



Designation: ~~F912-04~~^{ε1} Designation: F912 - 11

Standard Specification for Alloy Steel Socket Set Screws¹

This standard is issued under the fixed designation F912; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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

~~ε¹Note—Sections 2.2 and 3.1.9 were editorially revised in October 2006.~~

1. Scope*

1.1 This specification covers the requirements for quenched and tempered alloy steel socket-set screws (SSS) in nominal diameters 0.060 through ~~2.000 in.~~ sizes 2 in. having hardnesses 45 to 53 HRC.

1.2 These set screws are intended for compression applications only and are not customarily subjected to embrittlement tests. For tensile applications, consult with the manufacturer for proper alloy and hardness.

~~1.3~~

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.

NOTE 1—A complete metric companion to Specification F912 has been developed—F912M; therefore, no metric equivalents are shown in this Specification.

1.4 The hazard statement pertains 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 and health practices and determine the applicability of regulatory limitations prior to use.*

~~NOTE 1—A complete metric companion to Specification F912 has been developed—F912M; therefore, no metric equivalents are shown in this Specification.~~

2. Referenced Documents

2.1 ASTM Standards:²

A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products ~~D3951 Practice for Commercial Packaging~~

~~E3~~

E3 Guide for Preparation of Metallographic Specimens ~~E18 Test Methods for Rockwell Hardness of Metallic Materials~~

E112 Test Methods for Determining Average Grain Size ~~E384~~

E384 Test Method for Knoop and Vickers Hardness of Materials

F606 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, and Studs, Inch and Metric Series~~

~~2-2 Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series~~

F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

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

2.2 ASME Standards:³

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, Nuts, Rivets, and Washers.

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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.

³ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

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

B18.3 Socket Cap, Shoulder and Set Screw, Inch Series⁴

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 information:

3.1.1 Quantity (number of screws).

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

3.1.3 Name of the screw (SSS).

3.1.4 Coating, if required. See 4.4.

3.1.5 Lot testing, if required. See 10.3.

3.1.6 Certification, if required. See

3.1.5 Certification, if required. See 14.1.

3.1.7 ASTM designation and year of issue.

3.1.8 Any 3.1.7 Any special or supplemental requirements.

3.1.9 For 3.1.8 For establishment of a part identifying system, see ASME B18.24.

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 The screws may be forged, formed, extruded, machined, or ground to meet the dimensional characteristics and performance requirements.

4.3 Set screws shall be heat treated by quenching in oil from above the transformation temperature and then tempered by reheating to meet the hardness range specified in 6.2.

4.4 *Standard Finishes*—Unless otherwise specified, the screws shall be furnished with one of the following standard surfaces as manufactured, at the option of the manufacturer; (1) bright uncoated; (2) thermal black oxide; or (3) chemical black oxide. Hydrogen embrittlement tests shall not be required for screws furnished in these conditions.

4.5 *Protective Coatings*:

4.5.1 When a protective finish other than as specified in 4.4 is required, it shall be specified on the purchase order with the applicable finish specification.

4.5.2 When protective or decorative coatings are applied to the screws, precautions specified by the coating requirements to minimize embrittlement shall be exercised.

5. Chemical Composition

5.1 The chemical composition of the screw material shall conform to the heat analysis specified in Table 1.

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 assure 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 Alloy steel to which bismuth, selenium, tellurium, or lead has been intentionally added to improve machinability shall 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 1.

6. Mechanical Properties

6.1 Socket set screws when subjected to a torque test in accordance with 11.2 shall withstand application of the test tightening torque specified in Table 2 without evidence of the socket reaming or the screw bursting.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

TABLE 1 Chemical Requirements

NOTE 1—Plus alloys in accordance with 5.2.

