chloride, can include varying amounts of combustible gases, depending on the askarel type.

Δ **Associated Apparatus.** Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affects the energy in the intrinsically safe circuits and is relied on to maintain intrinsic safety. Such apparatus is one of the following:

(1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location
(2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location

(CMP-14)

Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also might have connections for non-intrinsically safe apparatus.

Informational Note No. 2: An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location under specified fault conditions.

Informational Note No. 3: See ANSI/UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations*; ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i"*; and ANSI/ISA RP 12.06.01, *Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety*, for additional information.

Δ **Associated Nonincendive Field Wiring Apparatus.** Apparatus in which the circuits are not necessarily nonincendive themselves but that affects the energy in nonincendive field wiring circuits and is relied on to maintain nonincendive energy levels. Such apparatus is one of the following:

(1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location
(2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location

(CMP-14)

Informational Note No. 1: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and also might have connections for other electrical apparatus.

Informational Note No. 2: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*, for additional information.

Attachment Fitting, Weight-Supporting (WSAF) (Weight-Supporting Attachment Fitting). A device that, by insertion into a weight-supporting ceiling receptacle, establishes a connection between the conductors of the attached utilization equipment and the branch-circuit conductors connected to the weight-supporting ceiling receptacle. (CMP-18)

Informational Note No. 1: A weight-supporting attachment fitting is different from an attachment plug because no cord is associated with the fitting. A weight-supporting attachment fitting in combination with a weight-supporting ceiling receptacle secures the associated utilization equipment in place and supports its weight.

Informational Note No. 2: See ANSI/NEMA WD 6, *American National Standard for Wiring Devices — Dimensional*

Δ Table 315.60(C)(20) Ampacities of Three Triplexed Single Insulated Aluminum Conductors Directly Buried in Earth

	Temperature Rating of Conductor			
	2001–5000 Volts Ampacity		5001–35,000 Volts Ampacity	
Conductor Size (AWG or kcmil)	90°C (194°F) Type MV-90	105°C (221°F) Type MV-105	90°C (194°F) Type MV-90	105°C (221°F) Type MV-105
One Circuit, Three Conductors [See Figure 315.60(D)(3), Detail 7.]				
8	70	75	—	—
6	90	100	90	95
4	120	130	115	125
2	155	165	145	155
1	175	190	165	175
1/0	200	210	190	205
2/0	225	240	215	230
3/0	255	275	245	265
4/0	290	310	280	305
250	320	350	305	325
350	385	420	370	400
500	465	500	445	480
750	580	625	550	590
1000	670	725	635	680
Two Circuits, Six Conductors [See Figure 315.60(D)(3), Detail 8.]				
8	65	70	—	—
6	85	95	85	90
4	110	120	105	115
2	140	150	135	145
1	160	170	155	170
1/0	180	195	175	190
2/0	205	220	200	215
3/0	235	250	225	245
4/0	265	285	255	275
250	290	310	280	300
350	350	375	335	360
500	420	455	405	435
750	520	560	485	525
1000	600	645	565	605

Note: Refer to 315.60(F) for basis of ampacities and Table 315.10(A) for the temperature rating of the conductor.

other than those specified in the ampacity tables shall be corrected in accordance with 315.60(D)(4).

Informational Note No. 1: See IEEE 835, *Standard Power Cable Ampacity Tables*, and the references therein for availability of all factors and constants for ampacities calculated in accordance with 315.60(A).

Informational Note No. 2: See 210.19, Informational Note, for voltage drop on branch circuits that this section does not take into consideration. See 215.2(A)(2), Informational Note No. 2, for voltage drop on feeders that this section does not take into consideration.

(D) Ampacity Adjustment.

(1) Grounded Shields. Ampacities shown in Table 315.60(C)(3), Table 315.60(C)(4), Table 315.60(C)(15), and Table 315.60(C)(16) shall apply for cables with shields grounded at one point only. Where shields for these cables are grounded at more than one point, ampacities shall be adjusted to take into consideration the heating due to shield currents.

Informational Note: Tables other than those listed contain the ampacity of cables with shields grounded at multiple points.

(2) Burial Depth. Where the burial depth of direct burial or electrical duct bank circuits is modified from the values shown in a figure or table, ampacities shall be permitted to be modified as indicated in 315.60(D)(2)(a) and (D)(2)(b). No ampacity adjustments shall be required where the burial depth is decreased.

(a) Where burial depths are increased in part(s) of an electrical duct run, a decrease in ampacity of the conductors shall not be required, provided the total length of parts of the duct run increased in depth is less than 25 percent of the total run length.

(b) Where burial depths are deeper than shown in a specific underground ampacity table or figure, an ampacity derating factor of 6 percent per 300 mm (1 ft) increase in depth for all values of rho shall be permitted.

(3) Electrical Ducts Entering Equipment Enclosures. At locations where electrical ducts enter equipment enclosures from underground, spacing between such ducts, as shown in Figure 315.60(D)(3), shall be permitted to be reduced without requiring the ampacity of conductors therein to be reduced.

(4) Ambient Temperature Correction. Ampacities for ambient temperatures other than those specified in the ampacity tables shall be corrected in accordance with Table 315.60(D)(4) or shall be permitted to be calculated using the following equation:

$$I' = I\sqrt{\frac{T_c - T_a'}{T_c - T_a}} \qquad \textbf{[315.60(D)(4)]}$$

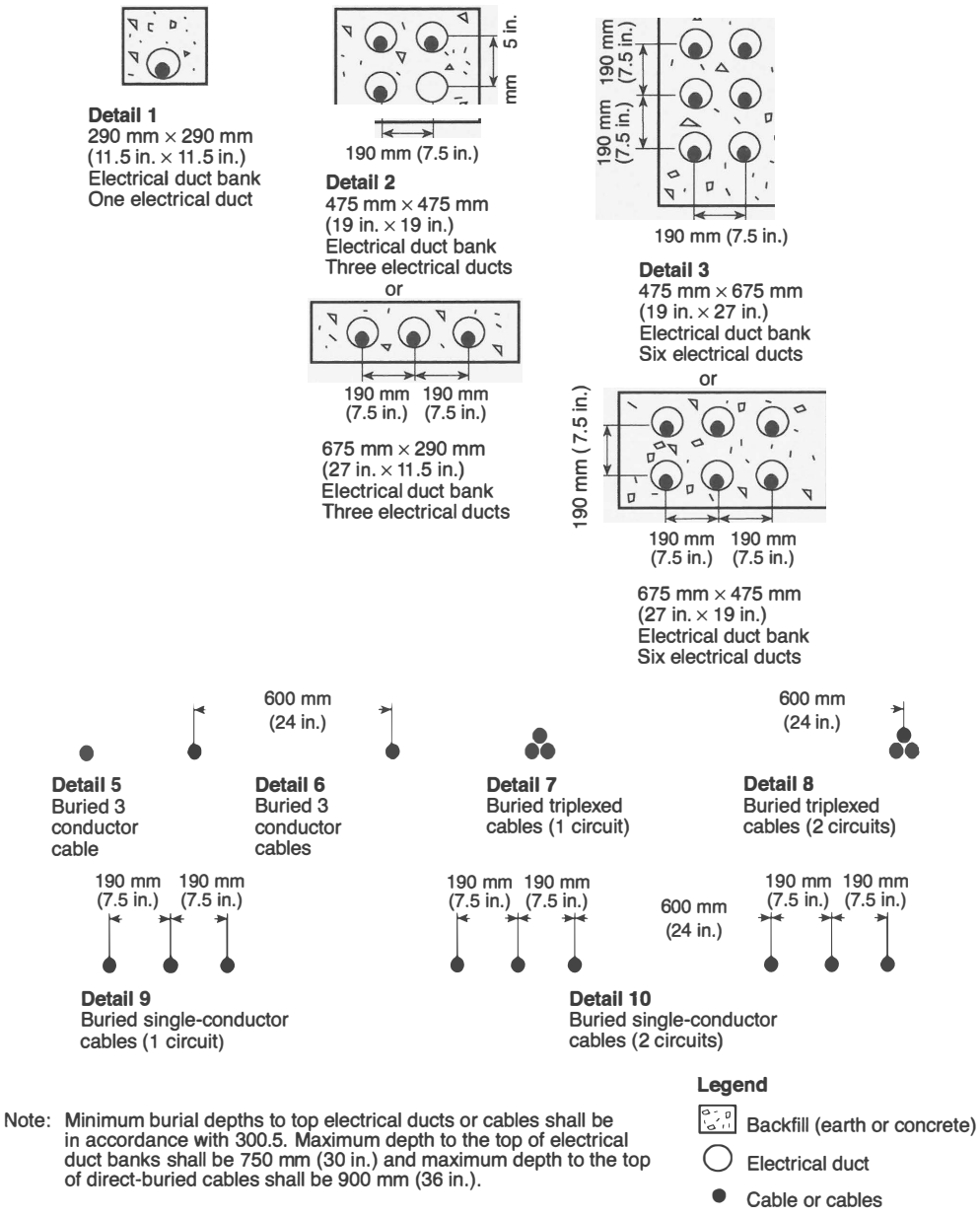
where:

I' = ampacity corrected for ambient temperature
I = ampacity shown in the table for T_c and T_a
T_c = temperature rating of conductor (°C)
T_a' = new ambient temperature (°C)
T_a = ambient temperature used in the table (°C)

Informational Note: See 110.40 for ambient temperature adjustments for terminals.

(E) Ampacity in Air. Ampacities for conductors and cables in air shall be as specified in Table 315.60(C)(1) through Table 315.60(C)(10). Ampacities shall be based on the following:

(1) Conductor temperatures of 90°C (194°F) and 105°C (221°F)
(2) Ambient air temperature of 40°C (104°F)



Note: Minimum burial depths to top electrical ducts or cables shall be in accordance with 300.5. Maximum depth to the top of electrical duct banks shall be 750 mm (30 in.) and maximum depth to the top of direct-buried cables shall be 900 mm (36 in.).

Δ FIGURE 315.60(D)(3) Cable Installation Dimensions for Use with Table 315.60(C)(11) Through Table 315.60(C)(20).

Informational Note: See 315.60(D)(4) where the ambient air temperature is other than 40°C (104°F).

(F) Ampacity in Underground Electrical Ducts and Direct Buried in Earth. Ampacities for conductors and cables in underground electrical ducts and direct buried in earth shall be as specified in Table 315.60(C)(11) through Table 315.60(C)(20). Ampacities shall be based on the following:

(1) Ambient earth temperature of 20°C (68°F)
(2) Arrangement in accordance with Figure 315.60(D)(3)
(3) 100 percent load factor
(4) Thermal resistance (Rho) of 90
(5) Conductor temperatures 90°C (194°F) and 105°C (221°F)
(6) Minimum burial depths to the top electrical ducts or cables shall be in accordance with 305.15.
(7) Maximum depth to the top of electrical duct banks shall be 750 mm (30 in.), and maximum depth to the top of direct-buried cables shall be 900 mm (36 in.).

ARTICLE 422
Appliances

Part I. General

422.1 Scope. This article covers electrical appliances used in any occupancy.

422.3(A) California Energy Code Requirements for Heat Pump Water Heaters, Electric Cooktops, Electric Clothes Dryers and their Readiness in Single-Family Buildings [CEC]. *In single family residential buildings that include one or two dwellings, each dwelling unit shall be provided with:*

(1) designated spaces, receptacles, branch circuits and circuit identifications as specified for heat pump water heaters in California Energy Code Section 150.0(n); and
(2) dedicated circuits and circuit identifications as specified for electric cooktops in California Energy Code Section 150.0(u); and
(3) dedicated circuits and circuit identifications as specified for electric clothes dryers in California Energy Code Section 150.0(v).

(B) California Energy Code Requirements for Electric Cooktops, Electric Clothes Dryers and their Readiness in Multifamily Buildings [CEC]. *In multifamily buildings, each dwelling unit shall be provided with:*

(1) dedicated circuits and circuit identifications as specified for electric cooktops in California Energy Code Section 160.9(c); and
(2) dedicated circuits and circuit identifications as specified for electric clothes dryers in California Energy Code Section 160.9(d).

422.5 GFCI Protection.

Δ **(A) General.** Appliances identified in 422.5(A)(1) through (A)(7) 150 volts or less to ground and 60 amperes or less, single- or 3-phase, shall be provided with Class A protection for personnel. Multiple Class A protective devices shall be permitted but shall not be required.

(1) Automotive vacuum machines
(2) Drinking water coolers and bottle fill stations
(3) Cord-and-plug-connected high-pressure spray washing machines
(4) Tire inflation machines
(5) Vending machines
(6) Sump pumps
(7) Dishwashers

Informational Note: Section 210.8 specifies requirements for GFCI protection for the branch-circuit outlet where the covered location warrants such protection.

(B) Type and Location. The GFCI shall be readily accessible, listed, and located in one or more of the following locations:

(1) Within the branch-circuit overcurrent device
(2) A device or outlet within the supply circuit
(3) An integral part of the attachment plug
(4) Within the supply cord not more than 300 mm (12 in.) from the attachment plug
(5) Factory installed within the appliance

422.6 Listing Required. All appliances supplied by 50 volts or higher shall be listed.

Part II. Installation

422.10 Branch Circuits. Branch circuits supplying appliances shall comply with 422.10(A) or (B).

(A) Individual Branch Circuits. Individual branch circuits supplying appliances shall comply with the following as applicable:

(1) The ampacities of branch-circuit conductors shall not be less than the marked rating of the appliance or the marked rating of an appliance having combined loads.
(2) The ampacities of branch-circuit conductors for motor-operated appliances not having a marked rating shall be in accordance with Part II of Article 430.
(3) The branch-circuit rating for an appliance that is a continuous load, other than a motor-operated appliance, shall not be less than 125 percent of the marked rating, or not less than 100 percent of the marked rating if the branch-circuit device and its assembly are listed for continuous loading at 100 percent of its rating.
(4) Branch circuits and branch-circuit conductors for household ranges and cooking appliances shall be permitted to be in accordance with Table 220.55 and shall be sized in accordance with 210.19(C).

