



THE CITY OF SAN DIEGO

City of San Diego  
Planning & Development Review  
**Building Development Review**  
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# Building Newsletter 17-4

## Sampling, Testing and Special Inspection requirements for High-Strength Bolts

Interpretations of State and Local Building Codes  
1998 California Building Code: Chapter 17  
Revision Date: July 1999

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### I. Purpose

The purpose of this newsletter is to provide minimum standards for use and installation of high-strength bolts, nuts and washers in connections in structural steel members.

### II. Scope

All high strength bolts, carbon and alloy steel nuts, and hardened steel washers that are used for making steel-to-steel connections shall be verified to meet the requirements of the California Building Code (Building Code) and this newsletter. This includes all applications that are designed as slip-critical (SC), Bearing type (N or X), or subject to applied tensile force<sup>1</sup>.

#### A. Bolts, Nuts, Washers

1. The use, installation, inspection and testing of high-strength A325 and A490 bolts, nuts and washers shall be in accordance with the requirements of the Building Code, CH. 22, Division II and Division III.
2. Alternative Fastener Designs - Other fasteners or fastener assemblies which meet the materials, manufacturing and chemical composition requirements of ASTM (American Society for Testing and Materials) Specifications A325 or A490 and which meet the mechanical property requirements of the same specifications in full-size tests, and which have a body diameter and bearing areas under the head and nut not less than those provided by a bolt and nut of the same nominal dimensions, and which meet the installation, inspection and testing requirements prescribed by the Building Code may be used if specified on plans by the responsible engineer of record and approved by the City of San Diego Building Official. When a different installation procedure or inspection is used, it shall be detailed on plans by the responsible engineer of record and approved by the City of San Diego Building Official. .
3. Tension Indicating Devices - Direct tension indicating devices may be used in conjunction with bolts, nuts and washers provided they satisfy the specification, installation, testing and inspection requirements of the Building Code. Their installation procedure and inspection shall be detailed on plans by the responsible engineer of record and approved by the City of San Diego Building Official.
4. Reuse of High-Strength Bolts - High-strength

A490 bolts and galvanized A325 bolts shall not be reused. Other A325 bolts which meet the requirements of the Building Code may be reused if authorized by the responsible engineer of record and approved by the City of San Diego Building Official. Touching up or re-tightening previously tightened bolts which may have been loosened by the tightening of adjacent bolts shall not be considered as reuse provided the snugging up continues from the initial position and does not require greater rotation, including the tolerance, than that required by the Building Code.

### III. Verification of High-Strength Bolts, Nuts, Washers

Prior to installation of high-strength bolts within the scope of this newsletter in any structure, the geometry, chemical properties and mechanical properties of the bolts, nuts and washers shall be verified to be in compliance with the Building Code and ASTM standards..

#### A. "Made in U.S.A." High-Strength Bolts, Nuts, Washers, etc.

Sampling and testing requirements of high-strength bolts, nuts and washers as noted in section III (B) may not be required provided that, the conditions specified below are satisfied:

1. Material - Steel for the manufacturing of the bolts, nuts and washers is melted and manufactured in the United States.
2. Product - High strength bolts, nuts and washers are manufactured in the United States.
3. Identification - All bolts, nuts and washers shall be marked with a symbol to identify the manufacturers and their class, type or grade. Any piece that is not readily identifiable as to the manufacturer shall be rejected.
4. Mill Certificate - Manufacturer mill certificate shall be submitted to the Inspection Services for review and approval prior to installation of the bolts. Such mill certificate is required to show the name and address of the manufacturer, date of test reports, description and size of bolts, nuts and washers tested, chemistry composition of the product, mechanical properties of the product (hardness, tensile strength, etc.). Mill certificate must be verified and cross-referenced to the products shipped to the job site and planned to be used in the structure. The reports shall be submitted in a clear, concise and legible format.
5. ASTM Standards - Mill certificate shall have a statement that "all tests are in accordance with

the latest requirements of the methods prescribed in the applicable ASTM specifications. The steel was melted and manufactured in the United States. The fasteners listed in the report meet or exceed the required specifications as prescribed by the ASTM Standards.”

6. Signature - Manufacturer mill certificate shall bear the signature of the company executive or an authorized agent of the company having the authority to execute such document.
  7. Approval of Mill Certificate - The certificate and test reports shall be submitted to the project engineer of record and Inspection Services for review and approval. High-strength bolts, nuts and washers shall not be installed in any connections until the reports are approved by responsible engineer of record and Inspection Services.
- B. “Imported” High-Strength Bolts, Nuts, Washers, etc.