| 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 |

TABLE 2 Torsional Strength Requirements

| Nominal Size | | Shortest Nominal Screw Lengths Subject to Torque Testing for | | | Test Torque in.-lb, min |
|--------------|-------|--|----------------------|-----------------|----------------------------|
| | | Cup and Flat Points | Cone and Oval Points | Half Dog Points | |
| 0 | 0.060 | 0.109 | 0.125 | 0.109 | 1.1 |
| 1 | 0.073 | 0.125 | 0.141 | 0.125 | 2.1 |
| 2 | 0.086 | 0.125 | 0.141 | 0.141 | 2.1 |
| 3 | 0.099 | 0.141 | 0.156 | 0.156 | 6.0 |
| 4 | 0.112 | 0.141 | 0.172 | 0.156 | 6.0 |
| 5 | 0.125 | 0.156 | 0.188 | 0.172 | 11 |
| 6 | 0.138 | 0.172 | 0.203 | 0.188 | 11 |
| 8 | 0.164 | 0.188 | 0.219 | 0.203 | 23 |
| 10 | 0.190 | 0.188 | 0.250 | 0.234 | 40 |
| 1/4 | 0.250 | 0.250 | 0.312 | 0.297 | 94 |
| 5/16 | 0.312 | 0.312 | 0.391 | 0.359 | 183 |
| 3/8 | 0.375 | 0.375 | 0.438 | 0.438 | 317 |
| 7/16 | 0.437 | 0.438 | 0.547 | 0.484 | 502 |
| 1/2 | 0.500 | 0.500 | 0.609 | 0.547 | 750 |
| 5/8 | 0.625 | 0.625 | 0.766 | 0.672 | 1460 |
| 3/4 | 0.750 | 0.750 | 0.906 | 0.797 | 2520 |
| 7/8 | 0.875 | 0.875 | 1.125 | 0.984 | 5750 |
| 1 | 1.000 | 1.000 | 1.266 | 1.125 | 8000 |
| 1 1/8 | 1.125 | 1.125 | 1.391 | 1.188 | 8000 |
| 1 1/4 | 1.250 | 1.250 | 1.500 | 1.312 | 11 000 |
| 1 3/8 | 1.375 | 1.375 | 1.656 | 1.438 | 11 000 |
| 1 1/2 | 1.500 | 1.500 | 1.797 | 1.562 | 18 100 |
| 1 3/4 | 1.750 | 1.750 | 2.219 | 1.953 | 38 000 |
| 2 | 2.000 | 2.000 | 2.391 | 2.078 | 38 000 |

6.2 Socket set screws shall have a hardness of 45 to 53 HRC. The hardness limits shall apply throughout the screw from core to surface.

7. Other Requirements

7.1 Decarburization:

7.1.1 There shall be no evidence of gross decarburization of the surfaces of the heat-treated screws when measured in accordance with 11.4.

7.1.2 The depth of partial decarburization shall be limited to the values in Table 3 when measured as shown in Fig. 1, and in accordance with 11.4.

7.1.2 The depth of partial decarburization shall be limited to the values in Test Method F2328 (Class 3 Product) when measured as described therein.

8. Dimensions

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

9. Workmanship, Finish, and Appearance

9.1 Surface Discontinuities:

9.1.1 The surface discontinuities for these products shall conform to Specification F788/F788M and the additional limitations specified herein.

9.1.2 Processing defects that connect the socket to the periphery of the screw are not permissible. Defects originating on the periphery and with a traverse indicating a potential to intersect are not permissible.

9.1.3 Quench cracks of any depth, any length, or in any location are not permitted.

10. Number of Tests

10.1 The requirements of this specification shall be met in continuous mass production for stock, and the manufacturer shall make ample inspections to insure that the product conforms to the specified requirements. Additional tests of individual shipments of material are not ordinarily contemplated. A record of individual heats of steel in each test lot shall be maintained. The container shall be coded to permit identification of the lot.

10.2 When specified in the order, the manufacturer shall furnish a test report certified to be the last complete set of mechanical tests for each stock size in each shipment.

10.3 When additional tests are specified on the purchase order, a lot, for purposes of selecting test samples, shall consist of all screws offered for inspection at one time of one diameter and length. From each lot, the number of samples for each requirement shall be as follows: (Note: This will be aligned with F 16.02 assurance decision.)