(B) Branch Circuits Supplying Two or More Loads. For branch circuits supplying appliances and other loads, the rating shall be determined in accordance with 210.23.

422.11 Overcurrent Protection. Appliances shall be protected against overcurrent in accordance with 422.11(A) through (G) and 422.10.

(A) Branch-Circuit Overcurrent Protection. Branch circuits shall be protected in accordance with 240.4.

If a protective device rating is marked on an appliance, the branch-circuit overcurrent device rating shall not exceed the protective device rating marked on the appliance.

(B) Household-Type Appliances with Surface Heating Elements. Household-type appliances with surface heating elements having a maximum demand of more than 60 amperes calculated in accordance with Table 220.55 shall have their power supply subdivided into two or more circuits, each of which shall be provided with overcurrent protection rated at not over 50 amperes.

(C) Infrared Lamp Commercial and Industrial Heating Appliances. Infrared lamp commercial and industrial heating

appliances shall have overcurrent protection not exceeding 50 amperes.

(D) Open-Coil or Exposed Sheathed-Coil Types of Surface Heating Elements in Commercial-Type Heating Appliances. Open-coil or exposed sheathed-coil types of surface heating elements in commercial-type heating appliances shall be protected by overcurrent protective devices rated at not over 50 amperes.

(E) Single Non-Motor-Operated Appliance. If the branch circuit supplies a single non-motor-operated appliance, the rating of overcurrent protection shall comply with the following:

(1) Not exceed the overcurrent protection rating marked on the appliance.
(2) Not exceed 20 amperes if the overcurrent protection rating is not marked and the appliance is rated 13.3 amperes or less.
(3) Not exceed 150 percent of the appliance rated current if the overcurrent protection rating is not marked and the appliance is rated over 13.3 amperes. Where 150 percent of the appliance rating does not correspond to a standard overcurrent device ampere rating, the next higher standard rating shall be permitted.

(F) Electric Heating Appliances Employing Resistance-Type Heating Elements Rated More Than 48 Amperes.

(1) Electric Heating Appliances. Electric heating appliances employing resistance-type heating elements rated more than 48 amperes, other than household appliances with surface heating elements covered by 422.11(B), and commercial-type heating appliances covered by 422.11(D), shall have the heating elements subdivided. Each subdivided load shall not exceed 48 amperes, and each subdivided load shall be protected at not more than 60 amperes.

These supplementary overcurrent protective devices shall be (1) factory-installed within or on the heater enclosure or provided as a separate assembly by the heater manufacturer; (2) accessible; and (3) suitable for branch-circuit protection.

The main conductors supplying these overcurrent protective devices shall be considered branch-circuit conductors.

(2) Commercial Kitchen and Cooking Appliances. Commercial kitchen and cooking appliances using sheathed-type heating elements not covered in 422.11(D) shall be permitted to be subdivided into circuits not exceeding 120 amperes and protected at not more than 150 amperes where one of the following is met:

(1) Elements are integral with and enclosed within a cooking surface.
(2) Elements are completely contained within an enclosure identified as suitable for this use.
(3) Elements are contained within an ASME-rated and stamped vessel.

(3) Water Heaters and Steam Boilers. Resistance-type immersion electric heating elements shall be permitted to be subdivided into circuits not exceeding 120 amperes and protected at not more than 150 amperes as follows:

(1) Where contained in ASME-rated and stamped vessels
(2) Where included in listed instantaneous water heaters
(3) Where installed in low-pressure water heater tanks or open-outlet water heater vessels

Informational Note: See IEC 60335-2-21, *Household and similar electrical appliances—Safety—Particular requirements for storage water heaters*, for information on low-pressure and open-outlet heaters are atmospheric pressure water heaters

(G) Motor-Operated Appliances. Motors of motor-operated appliances shall be provided with overload protection in accordance with Part III of Article 430. Hermetic refrigerant motor-compressors in air-conditioning or refrigerating equipment shall be provided with overload protection in accordance with Part VI of Article 440. Where appliance overcurrent protective devices that are separate from the appliance are required, data for selection of these devices shall be marked on the appliance. The minimum marking shall be that specified in 430.7 and 440.4.

422.12 Central Heating Equipment. Central heating equipment other than fixed electric space-heating equipment shall be supplied by an individual branch circuit.

Exception No. 1: Auxiliary equipment, such as a pump, valve, humidifier, or electrostatic air cleaner directly associated with the heating equipment, shall be permitted to be connected to the same branch circuit.

Exception No. 2: Permanently connected air-conditioning equipment shall be permitted to be connected to the same branch circuit.

Δ **422.13 Storage-Type Water Heaters.** The branch-circuit overcurrent device and conductors for fixed storage-type water heaters that have a capacity of 450 L (120 gal) or less shall have an ampere rating of not less than 125 percent of the ampere rating of the water heater.

Informational Note: See 422.10 for branch-circuit rating.

422.16 Flexible Cords.

(A) General. Flexible cord shall be permitted as follows:

(1) To connect appliances to facilitate their frequent interchange or to prevent the transmission of noise or vibration.
(2) To facilitate the removal or disconnection of appliances that are fastened in place, where the fastening means and mechanical connections are specifically designed to permit ready removal for maintenance or repair and the appliance is intended or identified for flexible cord connection.
(3) All cord-and-plug-connected electrically heated appliances that produce temperatures in excess of 121°C (250°F) on surfaces with which the cord is likely to be in contact shall

ARTICLE 512 — CANNABIS OIL EQUIPMENT AND CANNABIS OIL SYSTEMS USING FLAMMABLE MATERIALS

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article	X		X					X	X								
Adopt entire Article as amended (amended sections listed below)																	
Adopt only those sections that are listed below																	
Article/Section																	

ARTICLE 513 — AIRCRAFT HANGARS

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article	X		X					X	X								
Adopt entire Article as amended (amended sections listed below)																	
Adopt only those sections that are listed below																	
Article/Section																	

ARTICLE 514 — MOTOR FUEL DISPENSING FACILITIES

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article	X		X					X	X								
Adopt entire Article as amended (amended sections listed below)																	
Adopt only those sections that are listed below																	
Article/Section																	

ARTICLE 515 — BULK STORAGE PLANTS

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article	X		X					X	X	X	X	X	X	X	X	X	
Adopt entire Article as amended (amended sections listed below)																	
Adopt only those sections that are listed below																	
Article/Section																	

ARTICLE 516 — SPRAY APPLICATION, DIPPING, COATING, AND PRINTING PROCESSES USING FLAMMABLE OR COMBUSTIBLE MATERIAL

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article	X		X					X	X								
Adopt entire Article as amended (amended sections listed below)																	
Adopt only those sections that are listed below																	
Article/Section																	

ARTICLE 517 — HEALTH CARE FACILITIES

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article								X	X								
Adopt entire Article as amended (amended sections listed below)			X							X	X	X	X	X	X	X	
Adopt only those sections that are listed below																	
Article/Section																	
517.1(A)											X						
517.1(B)												X					
517.1(C)										X		X		X	X		
517.4			X							X	X	X		X	X		
517.8										X		X	X	X	X	X	
517.9										X	X	X	X	X	X		
517.12(A)										X		X		X	X		
517.13(C)										X		X		X	X		
517.13(D)										X		X		X	X		
517.18(B) Exception 3										X					X		
517.18(B) Exception 4										X	X						
517.18(D)										X				X			
517.19(B)(1) Exception										X		X		X	X		
517.20										X			X	X			
517.20(A)(3)										X			X	X			
517.26										X		X	X	X	X		
517.29(A.1)										X		X	X	X	X		
517.30(A.1)										X			X	X	X		
517.30(B)(5)										X		X	X	X	X		
517.30(C)										X				X			

(continues)

ARTICLE 517 — HEALTH CARE FACILITIES *(Continued)*

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
517.30(D)										X				X	X		
517.31(B)(1)(3)										X		X	X	X	X		
517.31(B)(3)										X		X	X	X	X		
517.31(C)(3)(3)(g)										X		X	X	X	X		
517.31(H)			X							X				X	X		
517.31(H)(1)			X							X				X			
517.31(H)(2)			X											X	X		
517.32(A)										X		X	X	X	X		
517.34(A)(4)			X							X		X	X	X	X		
517.34(A)(7) j. – k.										X		X	X	X	X		
517.34(A)(7)(l)										X							
517.34(A)(11)										X		X	X	X	X		
517.35(A)(9)										X		X	X	X	X		
517.35(B)(1.1)										X		X	X	X	X		
517.35(B)(1.2)										X		X	X	X	X		
517.40												X		X	X		
517.40(A.1)												X		X	X		
517.41(A.1)												X		X	X		
517.41(C)												X		X	X		
517.41(D)												X		X	X		
517.42(B)(3)												X		X			
517.42(F)												X		X	X		
517.42(G)			X									X		X	X		
517.42(G)(1)			X									X		X	X		
517.42(G)(2)			X									X					
517.44												X		X	X		
517.44(A)(1)(a)															X		
517.44(A)(6), (7)										X		X		X	X		
517.44(A)(6) Exception 2												X		X			
517.44(A)(8)										X		X		X	X		
517.44(A)(9)										X		X	X	X	X		
517.44(A)(10)										X		X		X	X		
517.44(B)(1.1)										X		X		X	X		
517.45(E.1)													X				
517.45(F)													X				
517.45(G)													X				
517.45(H)			X										X				
517.63(A)										X			X	X			
517.123			X							X		X	X	X	X		
517.124										X				X	X		
517.160(B)(4)										X		X	X	X	X		

ARTICLE 518 — ASSEMBLY OCCUPANCIES

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article	X		X	X	X			X	X	X	X	X	X	X	X	X	
Adopt entire Article as amended (amended sections listed below)																	
Adopt only those sections that are listed below																	
Article/Section																	

ARTICLE 520 — THEATERS, AUDIENCE AREAS OF MOTION PICTURE AND TELEVISION STUDIOS, PERFORMANCE AREAS, AND SIMILAR LOCATIONS

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article	X		X					X	X	X	X	X	X	X	X	X	
Adopt entire Article as amended (amended sections listed below)																	
Adopt only those sections that are listed below																	
Article/Section																	

ARTICLE 522 — CONTROL SYSTEMS FOR PERMANENT AMUSEMENT ATTRACTIONS

Adopting Agency	BSC	BSC-CG	SFM	HCD 1	HCD 2	HCD 1-AC	DSA AC	DSA SS	DSA SS/CC	OSHPD 1	OSHPD 1R	OSHPD 2	OSHPD 3	OSHPD 4	OSHPD 5	OSHPD 6	DPH
Adopt Entire Article	X		X					X	X								
Adopt entire Article as amended (amended sections listed below)																	
Adopt only those sections that are listed below																	
Article/Section																	

• *Cooling and heating equipment will be required to be restored to power within sufficient time to maintain temperature between 71°–81°F.*

(2) Alternate Source of Power Backup Requirements.

(a) Generator Units: *Where generators are used as an alternative source of power, sufficient fuel onsite shall be maintained to sustain generator operation for no less than 96 hours, or contract arrangements shall be made for fuel delivery and refueling during an emergency event. If fuel is to be delivered during an emergency event, the facility shall ensure that fuel will be available with no delays. Onsite fuel storage shall not be less than 6 hours capacity in a minimum of one tank. For instances where 96 hours of onsite fuel is not provided, the California Department of Public Health (CDPH) must approve the contract arrangements that have been made for delivery of fuel to meet this requirement.*

(b) Battery Systems: *Facilities that use batteries or a combination of batteries in tandem with renewable electrical generation resource(s) as their alternative source of power shall have sufficient storage or generation capacity to maintain operation for no fewer than 96 hours (6 hours onsite minimum). Facilities shall also make arrangements for delivery of a generator and fuel in the event normal power is not restored within 96 hours and the generation capacity of the renewable electrical generation resource(s) is unable to provide sufficient power to comply with state requirements for skilled nursing facilities.*

(3) Special Seismic Certification. *All Generators, batteries and alternate power sources including distribution equipment and controls provided to supply loads identified in 517.1(B) shall have special seismic certification as defined in the American Society of Civil Engineers (ASCE) ASCE 7, Section 13.2.2.*

(C) Electrical Equipment Schedules [OSHPD 1, 2, 4 & 5]. *Electrical equipment schedules in the construction documents shall clearly indicate which equipment will be powered by the essential electrical system and provide appropriate documentation for special seismic certifications.*

517.4 [OSHPD 1, 1R, 2, 4 & 5] Electric Power Sources, Feeders and Services. *One source (or sets of sources) shall be sized to supply power to support the entire healthcare facility electrical load and shall be permitted to be located on-site or off-site. The source(s) shall be one of the following:*

a. An off-site public utility source with service to the site
b. On-site resources (PV's Batteries, fuel cells, etc.)
c. A combination of both

All sources other than utility owned equipment that are required to meet the entire healthcare facility electrical load, shall have special seismic certification, and be located to minimize interruptions caused by natural forces common to the area or natural disasters identified in the facilities emergency operations plan.

Refer to Sections 1224.4.1.1, 1225.2.1, and 1228.4.1.1, California Building Code.

Informational Note: See Sections 220.40 for sizing requirements for Electric Power Sources, Feeders and Services.

N **517.6 Patient Care–Related Electrical Equipment.** The reconditioning requirements of this *Code* shall not apply to patient care–related electrical equipment.

Informational Note No. 1: Patient care–related electrical equipment is differentiated from electrical equipment as described in 110.21(A)(2).

