

IDENTIFICATION, SAMPLING AND TESTING OF THREADED STEEL ANCHOR BOLTS AND ANCHOR RODS

Disciplines: Structural Safety

History:

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PURPOSE: This Interpretation of Regulations (IR) describes the Division of the State Architect (DSA) requirements for identification, sampling and testing of threaded steel anchor bolts and anchor rods used to anchor structural elements to foundations on construction projects under DSA jurisdiction.

BACKGROUND: California Building Code Section 2203A.1 states “Identification of structural steel members shall comply with the requirements contained in AISC 360.” This section further states “Other steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter.”

INTERPRETATION: Anchor bolt and anchor rod material identification, sampling and testing shall be performed in accordance with this IR and the applicable standards. Anchor bolts and anchor rods which are not readily identifiable by physical markings, and which are not traceable to the documentation accompanying the material’s shipment, shall be either:

- Sampled and tested to establish conformity to the project documents.
- Removed from the job site and replaced with identifiable material.

DEFINITIONS:

Anchor Bolt – A steel rod used to anchor a structural element to a foundation. One end is embedded in the foundation. The end projecting from the foundation is threaded for the purpose of receiving a nut. Common forms of this anchor bolt type are as follows:

- Headed Anchor Bolts – The embedded end of this anchor bolt has a forged head.
- Bent Anchor Bolts – The embedded end of this anchor bolt is typically bent in an “L” or “J.”

Anchor Rod* – A steel rod used to anchor a structural element to a foundation. This anchor is manufactured from a straight rod threaded at both ends or can be threaded the full length. The embedded end typically has some configuration of nut(s) and plate or washer.

*For the balance of this IR, “anchor rod” will be referred to as an “anchor bolt.”

Anchor Bolt Manufacturer – A manufacturer who processes steel into anchor bolts.

Distributor – A person or organization who purchases anchor bolts for the purpose of reselling them. For the purposes of this IR, a distributor shall not alter the fasteners prior to resale and therefore has no control, other than through careful handling, over the quality and workmanship of material.

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End User – The person or organization that purchases the anchor bolt from the supplier for the purpose of placing it in its final position on a project.

Heat Analysis – A chemical analysis of a given heat of steel by the raw material producer which determines the percentages of its chemical elements.

Product Analysis – A chemical analysis performed on the finished anchor bolt for the purpose of verifying that the chemical composition falls within the limits of the material specified in the construction documents.

Raw Material Producer – A mill who produces the steel.

Secondary Manufacturer – Any entity that alters the anchor bolt after it has been manufactured from raw material.

Secondary Processes – Processes performed on an anchor bolt to add value or develop specific properties. Heat treatment and galvanizing are examples of secondary processing.

Supplier – A person or organization who furnishes the finished anchor bolt and nuts to the end user. The supplier can be either the anchor bolt manufacturer or a distributor.

1. EXEMPT ANCHOR BOLTS: Anchor bolts used for the purposes listed below are exempt from the requirements of this IR.

- Anchor bolts with a specified yield strength of 55 ksi (Grade 55) or less used to anchor columns supporting gravity loads only.
- Sill anchor bolts in light framed construction.
- Holdown anchor bolts used for light framed construction with a yield strength not to exceed 36 ksi (Grade 36).

2. ANCHOR BOLT MARKING: Each anchor bolt shall have permanent identification marks as follows:

2.1 Anchor Bolts with a specified yield strength less than 75 ksi: These anchor bolts shall have the end intended to project from the concrete marked to the minimum requirements of the standard specified in the construction documents. The color coding system described in ASTM F1554 is an acceptable form of marking for these anchor bolts. These anchor bolts are not required to have a permanent strength grade stamp and are not required to have a permanent manufacturer's identification stamp.

2.2 Anchor Bolts with a specified yield strength equal to or greater than 75 ksi: These anchor bolts shall have the end, intended to project from the concrete, permanently die stamped with the material strength grade and manufacturer's identification. ASTM F1554 supplementary requirements S2 and S3 are an acceptable form of this marking.

3. COMPREHENSIVE DOCUMENTATION REQUIREMENTS FOR ANCHOR BOLT IDENTIFICATION: The party responsible for supplying the anchor bolts, nuts and washers (the supplier) shall provide the following identification documentation with each anchor bolt shipment.

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#	REQUIRED DOCUMENTATION
3.1	a. ASTM designation, including strength grade, for the end product anchor bolt. b. ASTM designation, including grade, for the nut. c. ASTM designation, including type, for the washer. d. Anchor bolt raw material producers heat analysis including the heat number. e. Results of hardness, tensile and proof load tests, if applicable.
3.2	Statement of compliance from the anchor bolt manufacturer that the threads in both the anchor bolt and nut meet the dimensional and fit requirements of the specified standard.
3.3	Zinc coating weight and thickness test result for anchor bolt, nut and washer, if applicable.
3.4	A complete description of the anchor bolt(s) provided in the shipment, including but not limited to the following: <ul style="list-style-type: none"> • The anchor bolt type (headed, bent, etc.), anchor bolt diameter, anchor bolt length, threaded portion length, and thread specification. • Nut size, nut type, nut thread specification, and secondary processing. • Washer size, washer type, and secondary processing.
3.5	Where heat treatment is required to obtain the anchor bolt strength properties, the test report shall include a heat treat certification.
3.6	A description of how all anchor bolts and nuts are marked to identify the material, and, if required, how the anchor bolts are marked to identify the manufacturer.
3.7	A certificate of conformance stating that the anchor bolts were manufactured and tested in accordance with the ASTM specified on the DSA approved construction documents as noted above. The certificate shall list the anchor bolt raw material producer’s heat number.
3.8	Title and signature of the individual assigned certification responsibility by the anchor bolt supplier.

