



Designation: A449 – 14 (Reapproved 2020)

# Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use<sup>1</sup>

This standard is issued under the fixed designation A449; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope\*

1.1 This specification<sup>2</sup> covers quenched and tempered steel hex cap screws, bolts, and studs having a minimum tensile strength of 120 ksi for diameters 1.0 in. and smaller; 105 ksi for diameters over 1.0 in. to 1½ in.; and 90 ksi for diameters 1¾ in. to 3.0 in. inclusive. The term "fasteners" in this specification denotes hex cap screws, bolts, and studs.

1.2 The fasteners are intended for general engineering use.

1.3 The fasteners are furnished in diameters ¼ to 3.0 in. inclusive. They are designated by type denoting chemical composition as follows:

Type	Description
Type 1	
Type 2	
Type 3	

1.4 Terms used in this specification are defined in Terminology **F1789** unless otherwise defined in this specification.

1.5 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee **F16** on Fasteners and is the direct responsibility of Subcommittee **F16.02** on Steel Bolts, Nuts, Rivets and Washers.

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<sup>2</sup> For *ASME Boiler and Pressure Vessel Code* applications see related Specifications SA-449 in Section II of that Code.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

- A563** Specification for Carbon and Alloy Steel Nuts
- A751** Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
- B695** Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
- F436/F436M** Specification for Hardened Steel Washers Inch and Metric Dimensions
- F606/F606M** Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

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- F789/F789M** Specification for Surface Discontinuities of Steel Bolts, Nuts, Washers, and Screws, Inch and Metric Series
- F1178** Terminology for Mechanical Fasteners
- F2329** Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
- G101** Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

### 2.2 ASME Standards:<sup>4</sup>

- B 1.1** Unified Screw Threads
- B 18.2.1** Square and Hex Bolts and Screws
- B 18.24** Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

## 3. Ordering Information

3.1 Orders for fasteners under this specification shall include the following:

- 3.1.1 Quantity (number of pieces),
- 3.1.2 Size, including nominal diameter and length,
- 3.1.3 Name of product,

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>4</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

\*A Summary of Changes section appears at the end of this standard

- 3.1.4 Type, that is, Type 1, or Type 3 as required,
- 3.1.5 ASTM designation and year of issue, and
- 3.1.6 Other components such as nuts and washers if required.
- 3.1.7 *Hot-Dip or Mechanically Deposited Zinc Coatings*—For hot-dip or mechanically deposited zinc coatings covered by 5.1 and requiring over-tapped nuts, specify the zinc coating process required, that is, hot-dip, mechanically deposited, or no preference (see 5.1).
- 3.1.8 *Other Coatings*—Specify other protective coating if required (see 5.2).
- 3.1.9 Specify if inspection at point of manufacture is required.
- 3.1.10 Test reports if required.
- 3.1.11 Supplementary or special requirements.
- 3.1.12 For establishment of a part identifying system, see ASME B18.24.

NOTE 1—A typical ordering description follows: 1000 pieces 1/8 in. diameter x 4.0 in. long hex cap screw, Type 1, ASTM A449-XX, each with one finished hex nut ASTM A563, Grade DH. Each component mechanically zinc coated in accordance with B695, Class 5, Type II.

3.2 *Suitable Nuts and Washers:*

3.2.1 Suitable nuts are covered in Specification A563. Unless otherwise specified, the grade and style of nut shall be as follows:

Fastener Size and Surface Finish	Nut Grade and Style <sup>A</sup>
1/4 to 1 1/2 in., plain (or with a coating thickness to require over-tapped nuts)	C3, DH3, heavy hex
Over 1 1/2 to 3 in., plain (or with a coating thickness to require over-tapped nuts)	
1/4 to 3 in., zinc-coated (or with a coating thickness to require over-tapped nuts)	
1/4 to 3 in., Type 3	

<sup>A</sup> Nuts of other grades and styles having specified proof load stresses (Specification A563, Table 3) greater than the specified grade and style of nut are suitable.

3.2.2 Unless otherwise specified, washers ordered with fasteners shall be furnished to the requirements of Specification F436/F436M, Type 1 or Specification F436/F436M, Type 3. Washers for A449 Type 3 fasteners shall conform to Specification F436/F436M Type 3.

4. Materials and Manufacture

4.1 *Heat Treatment:*

- 4.1.1 Type 1 fasteners produced from medium carbon steel shall be quenched in a liquid medium from the austenitizing temperature.
- 4.1.2 Type 1 fasteners produced from medium carbon steel to which chromium, nickel, molybdenum, or boron were intentionally added, and Type 3 fasteners, shall be quenched in oil from the austenitizing temperature.
- 4.1.3 Type 1 and Type 3 fasteners, regardless of the steel used, shall be tempered by reheating to not less than 800 °F.

4.2 *Threading*—Threads shall be rolled, cut, or ground.

4.3 *Secondary Processing*—If any processing which can affect the mechanical properties of the fasteners is performed after the initial testing, the fasteners shall be retested for all specified mechanical properties affected by the reprocessing.

5. Protective Coatings

5.1 *Zinc, Hot Dip, and Mechanically Deposited Requiring Over-tapped Nuts:*

- 5.1.1 When zinc-coated fasteners are required, the purchaser shall specify the zinc-coating process, such as, hot-dip, mechanically deposited, or no preference.
- 5.1.2 When hot dip is specified, the fasteners shall be zinc coated by the hot-dip process in accordance with the requirements of Specification F2329.
- 5.1.3 When mechanically deposited is specified, the fasteners shall be zinc coated by the mechanical deposition process in accordance with the requirements of Class 55 of Specification B695.

5.1.4 When no preference is specified, the supplier may furnish either a hot-dip zinc coating in accordance with Specification F2329, or a mechanically deposited zinc coating in accordance with Specification B695, Class 55. Threaded components (bolts and nuts) shall be coated by the same zinc coating process, and the suppliers' option shall be limited to one process per item with no mixed processes in a lot.

NOTE 2—When the intended application requires that assembled tension exceeds 50 % of minimum bolt or stud proof load, an anti-galling lubricant may be needed. Application of such a lubricant to nuts and a test of the lubricant efficiency are provided in Supplementary Requirement S1 of Specification A563 and should be specified when required.

5.2 *Other Coatings:*

When a specification does not apply, the purchaser shall specify the desired coating, coating thickness, supplemental treatments, or other requirements to define the coating. The fasteners shall be coated in accordance with and conform to the specified coating specification.

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6. Chemical Composition

- 6.1 Type 1 fasteners shall be plain carbon steel, carbon boron steel, alloy steel, or alloy boron steels, at the manufacturers option, conforming to the requirements in Table 1.
- 6.2 Type 3 fasteners shall be weathering steel and shall conform to one of the chemical compositions specified in Table 2. The selection of the chemical composition, A, B, C, D, E or F, shall be a the option of the manufacturer. See Guide G101 for methods of estimating the atmospheric corrosion resistance of low alloy steel.
- 6.3 Product analyses made on finished fasteners representing each lot shall conform to the product analysis requirements specified in Table 1 or Table 2, as applicable.
- 6.4 Heats of steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be permitted for bolts. Compliance shall be based on certification that heats of steel having any of the listed elements intentionally added were not used to produce the bolts.

6.5 Chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology A751.