Informational Note No. 2: If patient care–related electrical equipment is relocated, it is expected to be recommissioned or recertified in accordance with the U.S. *Federal Food, Drug, and Cosmetic Act (FDCA).*

517.8 [OSHPD 1, 2, 3, 4, 5 & 6] Artificial Lighting.

(A) Rooms and Passageways. *All rooms and passageways shall be provided with artificial illumination.*

(B) Illumination.

(1) [OSHPD 1, 3, 4 & 5] Illumination intensity. *Illumination intensity values in each area shall meet the recommended values in the latest edition of ANSI/IES RP-29, Recommended Practice: Lighting Hospital and Healthcare Facilities.*

(2) [OSHPD 2] Minimum illuminance. *Minimum maintained average illuminance in each area shall meet the recommended values in the latest edition of ANSI/IES RP-28, Recommended Practice: Lighting and the Visual Environment for Older Adults and the Visually Impaired.*

(C) Lamp Protection. *Lamps in fixtures shall be protected against accidental breakage by means of an enclosing lens or diffuser.*

Exception No. 1: Open bottom luminaries with a maximum opening or cell size of 64 square inches if the lamp is completely recessed above the ceiling or enclosure in accordance with its listing.

Exception No. 2: Wall mounted night lights with louvered covers with a maximum opening or cell size of 64 square inches provided they are completely recessed in the wall or enclosure in accordance with its listing.

Exception No. 3: Wire guards or plastic tube guards in service areas such as electrical rooms, equipment rooms, and janitor closets.

(D) Special Locations.

(1) The general illumination fixtures in nurseries, central sterilizing rooms, treatment rooms, surgical suites, intensive care units, recovery rooms, obstetrical suites, emergency rooms, and laboratories shall be smooth and easily cleanable.

(2) Lighting in intensive care nurseries shall be controlled by a dimmer or other means of multiple switching to provide varied lighting intensities. Lighting shall have the ability to provide 100 footcandles at each infant bed location when needed.

(3) Individual bed area lighting in intensive care and coronary care units shall be controlled by a dimmer or other means of multiple switching, to provide varied lighting intensities.

C A C A C A C A C A C A C A C A C A C A C

(4) Where a psychiatric care area is identified in the Patient Safety Risk Assessment as high- or medium-risk, lighting shall be tamper-resistant.

(5) Acute psychiatric patient bedrooms shall have general lighting and night lighting with at least one nightlight fixture in each bedroom that shall be controlled at the room entrance.

(6) Corridors in psychiatric nursing units shall have general illumination with provisions for reducing light levels at night.

517.9 [OSHPD 1, 1R, 2, 3, 4 & 5] Mobile Medical Facilities.

(A) Feeder. *The feeder shall be sized in accordance with the requirements of Article 220.*

(B) Service Receptacle. *The service receptacle shall be listed and rated for its use.*

(C) Disconnect. *A disconnecting means listed and rated for its use shall be located adjacent to and within sight of the service receptacle. It shall be capable of simultaneously disconnecting the ungrounded conductors which supply the service receptacle.*

Part II. Wiring and Protection

517.10 Applicability.

(A) Applicability. Part II shall apply to patient care space of all health care facilities.

Δ **(B) Not Covered.** Part II shall not apply to the following:

(1) Business offices, corridors, waiting rooms, and the like in clinics, medical and dental offices, and outpatient facilities

(2) Spaces of nursing homes and limited care facilities wired in accordance with Chapters 1 through 4 of this *Code* where these spaces are used exclusively as patient sleeping rooms, as determined by the health care facility's governing body

Informational Note No. 1: See 406.12(5) for receptacles located in health care facility business offices, corridors, and waiting rooms that are required to be tamper resistant.

Informational Note No. 2: See 210.12(D) for branch circuits supplying outlets and receptacles located in patient sleeping rooms in nursing homes and limited care facilities that are connected to arc-fault circuit-interrupter circuits.

(3) Areas used exclusively for any of the following purposes:

a. Intramuscular injections (immunizations)
b. Psychiatry and psychotherapy
c. Alternative medicine
d. Optometry
e. Pharmacy services not contiguous to health care facilities

Informational Note No. 3: See NFPA *101*-2021, *Life Safety Code*.

517.12 Wiring Methods. Except as modified in this article, wiring methods shall comply with Chapters 1 through 4 of this *Code.*

(A) [OSHPD 1, 2, 4 & 5] *Wall spaces in patient care rooms shall not be used for the installation of switchboards and panelboards, unless dedicated for that room.* C A C A

517.13 Equipment Grounding Conductor for Receptacles and Fixed Electrical Equipment in Patient Care Spaces. Wiring serving patient care spaces shall comply with the requirements of 517.13(A) and (B).

Exception: Luminaires more than 2.3 m (7½ ft) above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with the requirements of 517.13(A) or (B).

(A) Wiring Methods. All branch circuits serving patient care spaces shall be provided with an effective ground-fault current path by installation in a metal raceway system or a cable having a metallic armor or sheath assembly. The metal raceway system, metallic cable armor, or sheath assembly shall itself qualify as an equipment grounding conductor in accordance with 250.118.

(B) Insulated Equipment Grounding Conductors and Insulated Equipment Bonding Jumpers.

Δ **(1) General.** An insulated copper equipment grounding conductor that is clearly identified along its entire length by green insulation and installed with the branch circuit conductors within the wiring method in accordance with 517.13(A) shall be connected to the following:

(1) Grounding terminals of all receptacles other than isolated ground receptacles
(2) Metal outlet boxes, metal device boxes, or metal enclosures
(3) Non-current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

Exception No. 1: For other than isolated ground receptacles, an insulated equipment bonding jumper that directly connects to the equipment grounding conductor shall be permitted to connect the box and receptacle(s) to the equipment grounding conductor. Isolated ground receptacles shall be connected in accordance with 517.16.

Exception No. 2: Metal faceplates shall be connected to an effective ground-fault current path by means of a metal mounting screw(s) securing the faceplate to a metal yoke or strap of a receptacle or to a metal outlet box.

(2) Sizing. Equipment grounding conductors and equipment bonding jumpers shall be sized in accordance with 250.122.

(C) Grounding System Testing. [OSHPD 1, 2, 4 & 5] *The effectiveness of the grounding systems in patient care spaces shall be tested in accordance with NFPA 99:6.3.3.1.* C A C A C A C

(D) Receptacle Testing in Patient Care Spaces. [OSHPD 1, 2, 4 & 5] *Receptacles in patient care spaces shall be tested in accordance with NFPA 99:6.3.3.2.*

517.14 Panelboard Bonding. The equipment grounding terminal buses of the normal and essential branch-circuit

panelboards serving the same individual patient care vicinity shall be connected together with an insulated continuous copper conductor not smaller than 10 AWG. Where two or more panelboards serving the same individual patient care vicinity are served from separate transfer switches on the essential electrical system, the equipment grounding terminal buses of those panelboards shall be connected together with an insulated continuous copper conductor not smaller than 10 AWG. This conductor shall be permitted to be broken in order to terminate on the equipment grounding terminal bus in each panelboard.

Exception: The insulated continuous copper conductor not smaller than 10 AWG shall be permitted to be terminated on listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide (¼ in. thick × 2 in. wide) and of sufficient length to accommodate the number of terminations necessary for the bonding of the panelboards. The busbar shall be securely fastened and installed in an accessible location.

517.16 Use of Isolated Ground Receptacles. An isolated ground receptacle, if used, shall not defeat the purposes of the safety features of the grounding systems detailed in 517.13. [**99:**6.3.2.2.5(A)]

(A) Inside of a Patient Care Vicinity. An isolated ground receptacle shall not be installed within a patient care vicinity. [**99:**6.3.2.2.5(B)]

(B) Outside of a Patient Care Vicinity. Isolated ground receptacle(s) installed in patient care spaces outside of a patient care vicinity(s) shall comply with 517.16(B)(1) and (B)(2).

(1) The equipment grounding terminals of isolated ground receptacles installed in branch circuits for patient care spaces shall be connected to an insulated equipment grounding conductor in accordance with 250.146(D) installed in a wiring method described in 517.13(A).

The equipment grounding conductor connected to the equipment grounding terminals of isolated ground receptacles in patient care spaces shall be clearly identified along the equipment grounding conductor's entire length by green insulation with one or more yellow stripes.

(2) The insulated equipment grounding conductor required in 517.13(B)(1) shall be clearly identified along its entire length by green insulation, with no yellow stripes, and shall not be connected to the grounding terminals of isolated equipment ground receptacles but shall be connected to the box or enclosure indicated in 517.13(B)(1)(2) and to non–current-carrying conductive surfaces of fixed electrical equipment indicated in 517.13(B)(1)(3).

Informational Note No. 1: This type of installation is typically used where a reduction of electrical noise (electromagnetic interference) is necessary, and parallel grounding paths are to be avoided.

Informational Note No. 2: Care should be taken in specifying a system containing isolated ground receptacles, because the impedance of the effective ground-fault current path is dependent upon the equipment grounding conductor(s) and does not benefit from any conduit or building structure in parallel with the equipment grounding conductor.

517.17 Ground-Fault Protection of Equipment.

Δ **(A) Applicability.** The requirements of 517 .17 shall apply to buildings or portions of buildings containing health care facilities with Category 1 spaces or utilizing electrical life-support equipment, and buildings that provide the required essential utilities or services for the operation of Category 1 spaces or electrical life-support equipment.

(B) Feeders. Where ground-fault protection of equipment is provided for operation of the service disconnecting means or feeder disconnecting means as specified by 230.95 or 215.10, an additional step of ground-fault protection shall be provided in all next level feeder disconnecting means downstream toward the load. Such protection shall consist of overcurrent devices and current transformers or other protective equipment that shall cause the feeder disconnecting means to open.

The additional levels of ground-fault protection of equipment shall not be installed on the load side of an essential electrical system transfer switch.

(C) Selectivity. Ground-fault protection of equipment for operation of the service and feeder disconnecting means shall be fully selective such that the feeder device, but not the service device, shall open on ground faults on the load side of the feeder device. Separation of ground-fault protection time-current characteristics shall conform to manufacturer's recommendations and shall consider all required tolerances and disconnect operating time to achieve 100 percent selectivity.

Informational Note: See 230.95, Informational Note, for transfer of alternate source where ground-fault protection is applied.

(D) Testing. When ground-fault protection of equipment is first installed, each level shall be performance tested to ensure compliance with 517.17(C). This testing shall be conducted by a qualified person(s) using a test process in accordance with the instruction provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.

Δ 517.18 Category 2 Spaces.

Δ **(A) Patient Bed Location.** Each patient bed location shall be supplied by at least two branch circuits, one from the critical branch and one from the normal system. All branch circuits from the normal system shall originate in the same panelboard. The electrical receptacles or the cover plate for the electrical receptacles supplied from the critical branch shall have a distinctive color or marking so as to be readily identifiable and shall also indicate the panelboard and branch-circuit number supplying them.

Branch circuits serving patient bed locations shall not be part of a multiwire branch circuit.

Exception No. 1: Branch circuits serving only special-purpose outlets or receptacles, such as portable X-ray outlets, shall not be required to be served from the same distribution panel or panels.

Exception No. 2: The requirements of 517.18(A) shall not apply to patient bed locations in clinics, medical and dental offices, and outpatient facilities; psychiatric, substance abuse, and rehabilitation hospitals; sleeping rooms of nursing homes; and limited care facilities meeting the requirements of 517.10(B)(2).

Exception No. 3: A Category 2 patient bed location served from two separate transfer switches on the critical branch shall not be required to have circuits from the normal system.

Exception No. 4: Circuits served by Type 2 essential electrical systems shall be permitted to be fed by the equipment branch of the essential electrical system.

(B) Patient Bed Location Receptacles.

(1) Minimum Number and Supply. Each patient bed location shall be provided with a minimum of eight receptacles.

(2) Receptacle Requirements. The receptacles required in 517.18(B)(1) shall be permitted to be of the single, duplex, or quadruplex type or any combination of the three. All receptacles shall be listed "hospital grade" and shall be so identified. The grounding terminal of each receptacle shall be connected to an insulated copper equipment grounding conductor sized in accordance with Table 250.122.

Exception No. 1: The requirements of 517.18(B)(1) and (B)(2) shall not apply to psychiatric, substance abuse, and rehabilitation hospitals meeting the requirements of 517.10(B)(2).

Exception No. 2: Psychiatric security rooms shall not be required to have receptacle outlets installed in the room.

Exception No. 3: ***[OSHPD 1 & 5]*** *Psychiatric patient bedrooms shall not be required to have receptacle outlets installed in the room. If installed, the receptacles shall be tamper-resistant, controlled by a switch outside the room that is under the control of staff, and shall be protected by a ground-fault circuit interrupter.*

Exception No. 4: ***[OSHPD 1 & 1R]*** *Outpatient Observation bed and gurney locations shall be provided with a minimum of four receptacles.*

Informational Note: It is not intended that there be a total, immediate replacement of existing non–hospital grade receptacles. It is intended, however, that non–hospital grade receptacles be replaced with hospital grade receptacles upon modification of use, renovation, or as existing receptacles need replacement.

Δ **(C) Designated Category 2 Pediatric Locations.** Receptacles that are located within patient rooms, bathrooms, playrooms, and activity rooms of pediatric units or spaces with similar risk as determined by the health care facility's governing body by conducting a risk assessment, other than infant nurseries, shall be listed and identified as "tamper resistant" or shall employ a listed tamper-resistant cover. [**99:**6.3.2.2.1(D)]

(D) [OSHPD 1 & 4] Nursery receptacles. *One duplex receptacle shall be provided for every two bassinets.*

Δ 517 .19 Category 1 Spaces.

Δ **(A) Patient Bed Location Branch Circuits.** Each patient bed location shall be supplied by at least two branch circuits, one or more from the critical branch and one or more from the normal system. At least one branch circuit from the critical branch shall supply an outlet(s) only at that bed location.