When high-strength bolts, nuts and washers are manufactured by a manufacturer located outside of the United States and imported to the job site, prior to installation, the bolts, nuts and washers shall be examined, sampled and tested to verify bolt specifications, bolt geometry, nut specifications, chemical composition and mechanical properties in accordance with the Building Code, ASTM Standards and approved permitted plans and specifications.

1. Testing and Inspection Agency - The sampling, testing and special inspections shall be performed by a construction materials testing laboratory approved by Inspection services.
2. Identification - All bolts, nuts and washers shall be marked with a symbol to identify the manufacturers and their class, type or grade. Any piece that is not readily identifiable as to the manufacturer shall be rejected.
3. Sampling - The approved testing laboratory or agency shall take random samples of each different class, size, length, style, mechanical and chemical characteristics of bolts, nuts and washers delivered to the job. The samples shall be taken from each container or sack as indicated in Table No. (1).
4. Testing
  - a. All high strength-bolt samples shall be tested for hardness in accordance with ASTM Standard, F606.
  - b. The sample assemblies (nut and bolt) shall be tested for tensile strength in accordance with ASTM Standard, F606.
    1. Wedge Tension Testing of the full size product shall be performed whenever possible per Section 3.5, F606.
    2. When full size samples cannot be tested because the required test load exceeds available testing equipment capacity the bolts

may be machined and tested per Sec. 3.6, F606, with the approval of the engineer of record.

3. When the bolts are too short to be tested per Table No. (2), the hardness tested specified in Section 4a above shall be the basis for acceptance.
  - c. High-strength A490 heat treated bolts shall also be tested by magnetic particle method and visually inspected for longitudinal discontinuities, transverse cracks and bursts per ASTM Standard A490, Section II.
5. Approval of Results - The testing and inspection results shall be submitted to Inspection Services and the engineer of record in a clear, concise and acceptable format. If any sample fails one of the prescribed tests or inspections, then all of the product lot represented by that sample shall be rejected and removed from the jobsite. That product shall then be replaced by a new product lot that is sampled and tested satisfactorily per this newsletter.

#### IV. Special Inspection Requirements

- A. In addition to verification of high strength bolts, nuts and washers as noted under Section III above, continuous special inspection is required while the installation of such bolts is in progress. Such inspections may be performed on a periodic basis provided this periodic scheduled inspection is outlined in the project plans and approved by the building official. Building Code Sec. 1701.5.6.
- B. Special Inspections must be performed by special inspectors certified by the Inspection Services of the Planning and Development Review Department, City of San Diego. For additional information see Building Newsletter 17-1 for ‘Special Inspection Requirements’.

#### V. Sampling and Testing

Where a representative sample of bolts, nuts, washers or bolted assemblies are required to be tested by the Building Code or by this Newsletter they shall be performed by a construction materials testing laboratory approved by the City of San Diego Inspection Services.

#### VI. Limitations

- A. High-strength bolts shall not be installed in any connections until the required sampling and testing as noted above is completed and the results are accepted and approved by the engineer of record and this department.

#### VII. Questions

For questions regarding special inspection, structural observation, materials testing and off-site fabrication you may contact Inspection Services at (858) 492-5070.

**TABLE NO. 1<sup>4</sup>**

Lot Size	Shipping Lot <sup>2</sup> Sample Size	Production Lot <sup>3</sup> Sample Size
25 and less	2	4
26 to 150	3	6
151 to 1,200	5	10
1,201 to 10,000	8	16
10,001 to 35,000	13	26
35,001 to 150,000	20	40
150,001 and over	32	64

**TABLE NO. 2<sup>4</sup>**

<b>Minimum Length of Product Requiring Tension Testing</b>	
Nominal Product Size Diameter (inch)	Minimum Length (inch)
1/4	5/8
5/16	3/4
3/8	7/8
7/16	1
1/2	1 1/8
9/16	1 1/4
5/8	1 1/2
3/4	1 3/4
7/8 and larger	3x Diameter

**Footnotes:**

<sup>1</sup> The connection types as required by design for A325 or A490 high-strength bolts are as follows:

SC – Slip-critical connection

N – Bearing-type connection with threads included in shear plane

X – Bearing-type connection with threads excluded from shear plane.

<sup>2</sup> A shipping lot is defined as that quantity of each

different kind of bolt, nut, or washer necessary to fill the needs of a single purchase order.

<sup>3</sup> A production lot is defined as bolts supplied by any other means than a shipping lot. Production lot sampling will be required for all products in containers that have been opened by someone other than the laboratory representative.

<sup>4</sup> Reproduced from the American Society for Testing and Materials Standard Specifications.