



Designation: F835 – 23

Standard Specification for Alloy Steel Socket Button, Low and Flat Countersunk Head Cap Screws¹

This standard is issued under the fixed designation F835; 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 (ε) 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 covers the requirements for quenched and tempered alloy steel hexagon socket button (SBHCS) 0.060 through 0.625 thread sizes, flat countersunk (SFHCS) 0.060 through 1.5 thread sizes and low (SLHCS) 0.1120 through 0.625 thread sizes head cap screws having material properties for high-strength requirements.

1.2 Fasteners meeting this specification are intended for shear-type applications and have tensile requirements ranging from 122 to 150 ksi.

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

1.4 The hazard statement applies only to the test method section, Section 11, of this specification. *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.*

1.5 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

A751 Test Methods and Practices for Chemical Analysis of Steel Products

¹ This specification is under the jurisdiction of ASTM Committee F16 on Fasteners and is the direct responsibility of Subcommittee F16.02 on Steel Bolts, Studs and Nuts.

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² 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.

D3951 Practice for Commercial Packaging

E18 Test Methods for Rockwell Hardness of Metallic Materials

E112 Test Methods for Determining Average Grain Size

F606/F606M Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

F788/F788M Specification for Surface Discontinuities of Bolts, Screws, Studs, and Rivets, Inch and Metric Series

F2328 Test Method for Determining Decarburization and Carburization in Hardened and Tempered Threaded Steel Bolts, Screws, Studs, and Nuts

2.2 ASME Standards:³

B18.3 Socket Cap, Shoulder and Set Screws—Inch Series

B18.24 Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

3. Ordering Information

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

3.1.1 Quantity (number of screws).

3.1.2 Dimensions, including nominal thread designation, thread pitch, and nominal screw length (inches). A standard part number may be used for this definition.

3.1.3 Name of the screw: SBHCS, SLHCS or SFHCS.

3.1.4 Coating, if required. If a protective finish other than black oxide is required, it must be specified on the order or product standard.

3.1.5 Lot testing, if required (see 10.3).

3.1.6 Certification, if required (see 14.1).

3.1.7 ASTM designation and year of issue.

3.1.8 Any special requirements.

3.1.9 For establishment of a part identifying system, see ASME B18.24.

3.2 *Example*—1000 pieces 0.250 – 20 × 0.375 SBHCS lot tensile test. ASTM F835–XX.

³ 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

4. Materials and Manufacture

4.1 The screws shall be fabricated from alloy steel made to fine grain practice. In the event of controversy over grain size, referee tests on finished screws conducted in accordance with Test Methods E112 shall prevail.

4.2 Screws shall be hot or cold upset or extruded, or both.

4.3 Unless otherwise specified, threads shall be rolled for diameters through 0.625 in. and for screw lengths through 4 in. For diameters and lengths other than this, threads may be rolled, cut or ground.

4.4 Screws shall be heat treated by quenching in oil from above the transformation temperature and then tempering by reheating to at least 650°F to be within the hardness range specified in Table 1.

4.4.1 The minimum tempering temperature may be verified by submitting screws to 635°F for 30 min at temperature. The average cross-section hardness of three readings on the screw before and after retempering shall not differ by more than 20 DPH.

4.5 When protective or decorative coatings are applied to the screws, precautions as required by the coatings shall be taken to prevent embrittlement.

5. Chemical Composition

5.1 The chemical composition of the screw material shall conform to the heat analysis specified in Table 2.

5.2 One or more of the following alloying elements, chromium, nickel, molybdenum, or vanadium, shall be present in the steel in sufficient quantity to ensure the specific strength properties are met after oil quenching and tempering. The steel shall meet the AISI definition of alloy steel, that is, maximum and minimum element content requirement or minimum element limits specified.

5.3 Steel to which bismuth, selenium, tellurium, or lead has been added intentionally shall not be permitted.

5.4 Material analysis may be made by the purchaser from finished products and the chemical composition thus determined shall conform to the requirements specified for the product analysis in Table 2.

TABLE 1 Mechanical Requirements

	Nominal Thread Size, in.	
	0.500 and smaller	Over 0.500
<i>Full-size Screws:</i>		
Tensile, min, ksi	144	136
<i>Machined Test Specimen:</i>		
Yield strength at 0.2 % offset, min, ksi	^A	153
Tensile strength, min, ksi	^A	170
Elongation in 4 <i>D</i> , min, %	^A	8
Reduction of area, min, %	^A	35
<i>Product Hardness:</i>		
Rockwell C	39–44	37–44
Vickers DPH	382–434	363–434

^A Not applicable.

TABLE 2 Chemical Requirements

Element	Composition, %	
	Heat Analysis	Product Analysis
Carbon	0.30 to 0.48	0.28 to 0.50
Phosphorus, max	0.035	0.040
Sulfur, max	0.040	0.045
Alloying elements	see 5.2	see 5.2

6. Mechanical Properties

6.1 The finished screws shall conform to the mechanical requirements specified in Table 1.

6.2 Screws having a nominal length equal to or greater than 3 diameters shall be tested full size and shall conform to the full-size tensile requirements specified in Table 3. Tensile failures through the head are acceptable provided the load requirements are satisfied.

6.3 Screws having a nominal thread diameter-length combination as specified in 6.2 and a breaking load exceeding 200 000 lb preferably shall be tested full size and shall meet the full-size tensile properties in Table 3. When equipment of sufficient capacity for such tests is not available or if excessive length of the screws makes full-size testing impractical, standard round machined specimens may be used that shall meet the machined test specimen tensile properties in Table 1. If discrepancy between full-size and machined specimen results, full-size tests shall be used as the referee method to determine acceptance.

6.4 Screws that are too short (lengths less than three times nominal size) or that have insufficient threads for tension testing shall not be subject to tension tests but shall conform to the hardness (minimum and maximum) requirements of Table 1.

6.5 All screws, regardless of size, shall conform to the hardness specified in Table 1. Hardness shall be met anywhere on the cross section through the threaded portion one diameter from the screw point.

7. Other Requirements

7.1 *Carburization or Decarburization:*

7.1.1 There shall be no evidence of carburization or gross decarburization on the surfaces of the heat-treated screws when evaluated in accordance with Test Method F2328 (Class 3 Product).

7.1.2 Partial decarburization shall be limited to the criteria in Test Method F2328 (Class 3 Product) when evaluated as described therein.

7.2 *Embrittlement*—Coated screws shall withstand the embrittlement test in accordance with 11.4 without showing indications of discontinuities. The loading shall be calculated with minimum screw tensile requirements.

8. Dimensions

8.1 Unless otherwise specified, the dimensions shall conform to the requirements of ASME B 18.3.