The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety and critical branches shall have a distinctive color or marking so as to be readily identifiable. [**99:**6.7.2.2.5(B)]

All branch circuits from the normal system shall be from a single panelboard. Critical branch receptacles shall be identified and shall also indicate the panelboard and circuit number supplying them.

Branch circuits serving patient bed locations shall not be part of a multiwire branch circuit.

Exception No. 1: Branch circuits serving only special-purpose receptacles or equipment in Category 1 spaces shall be permitted to be served by other panelboards.

Exception No. 2: Category 1 spaces served from two separate critical branch transfer switches shall not be required to have circuits from the normal system.

(B) Patient Bed Location Receptacles.

Δ **(1) Minimum Number and Supply.** Each patient bed location shall be provided with a minimum of 14 receptacles, with at least one connected to either of the following:

(1) The normal system branch circuit required in 517.19(A)
(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same patient bed location

[OSHPD 1, 2, 4 & 5] *Exception: Beds subject to the requirements of 517.40(B) shall be provided with a minimum of eight receptacles.*

(2) Receptacle Requirements. The receptacles required in 517.19(B)(1) shall be permitted to be of the single, duplex, or quadruplex type or any combination of the three. All receptacles shall be listed "hospital grade" and shall be so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.

(C) Operating Room Receptacles.

(1) Minimum Number and Supply. Each operating room shall be provided with a minimum of 36 receptacles divided between at least two branch circuits. At least 12 receptacles, but no more than 24, shall be connected to either of the following:

(1) The normal system branch circuit required in 517.19(A)
(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same location

(2) Receptacle Requirements. The receptacles shall be permitted to be of the locking or nonlocking type and of the single, duplex, or quadruplex types or any combination of the three.

All nonlocking-type receptacles shall be listed hospital grade and so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.

(D) Patient Care Vicinity Grounding and Bonding (Optional). A patient care vicinity shall be permitted to have a patient equipment grounding point. The patient equipment grounding point, where supplied, shall be permitted to contain one or more listed grounding and bonding jacks. An equipment bonding jumper not smaller than 10 AWG shall be used to connect the grounding terminal of all grounding-type receptacles to the patient equipment grounding point. The bonding conductor shall be permitted to be arranged centrically or looped as convenient.

Informational Note: Where there is no patient equipment grounding point, it is important that the distance between the reference grounding point and the patient care vicinity be as short as possible to minimize any potential differences.

(E) Equipment Grounding and Bonding. Where a grounded electrical distribution system is used and metal feeder raceway or Type MC or MI cable that qualifies as an equipment grounding conductor in accordance with 250.118 is installed, grounding of enclosures and equipment, such as panelboards, switchboards, and switchgear, shall be ensured by one of the following bonding means at each termination or junction point of the metal raceway or Type MC or MI cable:

(1) A grounding bushing and a continuous copper bonding jumper, sized in accordance with 250.122, with the bonding jumper connected to the junction enclosure or the ground bus of the panel
(2) Connection of feeder raceways or Type MC or MI cable to threaded hubs or bosses on terminating enclosures
(3) Other approved devices such as bonding-type locknuts or bushings. Standard locknuts shall not be used for bonding.

Δ **(F) Additional Protective Techniques in Category 1 Spaces (Optional).** Isolated power systems shall be permitted to be used for Category 1 spaces, and, if used, the isolated power system equipment shall be listed as isolated power equipment. The isolated power system shall be designed and installed in accordance with 517.160.

Exception: The audible and visual indicators of the line isolation monitor shall be permitted to be located at the nursing station for the area being served.

(G) Isolated Power System Equipment Grounding. Where an isolated ungrounded power source is used and limits the first-fault current to a low magnitude, the equipment grounding conductor associated with the secondary circuit shall be permitted to be run outside of the enclosure of the power conductors in the same circuit.

Informational Note: Although it is permitted to run the equipment grounding conductor outside of the conduit, it is safer to run it with the power conductors to provide better protection in case of a second ground fault.

(H) Special-Purpose Receptacle Grounding. The equipment grounding conductor for special-purpose receptacles, such as the operation of mobile X-ray equipment, shall be extended to the reference grounding points of branch circuits for all locations likely to be served from such receptacles. Where such a circuit is served from an isolated ungrounded system, the equipment grounding conductor shall not be required to be run with the power conductors; however, the equipment grounding terminal of the special-purpose receptacle shall be connected to the reference grounding point.

517.20 Wet Procedure Locations. *[OSHPD 1, 3 & 4] Operating rooms shall be considered to be a wet procedure location unless a risk assessment conducted by the health care governing body determines otherwise. [99:6.3.2.3.4]* C

Δ **(A) Receptacles and Fixed Equipment.** Wet procedure locations shall be provided with special protection against electric shock. [**99:**6.3.2.3.1]

This special protection shall be provided by one of the following:

(1) Isolated power systems that remain in operation in the event of a single line-to-ground fault condition that inherently limits the possible ground-fault current due to a first fault to a low value, without interrupting the power supply

Informational Note No. 1: Isolated power systems can eliminate the danger of electric shock to patients who might be more susceptible to leakage current and unable to move in their beds.

(2) Power distribution system in which the power supply is interrupted if the ground-fault current does, in fact, exceed the trip value of a Class A GFCI

Informational Note No. 2: See Annex E of ANSI/UL 943-2018, *Ground-Fault Circuit-Interrupters*, and 110.3(B) for the manufacturers' installation instructions of listed ground-fault circuit interrupters for information on the supply connection of life-support equipment to circuits providing ground-fault circuit-interrupter (GFCI) protection of personnel at outlets.

[**99:**6.3.2.3.2]

(3) *[OSHPD 1, 3 & 4] Where GFCI protection is used in an operating room, one of the following shall apply:* C A C A C A

(a) Each receptacle shall be an individual GFCI device.
(b) Each receptacle shall be individually protected by a single GFCI device. [99:6.3.2.3.9]

Exception: Branch circuits supplying only listed, fixed, therapeutic, and diagnostic equipment shall be permitted to be supplied from a grounded service, single- or 3-phase system if the following conditions are met:

(1) Wiring for grounded and isolated circuits does not occupy the same raceway.
(2) All conductive surfaces of the equipment are connected to an insulated copper equipment grounding conductor.

Δ **(B) Isolated Power Systems.** Where an isolated power system is utilized, the isolated power equipment shall be listed as isolated power equipment, and the isolated power system shall be designed and installed in accordance with 517.160.

Informational Note: See Part IV of Article 680 for requirements on the installation of therapeutic pools and tubs.

Δ **517.21 Ground-Fault Circuit-Interrupter Protection for Personnel in Category 2 and Category 1 Spaces.** Receptacles shall not be required in bathrooms or toilet rooms. [99:6.3.2.2.2(D)]

Receptacles located in patient bathrooms and toilet rooms in Category 2 spaces shall have ground-fault circuit-interrupter protection in accordance with 210.8(B)(1).

Ground-fault circuit-interrupter protection for personnel shall not be required for receptacles installed in those Category 2 and Category 1 spaces where a basin, sink, or other similar plumbing fixture is installed in the patient bed location.

Informational Note: See ANSI/UL 943-2018, *Ground-Fault Circuit-Interrupters*, Annex E, and, in accordance with 110.3(B), the manufacturers' installation instructions of listed ground-fault circuit interrupters for information on the supply connection of life-support equipment to circuits providing ground-fault circuit-interrupter (GFCI) protection of personnel at outlets.

N **517.22 Demand Factors.** Demand factors for receptacle loads supplied by branch circuits not exceeding 150 volts to ground and installed in Category 1, Category 2, Category 3, and Category 4 patient care spaces shall be in accordance with 220.110.

Informational Note: See Article 100 for the definitions of patient care space categories.

Part III. Essential Electrical System (EES)

517.25 Essential Electrical Systems for Health Care Facilities. Type 1 and Type 2 essential electrical systems (EES) for health care facilities shall comprise separate branches capable of supplying a limited amount of lighting and power service, which is considered essential for life safety and orderly cessation of procedures during the time normal electrical service is interrupted for any reason.

Informational Note: See NFPA 99-2021, *Health Care Facilities Code*, for information on essential electrical systems.

517.26 Application of Other Articles. The life safety branch *[OSHPD 1, 2, 3, 4 & 5] critical branch, and equipment branch* of the essential electrical system shall meet the requirements of Article 700, except as amended as follows:

(1) Section 700.4 shall not apply.
(2) Section 700.10(D) shall not apply.
(3) Section 700.17 shall be replaced with the following: Branch circuits that supply emergency lighting shall be installed to provide service from a source in accordance with 700.12 when normal supply for lighting is interrupted or where single circuits supply luminaires containing secondary batteries.
(4) Section 700.32 shall not apply.

Informational Note No. 1: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, for additional information.

Informational Note No. 2: See 517.29 and NFPA 99-2021, *Health Care Facilities Code*, for additional information.

517.29 Type 1 Essential Electrical Systems. Informational Note: Type 1 essential electrical systems are comprised of three separate branches capable of supplying a limited amount of lighting and power service that is considered essential for life safety and effective facility operation during the time the normal electrical service is interrupted for any reason. These three separate branches are the life safety, critical, and equipment branches. [**99:**A.6.7.2.3]

Δ **(A) Applicability.** The requirements of 517 .29 through 517.35 shall apply to Type 1 essential electrical systems. Type 1 systems shall be required for Category 1 spaces. Type 1 systems shall be permitted to serve Category 2, Category 3, and Category 4 spaces.

(A.1) [OSHPD 1, 2, 3 (Surgical Clinics only), 4 & 5] Applicability. *The requirements of Part III, 517.29 through 517.35, shall apply to hospitals, facilities subject to the requirements of 517.40(B), clinics subject to the requirements of 517.45(B) or (C), correctional treatment centers and acute psychiatric hospitals providing critical care (Category 1) services.* ‖

Informational Note No. 1: See NFPA 99-2021, *Health Care Facilities Code*, for performance, maintenance, and testing requirements of essential electrical systems in hospitals. See NFPA 20-2019, *Standard for the Installation of Stationary Pumps for Fire Protection*, for installation of centrifugal fire pumps.

Informational Note No. 2: See NFPA 99-2021, *Health Care Facilities Code*, 6.7.5 and 6.7.6, for additional information on Type 1 and Type 2 essential electrical systems.

Δ **(B) Type 1 Essential Electrical Systems.** Category 1 spaces shall be served by a Type 1 essential electrical system. [**99:**6.4.1]

Category 1 spaces shall not be served by a Type 2 EES. [**99:**6.4.2]

c. Pharmacy dispensing spaces
d. Nurses' stations — unless adequately lighted by corridor luminaires

(3) Additional specialized patient care task illumination and receptacles, where needed
(4) Nurse call systems

[OSHPD 1, 2, 3, 4 & 5] Exception: Battery-powered components of wireless emergency nurse call systems complying with the latest edition of ANSI/UL 1069, Standard for Hospital Signaling and Nurse Call Equipment.

(5) Blood, bone, and tissue banks
(6) Telecommunications entrance facility, telecommunications equipment rooms, and telecommunication rooms and equipment in these rooms
(7) Task illumination, select receptacles, and select power circuits for the following areas:

a. Category 1 or 2 spaces with at least one duplex receptacle per patient bed location, and task illumination as required by the governing body of the health care facility
b. Angiographic labs
c. Cardiac catheterization labs
d. Coronary care units
e. Hemodialysis rooms or areas
f. Emergency room treatment areas (select)
g. Human physiology labs
h. Intensive care units
i. Postoperative recovery rooms (select)

‖ ***[Subsections j through k OSHPD 1, 2, 3 (surgery clinics), 4 & 5]***

j. Food preparation areas, central supply, and utility rooms
k. Electrical and mechanical rooms
*l. **[OSHPD 1]** Imaging room containing imaging equipment approved by Licensing Agency for diagnostic services of emergency/trauma patients found in California Building* ‖ *Code Section 1705A.14.3.1.7. Imaging equipment shall be connected to critical branch or equipment branch.*

(8) Clinical IT-network equipment
(9) Wireless phone and paging equipment for clinical staff communications
(10) Additional task illumination, receptacles, and select power circuits needed for effective facility operation, including single-phase fractional horsepower motors, which are permitted to be connected to the critical branch

[**99:**6.7.5.1.3.2]

*(11) **[OSHPD 1, 2, 3, 4 & 5]** The following equipment:*

a. Electric clocks required by California Building Code, where direct wired.
b. Sensor-operated fixtures required by California Plumbing Code, where direct wired.
c. Alarm systems for monitoring negative pressure isolation rooms and positive pressure isolation rooms.
d. Medication dispensing units.
e. Medication refrigerators and freezers.
f. Patient food refrigeration (single phase only).
g. Pharmacy compounding engineering controls such as hoods, laminar airflow workbenches, biological safety cabinets and barrier isolators.

(B) Switching. It shall be permitted to control task illumination on the critical branch.

Δ **(C) Subdivision of the Critical Branch.** The critical branch shall be permitted to be subdivided into two or more branches. [**99:**6.7.5.1.3.1]

Informational Note: It is important to analyze the consequences of supplying an area with only critical branch power when failure occurs between the area and the transfer switch. Some proportion of normal and critical power or critical power from separate transfer switches might be appropriate.

517.35 Equipment Branch Connection to Alternate Power Source. The equipment branch shall be installed and connected to the alternate power source such that the equipment described in 517.35(A) is automatically restored to operation at appropriate time-lag intervals following the energizing of the life safety and critical branches. [**99:**6.7.5.1.4.2(A)]

The arrangement of the connection to the alternate power source shall also provide for the subsequent connection of equipment described in 517.35(B). [**99:**6.7.5.1.4.2(B)]

Exception: For essential electrical systems under 150 kVA, deletion of the time-lag intervals feature for delayed automatic connection to the equipment system shall be permitted.