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4. MATERIAL IDENTIFICATION: The process of identifying anchor bolts delivered to the jobsite shall be initiated by the project inspector and completed by a qualified representative of the laboratory of record (LOR). The representative of the LOR shall have thorough knowledge of the standards used to manufacture and test threaded fasteners and shall have free access to all facilities and documents concerned with the manufacture and supply of the anchor bolts delivered to the jobsite so as to satisfy themselves that the furnished anchor bolts comply with the requirements of the DSA approved construction documents and this IR.

4.1 Anchor Bolt Packaging: Anchor bolts shall be delivered to the jobsite in units/containers which are packaged in accordance with ASTM D3951. When galvanized anchor bolts are specified, the anchor bolts and galvanized nuts shall be packaged together in the same unit/container. Each unit/container shall be marked with or include the following information:

- ASTM designation, Grade and Class.
- Anchor bolt, nut and washer size and type.
- Name of the manufacturer.
- Number of pieces.
- Lot number as applicable.
- Country of origin.

4.2 Project Inspector Responsibilities: The project inspector shall promptly:

- Secure all anchor bolt shipments and accompanying documentation.
- Notify the laboratory of record that anchor bolts have arrived at the jobsite and require material identification.

4.4 Laboratory of Record Responsibilities: A representative of the LOR shall, as a minimum, verify the following:

- Verify all anchor bolts have identifying marks in accordance with this IR.
- Verify the documentation accompanying all anchor bolt shipments contains a certificate of conformance and all supporting documents listed in Section 3 of this IR.
- Verify all anchor bolts are traceable to the accompanying certificate of conformance and all supporting documentation.

5. IDENTIFIABLE ANCHOR BOLTS: Anchor bolts and nuts delivered to the jobsite, which are deemed by the LOR to be identifiable in accordance with the requirements of this IR, need not be sampled and tested.

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6. SAMPLING AND TESTING OF UNIDENTIFIABLE ANCHOR BOLTS: All anchor bolt shipments, which are deemed by the LOR to be unidentifiable in accordance with the requirements of this IR, shall be sampled and tested to determine conformity with the DSA approved construction documents.

Shipments consisting of several distinct anchor bolt types shall have each unidentified anchor bolt type sampled and tested at the frequency specified in this IR. Examples include anchor bolts manufactured from various materials (material meeting various ASTM standards), various strength grades, various diameters, various lengths and various configurations (headed, rod, etc.).

All anchor bolt sampling and testing shall be performed by the LOR. The LOR may subcontract sampling and testing, for which it is not approved to perform, to another DSA Laboratory Evaluation and Acceptance program laboratory possessing the appropriate approval.

6.1 Frequency of Sampling: Unidentifiable anchor bolts and nuts shall be sampled at the frequencies listed in the following table unless a higher frequency is specified in the DSA approved construction documents.

UNIDENTIFIABLE ANCHOR BOLT SAMPLING	
Anchor Bolt Quantity	Anchor Bolt Sample Size
1 – 32	1
33 – 125	2
126 – 375	3
More than 375	4

6.2 Anchor Bolt Testing: Each sampled anchor bolt, nut and washer shall be tested to determine the properties listed below.

6.2.1 Product Analysis: The chemical composition of the anchor bolts shall be determined in accordance with ASTM A751 to verify the material conforms to the standard specified in the DSA approved construction documents.

Anchor bolts which are intended to be welded shall have the material chemical composition and carbon equivalent (by calculation) determined so as to provide assurance the material is weldable and provide the information needed to develop welding procedure specifications.

6.2.2 Mechanical Properties: Anchor bolt product hardness and tensile strength properties shall be determined in accordance with the methods detailed in ASTM F 606. Tension testing shall be performed on anchor bolts in the “ready-to-use” (full size) condition unless the specified material standard provides provisions for testing machined specimens.

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In the event there is controversy over a low hardness reading, acceptance based on tensile testing shall take precedence.

6.2.3 Thread Pitch Verification: Threads on the anchor bolt and the nut shall be measured for compliance with ANSI B1.1.

6.2.4 Zinc Coating: Weight and thickness shall be measured for compliance with the applicable ASTM standard.

7 GALVANIZED ANCHOR BOLTS: When galvanized anchor bolts are specified, the following requirements apply:

- Galvanized nuts shall be tapped oversize to accommodate the coating thickness and shall be delivered to the jobsite with the anchor bolt.
- Galvanized washers shall be delivered to the jobsite with the anchor bolt.
- Galvanizing ASTM A354 Grade BD material is prohibited.

REFERENCES:

California Code of Regulations (CCR) Title 24

California Administrative Code

California Building Code Section 2203A.1

This IR is intended for use by DSA staff and by design professionals to promote statewide consistency for review and approval of plans and specifications as well as construction oversight of projects within the jurisdiction of DSA, which includes State of California public schools (K–12), community colleges and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

This IR is subject to revision at any time. Please check DSA's website for currently effective IRs. Only IRs listed on the webpage at www.dgs.ca.gov/dsa/publications at the time of project application submittal to DSA are considered applicable.