(A) Equipment for Delayed Automatic Connection. The following equipment shall be permitted to be arranged for delayed automatic connection to the alternate power source:

(1) Central suction systems serving medical and surgical functions, including controls, with such suction systems permitted to be placed on the critical branch
(2) Sump pumps and other equipment required to operate for the safety of major apparatus, including associated control systems and alarms
(3) Compressed air systems serving medical and surgical functions, including controls with such air systems permitted to be placed on the critical branch
(4) Smoke control and stair pressurization systems
(5) Kitchen hood supply or exhaust systems, or both, if required to operate during a fire in or under the hood
(6) Supply, return, and exhaust ventilating systems for the following:

a. Airborne infectious/isolation rooms
b. Protective environment rooms
c. Exhaust fans for laboratory fume hoods
d. Nuclear medicine areas where radioactive material is used
e. Ethylene oxide evacuation
f. Anesthetic evacuation

[**99:**6.7.5.1.4.3(A)]

Where delayed automatic connection is not appropriate, the ventilation systems specified in 517.35(A)(6) shall be permitted to be placed on the critical branch. [**99:**6.7.5.1.4.3(B)]

(7) Supply, return, and exhaust ventilating systems for operating and delivery rooms
(8) Supply, return, exhaust ventilating systems and/or air-conditioning systems serving telephone equipment rooms and closets and data equipment rooms and closets
*(9) **[OSHPD 1, 2, 3 (surgical clinics), 4 & 5]** Equipment as required in the Essential Plumbing Provisions of the California Plumbing Code*

Exception: Sequential delayed automatic connection to the alternate power source to prevent overloading the generator shall be permitted where engineering studies indicate it is necessary.

Δ **(B) Equipment for Delayed Automatic or Manual Connection.** The following equipment shall be permitted to be arranged for either delayed automatic or manual connection to the alternate power source:

(1) Heating equipment to provide heating for operating, delivery, labor, recovery, intensive care, coronary care, nurseries, infection/isolation rooms, emergency treatment spaces, and general patient rooms and pressure maintenance (jockey or make-up) pump(s) for water-based fire protection systems

Exception: Heating of general patient rooms and infection/isolation rooms during disruption of the normal source shall not be required under any of the following conditions:

(1) The outside design temperature is higher than −6.7°C (20°F).
(2) The outside design temperature is lower than −6.7°C (20°F), and where a selected room(s) is provided for the needs of all confined patients, only such room(s) need be heated.
(3) The facility is served by a dual source of normal power.

*(1.1) **[OSHPD 1, 2, 3 (surgery clinics), 4 & 5]** Heating, ventilating and cooling equipment as required by the California Mechanical Code.*

*(1.2) **[OSPHD 1, 2, 3 (surgery clinics), 4 & 5]** Pressure maintenance (jockey or make-up) pumps for water-based fire suppression systems.*

Informational Note No. 1: The design temperature is based on the 97.5 percent design value as shown in Chapter 24 of the ASHRAE *Handbook of Fundamentals* (2013).

Informational Note No. 2: See 517.30(C) for a description of a dual source of normal power.

(2) An elevator(s) selected to provide service to patient, surgical, obstetrical, and ground floors during interruption of normal power. In instances where interruption of normal power would result in other elevators stopping between floors, throw-over facilities shall be provided to allow the temporary operation of any elevator for the release of patients or other persons who may be confined between floors.
(3) Hyperbaric facilities.
(4) Hypobaric facilities.
(5) Automatically operated doors.
(6) Minimal electrically heated autoclaving equipment shall be permitted to be arranged for either automatic or manual connection to the alternate source.
(7) Controls for equipment listed in 517.35.
(8) Other selected equipment shall be permitted to be served by the equipment system. [**99:**6.7.5.1.4.4]

Δ 517.40 Type 2 Essential Electrical Systems *for Nursing Homes and Limited Care Facilities [OSHPD 2], Correctional Treatment Centers and Acute Psychiatric Hospitals [OSHPD 4 & 5].*

Informational Note No. 1: Nursing homes and other limited care facilities can contain Category 1 and/or Category 2 patient care spaces, depending on the design and type of care administered in the facility. For Category 1 spaces, see 517.29 through 517.35. For Category 2 spaces not served by Type 1 essential electrical systems, see 517.40 through 517.44.

Informational Note No. 2: Type 2 essential electrical systems are comprised of two separate branches capable of supplying a limited amount of lighting and power service that is considered essential for the protection of life and safety and effective operation of the institution during the time normal electrical service is interrupted for any reason. These two separate branches are the life safety and equipment branches. The number of transfer switches to be used should be based upon reliability, design, and load considerations. Each branch of the essential electrical system should have one or more transfer switches. One transfer switch should be permitted to serve one or more branches in a facility with a maximum demand on the essential electrical system of 150 kVA (120 kW). [**99:**A.6.7.6.2.1]

Δ **(A) Applicability.** The requirements of 517.40(C) through 517.44 shall apply to Category 2 spaces.

Exception: The requirements of 517.40(C) through 517.44 shall not apply to freestanding buildings used as nursing homes and limited care facilities if the following apply:

(1) Admitting and discharge policies are maintained that preclude the provision of care for any patient or resident who might need to be sustained by electrical life-support equipment.
(2) No surgical treatment requiring general anesthesia is offered.
(3) An automatic battery-operated system(s) or equipment shall be effective for at least 1½ hours and is otherwise in accordance with 700.12 and that shall be capable of supplying lighting for exit lights, exit corridors, stairways, nursing stations, medical preparation areas, boiler rooms, and communications areas. This system shall also supply power to operate all alarm systems.

Informational Note: See NFPA *101*-2021, *Life Safety Code*.

C A C A *(A.1) [OSHPD 2, 4 & 5] Applicability. The requirements of Part C, Section 517.40(C) through 517.44, shall apply to nursing homes, intermediate and skilled nursing facilities, and correctional treatment centers and acute psychiatric hospitals not subject to 517.29(A.1).*

Δ **(B) Category 1 Spaces in Inpatient Hospital Care Facilities.** For those nursing homes and limited care facilities that admit patients who need to be sustained by electrical life-support equipment, the essential electrical system from the source to the portion of the facility where such patients are treated shall comply with the requirements of 517.29 through 517.35.

Δ **(C) Facilities Contiguous or Located on the Same Site with Hospitals.** Nursing homes and limited care facilities that are contiguous or located on the same site with a hospital shall be permitted to have their essential electrical systems supplied by the hospital.

517.41 Required Power Sources.

Δ **(A) Independent Power Sources.** Essential electrical systems (EES) shall have two or more independent sources (or sets of sources). One on-site source (or sets of sources) shall be sized to supply the entire EES. The other independent source (or sets of sources) shall be sized to supply the entire EES and shall be permitted to be located on-site or off-site. Additional sources other than the first two independent sources shall be permitted to be sized to supply the intended load.

Informational Note: An example of a set of sources may be several generators that combined serve the entire EES.

(A.1) [OSHPD 2, 4 & 5] Two Independent Power Sources. The Essential Electrical System (EES) shall be served by two or more independent sources (or sets of sources). In addition to the Electric Power Sources called out in 517.4, each healthcare facility shall have one on-site source (or sets of sources) sized to supply the entire EES. Both sources (entire site and EES) can share resources, however neither source (or sets of sources) shall depend on resources from the other to meet calculated load values for loads they are designated to feed.

Clearly indicate on design documents all EES components.

The two independent sources (or sets of sources) shall be located to reduce the likelihood of simultaneous interruption of EES components and non-EES components.

(B) Location of EES Components. EES components shall be located to minimize interruptions caused by natural forces common to the area (e.g., storms, floods, earthquakes, or hazards created by adjoining structures or activities). [**99:**6.2.4.1]

Installations of electrical services shall be located to reduce possible interruption of normal electrical services resulting from similar causes as well as possible disruption of normal electrical service due to internal wiring and equipment failures. [**99:**6.2.4.2]

Feeders shall be located to provide physical separation of the feeders of the alternate source and from the feeders of the normal electrical source to prevent possible simultaneous interruption. [**99:**6.2.4.3] >

(C) [OSHPD 2, 4 & 5] Power Sources for the EES. Power sources for the EES shall be permitted to be any of those listed in 517.30(B)(1) through (B)(5).

(D) [OSHPD 2, 4 & 5] Permanent Connection(s) Points for EES Maintenance and Repairs. Permanent connection(s) points shall be provided for the connection of temporary or permanent on-site storage or power sources configured and sized adequately to provide power for the EES, such that additional resources can be connected (without rewiring) to meet essential power requirements for equipment failures or maintenance.

517.42 Essential Electrical Systems for Nursing Homes and Limited Care Facilities.

(A) General. The [Type 2] essential electrical system shall be divided into the following two branches:

(1) Life safety branch
(2) Equipment branch
[**99:**6.7.6.2.1.2]

The division between the branches shall occur at transfer switches where more than one transfer switch is required. [**99:**6.7.2.2.1]

Informational Note No. 1: Type 2 essential electrical systems are comprised of two separate branches capable of supplying a limited amount of lighting and power service that is considered essential for the protection of life and safety and effective operation of the institution during the time normal electrical service is interrupted for any reason. These two separate branches are the life safety and equipment branches. [**99:**A.6.7.6.2.1]

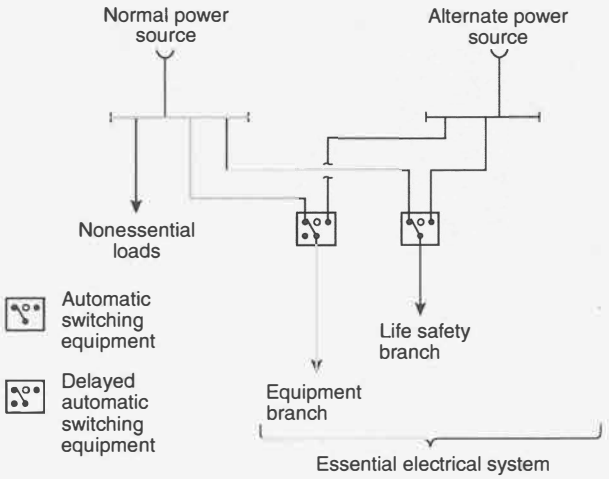
Informational Note No. 2: The number of transfer switches to be used should be based upon reliability, design, and load considerations. Each branch of the essential electrical system should have one or more transfer switches. One transfer switch should be permitted to serve one or more branches in a facility with a maximum demand on the essential electrical system of 150 kVA (120 kW). [**99:**A.6.7.6.2.1]

Informational Note No. 3: See NFPA 99-2021, *Health Care Facilities Code*, 6.7.2.2, for more information.

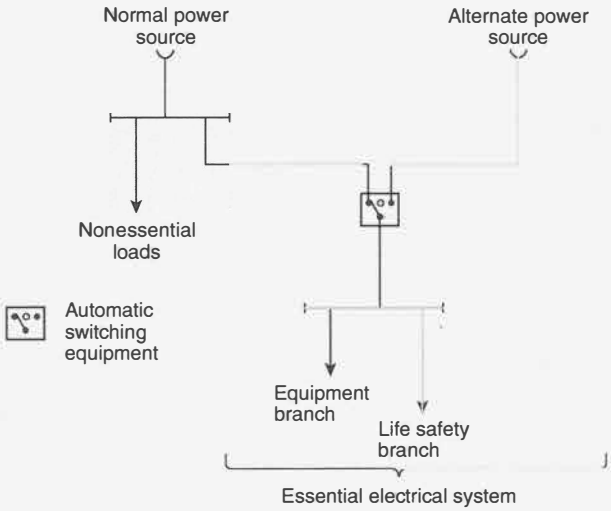
Δ **(B) Transfer Switches.** The number of transfer switches to be used shall be based upon reliability, design, and load considerations. [**99:**6.7.2.2.3]

Transfer switches shall be in accordance with one of the following:

(1) Each branch of the essential electrical system shall have one or more transfer switches. [**99:**6.7.2.2.3.1]
(2) One transfer switch shall be permitted to serve one or more branches in a facility with a continuous load on the switch of 150 kVA (120 kW) or less. [**99:**6.7.2.2.3.2]



Δ **Informational Note Figure 517.42(B)(1) Type 2 Essential Electrical Systems (Nursing Home and Limited Health Care Facilities) — Minimum Requirement (Greater Than 150 kVA) for Transfer Switch Arrangement.**



Δ **Informational Note Figure 517.42(B)(2) Type 2 Essential Electrical Systems (Nursing Home and Limited Health Care Facilities) — Minimum Requirement (150 kVA or Less) for Transfer Switch Arrangement.**

*(3) **[OSHPD 2 & 4]** Transfer switches installed in skilled nursing facilities meeting the requirements of Article 517.40(B) shall comply with Article 517.31(B)(3).*

Informational Note No. 1: See NFPA 99-2021, *Health Care Facilities Code*, 6.7.2.2.4, 6.7.2.2.5, 6.7.2.2.5.15, and 6.7.2.2.7 for more information on transfer switches.

Informational Note No. 2: See Informational Note Figure 517.42(B)(1).

Informational Note No. 3: See Informational Note Figure 517.42(B)(2).

(C) Capacity of System. The essential electrical system shall have capacity to meet the demand for the operation of all functions and equipment to be served by each branch at one time.

(D) Separation from Other Circuits. The life safety branch and equipment branch shall be kept entirely independent of all other wiring and equipment. [**99:**6.7.6.3.1]

These circuits shall not enter the same raceways, boxes, or cabinets with other wiring except as follows:

(1) In transfer switches
(2) In exit or emergency luminaires supplied from two sources
(3) In a common junction box attached to exit or emergency luminaires supplied from two sources

(E) Receptacle Identification. The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety or equipment branches shall have a distinctive color or marking so as to be readily identifiable. **[99:**6.7.6.3.2]

Informational Note: If color is used to identify these receptacles, the same color should be used throughout the facility. [**99:**A.6.7.6.3.2]

***(F) Coordination. [OSHPD 2, 4 & 5]** Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second.*

Exception No. 1: Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

Exception No. 2: Between overcurrent protective devices of the same size (ampere rating) in series.

Informational Note No. 1: The terms coordination and coordinated as used in this section do not cover the full range of overcurrent conditions.

Informational Note No. 2: See 517.17(C) for information on requirements for the coordination of ground-fault protection.

***(G) [SFM, OSHPD 2, 4 & 5] On-site energy storage systems and fuel supply.** The on-site Essential Electrical System sources (or set of sources) shall have sufficient resources on-site to provide continuous essential power as follows:*

***(1) [SFM, OSHPD 2, 4 & 5]** For the following health facilities of seven or more beds: correctional treatment centers that provide only basic services, acute psychiatric hospitals, intermediate care facilities, and skilled nursing facilities, on-site resources shall be available at all times sufficient to support not less than 6 hours at full output of the required Emergency Power Supply System (EPSS). On-Site fuel for redundant power sources is not required (i.e., for N+1 generators fuel is required for N generators only).*

***(2) [SFM, OSHPD 2]** For skilled nursing facilities that have an alternate source of power that is independent of the EES that*

provides power for mechanical equipment required to maintain safe temperatures, life-saving equipment and oxygen generating devices to meet requirements of 517.1(B), sufficient onsite fuel (or contractual arrangement) shall be provided to operate the EPSS for 96 hours.

517.43 Automatic Connection to Life Safety and Equipment Branch. The life safety and equipment branches shall be installed and connected to the alternate source of power specified in 517.41 so that all functions specified herein for the life safety and equipment branches are automatically restored to operation within 10 seconds after interruption of the normal source. [**99:**6.7.6.4.1]

No functions other than those listed in 517.43(A) through (G) shall be connected to the life safety branch. [**99:**6.7.6.2.1.5(D)]

The life safety branch shall supply power as follows:

(A) Illumination of Means of Egress. Illumination of means of egress as is necessary for corridors, passageways, stairways, landings, and exit doors and all ways of approach to exits. Switching arrangement to transfer patient corridor lighting from general illumination circuits shall be permitted if only one of two circuits can be selected and both circuits cannot be extinguished at the same time.

Informational Note: See NFPA *101*-2021, *Life Safety Code*, Sections 7.8 and 7.9.

(B) Exit Signs. Exit signs and exit directional signs.

Informational Note: See NFPA *101*-2021, *Life Safety Code*, Section 7.10.

(C) Alarm and Alerting Systems. Alarm and alerting systems, including the following:

(1) Fire alarms

Informational Note No. 1: See NFPA *101*-2021, *Life Safety Code*, Sections 9.6 and 18.3.4.

(2) Alarms required for systems used for the piping of nonflammable medical gases

Informational Note No. 2: See NFPA 99-2021, *Health Care Facilities Code*, 6.7.5.1.2.5.

(D) Communications Systems. Communications systems, where used for issuing instructions during emergency conditions. [**99:**6.7.5.1.2.4(3)]

(E) Generator Set Location. Task illumination and select receptacles at the generator set location and essential electrical system transfer switch locations.

(F) Elevators. Elevator cab lighting, control, communications, and signal systems. [**99:**6.7.5.1.2.4(5)]

(G) AC Equipment for Nondelayed Automatic Connection. Generator accessories, including, but not limited to, the transfer fuel pump, electrically operated louvers, and other generator accessories essential for generator operation shall be arranged for automatic connection to the alternate power source. [**99:**6.7.6.2.1.6(C)]

517.44 Connection to Equipment Branch. The equipment branch shall be installed and connected to the alternate power source such that equipment described in 517.35(A)(6) is automatically restored to operation at appropriate time-lag intervals following the energizing of the life safety and critical branches. [**99:**6.7.5.1.4.2(A)]

[OSHPD 2, 4 & 5] *The equipment branch shall be installed and connected to the alternate power source such that equipment described in 517.44(A) is automatically restored to operation at appropriate time-lag intervals following the energizing of the life safety. [99:6.7.5.1.4.2(A)]*

The equipment branch arrangement shall also provide for the additional connection of equipment listed in 517.44(B).

Exception: For essential electrical systems under 150 kVA, deletion of the time-lag intervals feature for delayed automatic connection to the equipment branch shall be permitted.

(A) Delayed Automatic Connections to Equipment Branch. The following equipment shall be permitted to be connected to the equipment branch and shall be arranged for delayed automatic connection to the alternate power source:

(1) Task illumination and select receptacles in the following: [**99:**6.7.6.2.1.6(D)(1)]
   a. Patient care spaces [99:6.7.6.2.1.6(D)(1)(a)] ***[OSHPD 5]*** *Receptacles not required for psychiatric patient beds. Follow 517.18(B) Exception No. 4 requirements if receptacles are provided.*
   b. Medication preparation spaces [**99:**6.7.6.2.1.6(D)(1)(b)]
   c. Pharmacy dispensing space [**99:**6.7.6.2.1.6(D)(1)(c)]
   d. Nurses' stations — unless adequately lighted by corridor luminaires [**99:**6.7.6.2.1.6(D)(1)(d)]
(2) Supply, return, and exhaust ventilating systems for airborne infectious isolation rooms [**99:**6.7.6.2.1.6(D)(2)]
(3) Sump pumps and other equipment required to operate for the safety of major apparatus and associated control systems and alarms [**99:**6.7.6.2.1.6(D)(3)]
(4) Smoke control and stair pressurization systems [**99:**6.7.6.2.1.6(D)(4)]
(5) Kitchen hood supply or exhaust systems, or both, if required to operate during a fire in or under the hood [**99:**6.7.6.2.1.6(D)(5)]
(6) Nurse call systems [**99:**6.7.6.2.1.6(D)(6)]

[OSHPD 1, 2, 4 & 5] *Exception No. 1: Battery powered components of wireless emergency nurse call systems complying with the latest edition of ANSI/UL 1069, Standard for Hospital Signaling and Nurse Call Equipment.*

[OSHPD 2 & 4] *Exception No. 2: Existing nurse call systems may remain on the life safety branch.*

(7) [OSHPD 1, 2, 4 & 5] Selected receptacles in patient rooms or corridors so that any patient bed can be reached with a fifty (50) foot extension cord.

(8) [OSHPD 1, 2, 4 & 5] Task lighting and at least one receptacle in electrical and mechanical rooms.

(9) [OSHPD 1, 2, 3, 4 & 5] Sensor-operated fixtures required by the California Plumbing Code, where direct wired.

(10) [OSHPD 1, 2, 4 & 5] Equipment as required in the Essential Plumbing Provisions of the California Plumbing Code.

Δ **(B) Delayed-Automatic or Manual Connection to the Equipment Branch.** The equipment specified in 517.44(B)(1) through (B)(4) shall be permitted to be connected to the equipment branch and shall be arranged for either delayed-automatic or manual connection to the alternate power source.

N **(1) Heating Equipment to Provide Heating for General Patient Rooms.** Heating of general patient rooms during disruption of the normal source shall not be required under any of the following conditions:

(1) The outside design temperature is higher than −6.7°C (20°F).

(2) The outside design temperature is lower than −6.7°C (20°F) and, where a selected room(s) is provided for the needs of all confined patients, then only such room(s) need be heated.

(3) The facility is served by a dual source of normal power as described in 517.30(C), Informational Note.

Informational Note: The outside design temperature is based on the 97.5 percent design values, as shown in Chapter 24 of the ASHRAE *Handbook of Fundamentals* (2013).

(1.1) [OSHPD 1, 2, 4 & 5] Heating, ventilating, and cooling equipment as required by California Mechanical Code.

N **(2) Elevator Service.** In instances where interruptions of power would result in elevators stopping between floors, throw-over facilities shall be provided to allow the temporary operation of any elevator for the release of passengers.

N **(3) Optional Connections to the Equipment Branch.** Additional illumination, receptacles, and equipment shall be permitted to be connected only to the equipment branch.

N **(4) Multiple Systems.** Where one switch serves multiple systems as permitted in 517.43, transfer for all loads shall be non-delayed automatic.
[**99:**6.7.6.2.1.6(E)]

Informational Note: See 517.43(G) for elevator cab lighting, control, and signal system requirements. [**99:**A.6.7.6.2.1.6(E)(2)]

517.45 Essential Electrical Systems for Other Health Care Facilities.

Δ **(A) Essential Electrical Distribution.** If required by the governing body, the essential electrical distribution system for Category 3 patient care spaces shall be comprised of an alternate power system capable of supplying a limited amount of lighting and power service for the orderly cessation of procedures during a time normal electrical service is interrupted.

Informational Note: See NFPA 99-2021, *Health Care Facilities Code.*

(B) Electrical Life Support Equipment. Where electrical life support equipment is required, the essential electrical distribution system shall be as described in 517.29 through 517.30.

Δ **(C) Category 1 Patient Care Spaces.** Where Category 1 patient care spaces are present, the essential electrical distribution system shall be in accordance with 517.29 through 517.30.

Δ **(D) Category 2 Patient Care Spaces.** Where Category 2 patient care spaces are present, the essential electrical distribution system shall be in accordance with 517.40 through 517.45.

(E) Power Systems. If required, alternate power sources acceptable to the governing body shall comply with the requirements of NFPA 99-2021, *Health Care Facilities Code*.

(E.1) [OSHPD 3 (Surgical Clinics only)]. *The essential electrical systems for ambulatory surgical clinics shall comply with 517.29 through 517.35.*

(F) [OSHPD 3] Receptacle Identification. *The cover plates for the electrical receptacles or the electrical receptacles, supplied from the critical or life safety branches, shall have a distinctive color or marking so as to be readily identifiable.*

(G) [OSHPD 3] Hemodialysis Clinic. *Illumination for means of egress and exit lights shall be provided, using battery operated equipment with a capacity to sustain its connected load for a minimum of 1-½ hours after loss of the normal source.*

(H) [SFM, OSHPD 3 (Surgical Clinics only)] *For ambulatory surgical clinics, sufficient resources on-site and shall be available at all times to provide not less than 4 hours at full output of the required Emergency Power Supply System (EPSS).*

Part IV. Inhalation Anesthetizing Locations

Informational Note: See NFPA 99-2021, *Health Care Facilities Code*, for further information regarding safeguards for anesthetizing locations.

517.60 Anesthetizing Location Classification.

Informational Note: See 517.20 if either of the anesthetizing locations in 517.60(A) or 517.60(B) is designated a wet procedure location.

(A) Hazardous (Classified) Location.

(1) Use Location. In a location where flammable anesthetics are employed, the entire area shall be considered to be a Class I, Division 1 location that extends upward to a level 1.52 m (5 ft) above the floor. The remaining volume up to the structural ceiling is considered to be above a hazardous (classified) location.

(2) Storage Location. Any room or location in which flammable anesthetics or volatile flammable disinfecting agents are

(4) Bonding and grounding of the service shall be in accordance with Part I through Part V of Article 250.
(5) The manufacturer shall include in its written installation instructions one method of grounding the service equipment at the installation site. The instructions shall clearly state that other methods of grounding are found in Article 250.
(6) The minimum size grounding electrode conductor shall be specified in the instructions.
(7) A warning label shall be mounted on or adjacent to the service equipment. The label shall meet the requirements in 110.21(B) and shall state the following:

WARNING
DO NOT PROVIDE ELECTRICAL POWER
UNTIL THE GROUNDING ELECTRODE(S)
IS INSTALLED AND CONNECTED
(SEE INSTALLATION INSTRUCTIONS).

Where the service equipment is not installed in or on the unit, the installation shall comply with the other requirements of this section.

(C) Rating. Mobile home service equipment shall be rated at not less than 100 amperes at 120/240 volts, and provisions shall be made for connecting a mobile home feeder assembly by a permanent wiring method. Power outlets used as mobile home service equipment shall also be permitted to contain receptacles rated up to 50 amperes with appropriate overcurrent protection. Fifty-ampere receptacles shall conform to the configuration shown in Figure 550.10(C).

Informational Note: See ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specifications*, Figure 14-50, for complete details of the 50-ampere plug and receptacle configuration.

(D) Additional Outside Electrical Equipment. Means for connecting a mobile home accessory building or structure or additional electrical equipment located outside a mobile home by a fixed wiring method shall be provided in either the mobile home service equipment or the local external disconnecting means permitted in 550.32(A).

(E) Additional Receptacles. Receptacles located outside a mobile or manufactured home shall be provided with ground-fault circuit-interrupter protection as specified by 210.8(A). Where receptacles provide power to a mobile or manufactured home in accordance with 550.10, ground-fault circuit-interrupter protection shall not be required.

(F) Mounting Height. Outdoor mobile home disconnecting means shall be installed so the bottom of the enclosure containing the disconnecting means is not less than 600 mm (2 ft) above finished grade or working platform. The disconnecting means shall be installed so that the center of the grip of the operating handle, when in the highest position, is not more than 2.0 m (6 ft 7 in.) above the finished grade or working platform.

(G) Marking. Where a 125/250-volt receptacle is used in mobile home service equipment, the service equipment shall be marked as follows:

TURN DISCONNECTING SWITCH OR
CIRCUIT BREAKER OFF BEFORE INSERTING
OR REMOVING PLUG. PLUG MUST BE FULLY
INSERTED OR REMOVED.

The marking shall be located on the service equipment adjacent to the receptacle outlet.

550.33 Feeder.

N **(A) Feeder Equipment.** The feeder assembly, including the disconnecting means, shall not be mounted in or on the mobile home. A manufactured home feeder disconnecting means shall be permitted to be installed in or on the manufactured home in accordance with the requirements of 550.32(B). The feeder equipment shall be rated not less than that required in 550.32(C), mounted in a readily accessible outdoor location, and within sight from the mobile home or manufactured home it serves. Grounding of the disconnecting means shall be in accordance with 250.32.

(B) Feeder Conductors. Feeder conductors shall comply with the following:

(1) Feeder conductors shall consist of either a listed cord, factory installed in accordance with 550.10(B), or a permanently installed feeder consisting of four insulated, color-coded conductors that shall be identified by the factory or field marking of the conductors in compliance with 310.6. Equipment grounding conductors shall not be identified by stripping the insulation.
(2) Feeder conductors shall be installed in compliance with 250.32(B).

Exception: An existing feeder installed without an equipment grounding conductor shall be permitted to comply with 250.32(B)(1) Exception No. 1.

(C) Feeder Capacity. Mobile home and manufactured home feeder circuit conductors shall have a capacity not less than the loads supplied, shall have an ampacity of not less than 100 amperes, and shall be permitted to be sized in accordance with 310.12.

ARTICLE 551
Recreational Vehicles and Recreational Vehicle Parks

Part I. General

551.1 Scope. This article covers the electrical conductors and equipment other than low-voltage and automotive vehicle circuits or extensions thereof, installed within or on recreational vehicles, the conductors that connect recreational vehicles to a supply of

electricity, and the installation of equipment and devices related to electrical installations within a recreational vehicle park.

Informational Note: See NFPA 1192-2021, *Standard on Recreational Vehicles,* and ANSI/RVIA LV-2020, *Standard for Low Voltage Systems in Conversion and Recreational Vehicles*, for information on low-voltage systems.

N **551.3 Electrical Datum Plane Distances.** The electrical datum plane distance(s) is determined by the normal high water level and encompasses the areas subject to tidal movement and areas in which the water level is affected by the conditions such as climate (rain or snowfall) or by human intervention (the opening and closing of dams or floodgates). The distance does not consider extremes due to natural or manmade disasters.

N **(A) Areas Subject to Tidal Fluctuations.** In land areas subject to tidal fluctuation, the electrical datum plane shall be a horizontal plane that is 606 mm (2 ft) above the highest high tide level for the area occurring under normal circumstances.

N **(B) Areas Not Subject to Tidal Fluctuations.** In land areas not subject to tidal fluctuation, the electrical datum plane shall be a horizontal plane that is 606 mm (2 ft) above the normal high water level for the area occurring under normal circumstances.

551.4 General Requirements.

(A) Not Covered. A recreational vehicle not used for the purposes as defined in Article 100 shall not be required to meet the requirements of Part IV pertaining to the number or capacity of circuits required. It shall, however, meet all other applicable requirements of this article if the recreational vehicle is provided with an electrical installation intended to be energized from a 120-volt, 208Y/120-volt, or 120/240-volt, nominal, ac power-supply system.

(B) Systems. This article covers combination electrical systems, generator installations, and 120-volt, 208Y/120-volt, or 120/240-volt, nominal, systems.

Informational Note: See NFPA 1192-2021, *Standard on Recreational Vehicles*, and ANSI/RVIA 12V-2020, *Standard for Low Voltage Systems in Conversion and Recreational Vehicles*, for information on low-voltage systems.

Δ **(C) Labels.** Labels required by Article 551 shall be made of etched, metal-stamped, or embossed brass; stainless steel; plastic laminates not less than 0.13 mm (0.005 in.) thick; or anodized or alclad aluminum not less than 0.5 mm (0.020 in.) thick or the equivalent.

Informational Note: See ANSI Z535.4-2011, *Product Safety Signs and Labels*, for guidance on other label criteria used in the recreational vehicle industry.

Part II. Combination Electrical Systems

551.20 Combination Electrical Systems.

(A) General. Vehicle wiring suitable for connection to a battery or dc supply source shall be permitted to be connected to a 120-volt source, provided the entire wiring system and equipment are rated and installed in full conformity with Parts I, II, III, IV, and V requirements of this article covering 120-volt electrical systems. Circuits fed from ac transformers shall not supply dc appliances.

(B) Voltage Converters (120-Volt Alternating Current to Low-Voltage Direct Current). The 120-volt ac side of the voltage converter shall be wired in full conformity with the requirements of Parts I, II, and IV of this article for 120-volt electrical systems.

Exception: Converters supplied as an integral part of a listed appliance shall not be subject to 551.20(B).

All converters and transformers shall be listed for use in recreational vehicles and designed or equipped to provide overtemperature protection. To determine the converter rating, the following percentages shall be applied to the total connected load, including average battery-charging rate, of all 12-volt equipment:

The first 20 amperes of load at 100 percent plus

The second 20 amperes of load at 50 percent plus

All load above 40 amperes at 25 percent

Exception: A low-voltage appliance that is controlled by a momentary switch (normally open) that has no means for holding in the closed position or refrigerators with a 120-volt function shall not be considered as a connected load when determining the required converter rating. Momentarily energized appliances shall be limited to those used to prepare the vehicle for occupancy or travel.

(C) Bonding Voltage Converter Enclosures. The non–current-carrying metal enclosure of the voltage converter shall be connected to the frame of the vehicle with a minimum 8 AWG copper conductor. The voltage converter shall be provided with a separate chassis bonding conductor that shall not be used as a current-carrying conductor.

(D) Dual-Voltage Fixtures, Including Luminaires or Appliances. Fixtures, including luminaires, or appliances having both 120-volt and low-voltage connections shall be listed for dual voltage.

(E) Autotransformers. Autotransformers shall not be used.

(F) Receptacles and Plug Caps. Where a recreational vehicle is equipped with an ac system, a low-voltage system, or both, receptacles and plug caps of the low-voltage system shall differ in configuration from those of the ac system. Where a vehicle equipped with a battery or other low-voltage system has an external connection for low-voltage power, the connector shall have a configuration that will not accept ac power.

Part III. Other Power Sources

551.30 Generator Installations.

(A) Mounting. Generators shall be mounted in such a manner as to be effectively bonded to the recreational vehicle chassis. The

(2) Simultaneously disconnect all ungrounded conductors of the circuit
(3) Located where readily accessible
(4) Externally operable without exposed live parts
(5) Plainly indicate whether in the open (off) or closed (on) position
(6) Have ratings sufficient for the maximum circuit current, available fault current, and voltage that is available at the terminals
(7) Where the line and load terminals are capable of being energized in the open position, be marked with the following words or equivalent:

WARNING
ELECTRIC SHOCK HAZARD TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION.

‖ *[OSHPD 1, 1R, 2, 3, 4, 5 & 6] The disconnecting means shall be installed either inside or outside of the building that houses equipment that will have connection(s) from electric power production equipment. The disconnecting means shall be located as near as practicable to where the conductors enter or leave OSHPD Jurisdiction.*

Informational Note: With interconnected power sources, some equipment, including switches and fuses, is capable of being energized from both directions.

705.25 Wiring Methods. Power source output conductors shall comply with 705.25(A) through (C).

Δ **(A) General.** Wiring methods and fittings listed for use with power production systems shall be permitted in addition to general wiring methods and fittings permitted elsewhere in this *Code*.

Δ **(B) Flexible Cords and Cables.** Flexible cords and cables, where used to connect the moving parts of power production equipment, or where used for ready removal for maintenance and repair, shall be listed and identified as DG cable, or other cable suitable for extra hard use, and shall be water resistant. Cables exposed to sunlight shall be sunlight resistant. Flexible, fine-stranded cables shall be terminated only with terminals, lugs, devices, or connectors in accordance with 110.14(A).

(C) Multiconductor Cable Assemblies. Multiconductor cable assemblies used in accordance with their listings shall be permitted.

Informational Note: See UL 3003, *Distributed Generation Cables*, and UL 9703, *Outline of Investigation for Distributed Generation Wiring Harnesses*, for additional information on DG cable (distributed generation cable) and harnesses. An ac module harness is one example of a multiconductor cable assembly.

705.28 Circuit Sizing and Current.

(A) Power Source Output Maximum Current. Where not elsewhere required or permitted in this *Code*, the maximum current for power sources shall be calculated using one of the following methods:

(1) The sum of the continuous output current ratings of the power production equipment at the circuit nominal system voltage
(2) For power production equipment controlled by an EMS, the current setpoint of the EMS
(3) Where sources controlled by an EMS are combined with other sources on the same power source output circuit, the sum of 705.28(A)(1) and (A)(2)

(B) Conductor Ampacity. Where not elsewhere required or permitted in this *Code*, the power source output conductors shall have an ampacity not less than the larger of the following and comply with 110.14(C):

(1) The maximum currents in 705.28(A) multiplied by 125 percent without adjustment or correction factors

Exception No. 1: If the assembly, including the overcurrent devices protecting the circuit, is listed for operation at 100 percent of its rating, the ampacity of the conductors shall be permitted to be not less than the calculated maximum current of 705.28(A).

Exception No. 2: Where a portion of a circuit is connected at both its supply and load ends to separately installed pressure connections as covered in 110.14(C)(2), it shall be permitted to have an ampacity not less than the calculated maximum current of 705.28(A). No portion of the circuit installed under this exception shall extend into an enclosure containing either the circuit supply or the circuit load terminations, as covered in 110.14(C)(1).

Exception No. 3: Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the calculated maximum current of 705.28(A).

(2) The maximum currents in 705.28(A) after the application of adjustment and correction factors in accordance with 310.14
(3) Where connected to feeders, if smaller than the feeder conductors, the ampacity as calculated in 240.21(B) based on the over-current device protecting the feeder

(C) Neutral Conductors. Neutral conductors shall be permitted to be sized in accordance with either 705.28(C)(1) or (C)(2).

(1) Single-Phase Line-to-Neutral Power Sources. Where not elsewhere required or permitted in this *Code*, the ampacity of a neutral conductor to which a single-phase line-to-neutral power source is connected shall not be smaller than the ampacity in 705.28(B).

(2) Neutral Conductor Used Solely for Instrumentation, Voltage, Detection, or Phase Detection. A power production equipment neutral conductor used solely for instrumentation, voltage detection, or phase detection shall be permitted to be sized in accordance with 250.102.

705.30 Overcurrent Protection.

Δ **(A) Circuit and Equipment.** Power source output conductors and equipment shall be provided with overcurrent protection. Circuits connected to more than one electrical source shall have overcurrent devices located to provide overcurrent protection from all sources.

(B) Overcurrent Device Ratings. The overcurrent devices in other than generator systems shall be sized to carry not less than 125 percent of the maximum currents as calculated in 705.28(A). The rating or setting of overcurrent devices shall be permitted in accordance with 240.4(B) and (C).

Exception: Circuits containing an assembly together with its overcurrent device(s) that is listed for continuous operation at 100 percent of its rating shall be permitted to be utilized at 100 percent of its rating.

N **(C) Marking.** Equipment containing overcurrent devices supplied from interconnected power sources shall be marked to indicate the presence of all sources.

N **(D) Suitable for Backfeed.** Fused disconnects, unless otherwise marked, shall be considered suitable for backfeed. Circuit breakers not marked "line" and "load" shall be considered suitable for backfeed. Circuit breakers marked "line" and "load" shall be considered suitable for backfeed or reverse current if specifically rated.

N **(E) Fastening.** Listed plug-in-type circuit breakers backfed from electric power sources that are listed and identified as interactive shall be permitted to omit the additional fastener normally required by 408.36(D) for such applications.

Δ **(F) Transformers.** The following apply to the installation of transformers:

(1) For the purpose of overcurrent protection, the primary side of transformers with sources on each side shall be the side connected to the largest source of available fault current.
(2) Transformer secondary conductors shall be protected in accordance with 240.21(C).

705.32 Ground-Fault Protection. Where ground-fault protection of equipment is installed in ac circuits as required elsewhere in this *Code*, the output of interconnected power production equipment shall be connected to the supply side of the ground-fault protection equipment.

Exception: Connection of power production equipment shall be permitted to be made to the load side of ground-fault protection equipment where installed in accordance with 705.11 or where there is ground-fault protection for equipment from all ground-fault current sources.

705.40 Loss of Primary Source. The output of interactive electric power production equipment shall be automatically disconnected from all ungrounded conductors of the primary source when one or more of the phases of the primary source to which it is connected opens. The interactive electric power production equipment shall not be reconnected to the primary source until all the phases of the primary source to which it is connected are restored. This requirement shall not be applicable to electric power production equipment providing power to an emergency or legally required standby system.

Exception: A listed interactive inverter shall trip or shall be permitted to automatically cease exporting power when one or more of the phases of the interconnected primary source opens and shall not be required to automatically disconnect all ungrounded conductors from the primary source. A listed interactive inverter shall be permitted to automatically or manually resume exporting power to the interconnected system once all phases of the source to which it is connected are restored.

Informational Note No. 1: Risks to personnel and equipment associated with the primary source could occur if an interactive electric power production source can operate as an intentional island. Special detection methods are required to determine that a primary source supply system outage has occurred and whether there should be automatic disconnection. When the primary source supply system is restored, special detection methods are typically required to limit exposure of power production sources to out-of-phase reconnection.

Informational Note No. 2: Induction-generating equipment connected on systems with significant capacitance can become self-excited upon loss of the primary source and experience severe overvoltage as a result.

Interactive power production equipment shall be permitted to operate in island mode to supply loads that have been disconnected from the electric utility or other electric power production and distribution network.

705.45 Unbalanced Interconnections.

(A) Single Phase. Single-phase power sources in interactive systems shall be connected to 3-phase power systems in order to limit unbalanced voltages at the point of interconnection to not more than 3 percent.

Informational Note: For interactive power sources, unbalanced voltages can be minimized by the same methods that are used for single-phase loads on a 3-phase power system. See ANSI/C84.1-2016, *Electric Power Systems and Equipment — Voltage Ratings (60 Hertz)*.

(B) Three Phase. Three-phase power sources in interactive systems shall have all phases automatically de-energized upon loss of, or unbalanced, voltage in one or more phases unless the interconnected system is designed so that significant unbalanced voltages will not result.

Part II. Microgrid Systems

705.50 System Operation. Interconnected microgrid systems shall be capable of operating in interactive mode with a primary

the ampere rating of the overcurrent devices shall be permitted to be not less than the maximum currents calculated in 706.30(B).

(C) Direct Current Rating. Overcurrent protective devices, either fuses or circuit breakers, used in any dc portion of an ESS shall be listed for dc and shall have the appropriate voltage, current, and interrupting ratings for the application.

(D) Current Limiting. A listed and labeled current-limiting overcurrent protective device shall be installed adjacent to the ESS for each dc output circuit.

Exception: Where current-limiting overcurrent protection is provided for the dc output circuits of a listed ESS, additional current-limiting overcurrent devices shall not be required.

(E) Fuses. Means shall be provided to disconnect any fuses associated with ESS equipment and components when the fuse is energized from both directions and is accessible to other than qualified persons. Switches, pullouts, or similar devices that are rated for the application shall be permitted to serve as a means to disconnect fuses from all sources of supply.

(F) Location. Where circuits from the input or output terminals of energy storage components in an ESS pass through a wall, floor, or ceiling, overcurrent protection shall be provided at the energy storage component end of the circuit.

706.33 Charge Control.

(A) General. Provisions shall be provided to control the charging process of the ESS. All adjustable means for control of the charging process shall be accessible only to qualified persons.

(B) Diversion Charge Controller.

(1) Sole Means of Regulating Charging. An ESS employing a diversion charge controller as the sole means of regulating charging shall be equipped with a second independent means to prevent overcharging of the storage device.

(2) Circuits with Diversion Charge Controller and Diversion Load. Circuits containing a diversion charge controller and a diversion load shall comply with the following:

(1) The current rating of the diversion load shall be less than or equal to the current rating of the diversion load charge controller. The voltage rating of the diversion load shall be greater than the maximum ESS voltage. The power rating of the diversion load shall be at least 150 percent of the power rating of the charging source.
(2) The conductor ampacity and the rating of the overcurrent device for this circuit shall be at least 150 percent of the maximum current rating of the diversion charge controller.

(3) ESS Using Interactive Inverters. Systems using interactive inverters to control energy storage state-of-charge by diverting excess power into an alternate electric power production and distribution system, such as utility, shall comply with 706.33(B)(3)(a) and (B)(3)(b).

(a) These systems shall not be required to comply with 706.33(B)(2).

(b) These systems shall have a second, independent means of controlling the ESS charging process for use when the alternate system is not available or when the primary charge controller fails or is disabled.

(C) Charge Controllers and DC-to-DC Converters. Where charge controllers and other DC-to-DC power converters that increase or decrease the output current or output voltage with respect to the input current or input voltage are installed, all of the following shall apply:

(1) The ampacity of the conductors in output circuits shall be based on the maximum rated continuous output current of the charge controller or converter for the selected output voltage range.
(2) The voltage rating of the output circuits shall be based on the maximum voltage output of the charge controller or converter for the selected output voltage range.

Part V. Flow Battery ESSs

Part V applies to ESSs composed of or containing flow batteries.

Informational Note: Due to the unique design features and difference in operating characteristics of flow batteries as compared with that of storage batteries such as lead acid or lithium ion batteries, the requirements for flow batteries have been included herein (Article 706, Part V).

Δ **706.40 General.** The system and system components shall also meet Parts I, II, and III of this article.

Informational Note: See NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems*, for installation requirements for ESS, including requirements for flow batteries.

706.41 Electrolyte Classification. The electrolyte(s) that are acceptable for use in the batteries associated with the ESS shall be identified by name and chemical composition. Such identification shall be provided by readily discernable signage adjacent to every location in the system where the electrolyte can be put into or taken out of the system.

706.42 Electrolyte Containment. Flow battery systems shall be provided with a means for electrolyte containment to prevent spills of electrolyte from the system. An alarm system shall be provided to signal an electrolyte leak from the system. Electrical wiring and connections shall be located and routed in a manner that mitigates the potential for exposure to electrolytes.

706.43 Flow Controls. Controls shall be provided to safely shut down the system in the event of electrolyte blockage.

706.44 Pumps and Other Fluid Handling Equipment. Pumps and other fluid handling equipment are to be rated/specified suitable for exposure to the electrolytes.

Part VI. Other Energy Storage Technologies

Part VI applies to ESSs using other technologies intended to store energy and when there is a demand for electrical power to use the stored energy to generate the needed power.

706.50 General. All electrical connections to and from the system and system components shall be in accordance with the applicable provisions of this *Code*. The systems shall comply with Parts I, II, III, and IV of this article.

N **706.51 Flywheel ESS (FESS).** Flywheel ESS (FESS) using flywheels as the storage mechanism shall also comply with all of the following:

(1) FESS shall not be used for one- or two-family dwelling units.

Informational Note No. 1: FESS are intended for high-power shorter term applications. They contain parts that rotate under high speed with hazardous kinetic energy and include parts such as magnetic bearings that require ongoing monitoring and maintenance and, therefore, are not suitable for residential-type applications.

(2) FESS shall be provided with bearing monitoring and controls that can identify bearing wear or damage to avoid catastrophic failure.

Informational Note No. 2: The bearing monitoring controls should be evaluated as part of the listing evaluation.

(3) FESS shall be provided with a containment means to contain moving parts that could break from the system upon catastrophic failure.

Informational Note No. 3: The containment means should be evaluated as part of the listing evaluation.

(4) The spin-down time of the FESS shall be provided in the maintenance documentation.

Δ

ARTICLE 708
Critical Operations Power Systems (COPS)

Part I. General

‖ **708.1 Scope.** ***[Not required for OSHPD 1, 1R, 2, 3, 4, 5 & 6]*** This article applies to the installation, operation, monitoring, control, and maintenance of the portions of the premises wiring system intended to supply, distribute, and control electricity to designated critical operations areas (DCOA) in the event of disruption to elements of the normal system.

Critical operations power systems are those systems so classed by municipal, state, federal, or other codes by any governmental agency having jurisdiction or by facility engineering documentation establishing the necessity for such a system. These systems include but are not limited to power systems, HVAC, fire alarm, security, communications, and signaling for designated critical operations areas.

Informational Note No. 1: Critical operations power systems are generally installed in vital infrastructure facilities that, if destroyed or incapacitated, would disrupt national security, the economy, public health or safety; and where enhanced electrical infrastructure for continuity of operation has been deemed necessary by governmental authority.

Informational Note No. 2: See *NFPA 1600*-2019, *Standard on Continuity, Emergency, and Crisis Management*, for further information on disaster and emergency management.

Informational Note No. 3: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, for further information regarding performance of emergency and standby power systems.

Informational Note No. 4: See NFPA *101*-2021, *Life Safety Code*, or the applicable building code, for specification of locations where emergency lighting is considered essential to life safety.

Informational Note No. 5: See NFPA 730-2020, *Guide for Premises Security*, and ANSI/TIA-5017-2016, *Telecommunications Physical Network Security Standard*, for further information regarding physical security.

Informational Note No. 6: See *NFPA 1600*-2019, *Standard on Continuity, Emergency, and Crisis Management*, A.5.3.2. Threats to facilities that may require transfer of operation to the critical systems include both naturally occurring hazards and human-caused events.

Informational Note No. 7: See Informative Annex F, Availability and Reliability for Critical Operations Power Systems; and Development and Implementation of Functional Performance Tests (FPTs) for Critical Operations Power Systems.

Informational Note No. 8: See Informative Annex G, Supervisory Control and Data Acquisition (SCADA).

Informational Note No. 9: Text that is followed by a reference in brackets has been extracted from *NFPA 1600*-2019, *Standard on Continuity, Emergency, and Crisis Management*. Only editorial changes were made to the extracted text to make it consistent with this *Code*.

N **708.2 Reconditioned Equipment.** Reconditioned transfer switches shall not be permitted.

708.4 Risk Assessment. Risk assessment for critical operations power systems shall be documented and shall be conducted in accordance with 708.4(A) through (C).

Informational Note: See *NFPA 1600*-2019, *Standard on Continuity, Emergency, and Crisis Management*, Chapter 5, which provides additional guidance concerning risk assessment and hazard analysis.

Informative Annex C Conduit, Tubing, and Cable Tray Fill Tables for Conductors and Fixture Wires of the Same Size

This informative annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

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*Where this table is used in conjunction with Tables C.1 through C.13, the conductors installed must be of the compact type.

Δ Table C.1 Maximum Number of Conductors or Fixture Wires in Electrical Metallic Tubing (EMT) (Based on Chapter 9: Table 1, Table 4, and Table 5)

Type	Conductor Size (AWG/ kcmil)	Trade Size (Metric Designator)												
		⅜ (12)	½ (16)	¾ (21)	1 (27)	1¼ (35)	1½ (41)	2 (53)	2½ (63)	3 (78)	3½ (91)	4 (103)	5 (129)	6 (155)
CONDUCTORS														
RHH, RHW, RHW-2	14	—	4	7	11	20	27	46	80	120	157	201	302	427
	12	—	3	6	9	17	23	38	66	100	131	167	251	354
	10	—	2	5	8	13	18	30	53	81	105	135	203	286
	8	—	1	2	4	7	9	16	28	42	55	70	106	150
	6	—	1	1	3	5	8	13	22	34	44	56	85	120
	4	—	1	1	2	4	6	10	17	26	34	44	66	94
	3	—	1	1	1	4	5	9	15	23	30	38	58	82
	2	—	1	1	1	3	4	7	13	20	26	33	50	71
	1	—	0	1	1	1	3	5	9	13	17	22	33	47
	1/0	—	0	1	1	1	2	4	7	11	15	19	29	41
	2/0	—	0	1	1	1	2	4	6	10	13	17	25	35
	3/0	—	0	0	1	1	1	3	5	8	11	14	21	30
	4/0	—	0	0	1	1	1	3	5	7	9	12	18	26
	250	—	0	0	0	1	1	1	3	5	7	9	14	20
	300	—	0	0	0	1	1	1	3	5	6	8	12	17
	350	—	0	0	0	1	1	1	3	4	6	7	11	16
	400	—	0	0	0	1	1	1	2	4	5	7	10	14
	500	—	0	0	0	0	1	1	2	3	4	6	8	12
	600	—	0	0	0	0	1	1	1	3	4	5	7	10
	700	—	0	0	0	0	0	1	1	2	3	4	6	9
	750	—	0	0	0	0	0	1	1	2	3	4	6	8
	800	—	0	0	0	0	0	1	1	2	3	4	6	8
	900	—	0	0	0	0	0	1	1	1	3	3	5	7
	1000	—	0	0	0	0	0	1	1	1	2	3	5	7
	1250	—	0	0	0	0	0	0	1	1	1	2	3	5
	1500	—	0	0	0	0	0	0	1	1	1	1	3	4
	1750	—	0	0	0	0	0	0	1	1	1	1	3	4
	2000	—	0	0	0	0	0	0	1	1	1	1	2	3
TW, THHW, THW, THW-2	14	—	8	15	25	43	58	96	168	254	332	424	638	900
	12	—	6	11	19	33	45	74	129	195	255	326	490	691
	10	—	5	8	14	24	33	55	96	145	190	243	365	515
	8	—	2	5	8	13	18	30	53	81	105	135	203	286
RHH*, RHW*, RHW-2*	14	—	6	10	16	28	39	64	112	169	221	282	424	599
	12	—	4	8	13	23	31	51	90	136	177	227	341	481
	10	—	3	6	10	18	24	40	70	106	138	177	266	376
	8	—	1	4	6	10	14	24	42	63	83	106	159	225
TW, THW, THHW, THW-2, RHH*, RHW*, RHW-2*	6	—	1	3	4	8	11	18	32	48	63	81	122	172
	4	—	1	1	3	6	8	13	24	36	47	60	91	128
	3	—	1	1	3	5	7	12	20	31	40	52	78	110
	2	—	1	1	2	4	6	10	17	26	34	44	66	94
	1	—	1	1	1	3	4	7	12	18	24	31	46	66
	1/0	—	0	1	1	2	3	6	10	16	20	26	40	56
	2/0	—	0	1	1	1	3	5	9	13	17	22	33	47
	3/0	—	0	1	1	1	2	4	7	11	15	19	28	40
	4/0	—	0	0	1	1	1	3	6	9	12	16	24	33
	250	—	0	0	1	1	1	3	5	7	10	13	19	27
	300	—	0	0	1	1	1	2	4	6	8	11	16	23
	350	—	0	0	0	1	1	1	4	6	7	10	15	21
	400	—	0	0	0	1	1	1	3	5	7	9	13	19
	500	—	0	0	0	1	1	1	3	4	6	7	11	16

(continues)

HISTORY NOTE APPENDIX

2025 California Electrical Code
California Code of Regulations, Title 24, Part 3

History:

For prior code history, see the History Note Appendix to the *California Electrical Code,* 2022 Triennial Edition, effective January 1, 2023.

1. (BSC 01/23, DSA-SS 01/23, HCD 01/23, OSHPD 01/23, SFM 01/23) Adoption by reference of the 2023 *National Electrical Code* with necessary amendments to become the 2025 *California Electrical Code*, and repeal of the 2020 edition of the *National Electrical Code.* Effective on January 1, 2026.
2. Erratum to correct editorial errors in the Preface, Article 89, Chapters 1, 2, 3, 4, 5, 7, Informative Annex C, and Index, effective January 1, 2026.