



# Standard Specification for Alloy Steel Socket Set Screws (Metric)<sup>1</sup>

This standard is issued under the fixed designation F912M; 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 covers the requirements for quenched and tempered alloy steel socket set screws (SSS) M1.6 through M24 sizes having hardnesses 45 to 53 HRC, ISO 898/5 property class 45H.

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 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

NOTE 1—This specification is the metric companion of Specification F912.

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.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

[A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products](#)

[E3 Guide for Preparation of Metallographic Specimens](#)

[E112 Test Methods for Determining Average Grain Size](#)

[E384 Test Method for Knoop and Vickers Hardness of Materials](#)

[F606M Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets \(Metric\)](#)

<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 referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

### Washers, and Rivets (Metric)

[F788/F788M 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](#)

[F2328M Test Method for Determining Decarburization and Carburization in Hardened and Tempered Threaded Steel Bolts, Screws and Studs \(Metric\)](#)

### 2.2 ASME Standards:<sup>3</sup>

[B18.3.6M Hexagon Socket Set Screws Metric Series](#)

[B18.24 Part Identifying Number \(PIN\) Code System Standard for B18 Fastener Products](#)

### 2.3 ISO Standard:

[898/5 Mechanical Properties of Fasteners—Set Screws and Similar Threaded Fasteners Not Under Tensile Stress<sup>4</sup>](#)

## 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, thread pitch, nominal screw length (millimetres) 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 Certification, if required. See 14.1.

3.1.6 ASTM designation and year of issue.

3.1.7 Any special or supplemental requirements.

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

3.2 *Example*—50 000 pieces M6x1x8 cone point SSS—certification per 14.1—ASTM F912M—\_\_ (state issue date), or 25000 pcs B1836A 060008K SSS—certification per 14.1—ASTM F912M—\_\_ (state issue date).

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

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

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

**4. Material and Manufacture**

4.1 The screws shall be fabricated from alloy steel made to a 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 screw 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 alloying elements chromium, nickel, molybdenum, or vanadium shall be present in the steel in sufficient quantity to assure that 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 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.

6.2 Socket set screws shall have a hardness of 45 to 53 HRC. The point end hardness within 0.04 mm distance from the surface shall be equal to or greater than the measured core hardness but shall not exceed 53 HRC (560 DPH).

**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 Test Method F2328M (Class 4 Product) when measured as described therein.

**8. Dimensions**

8.1 Unless otherwise specified, the product shall conform to the requirements of ASME B18.3.6M.

**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 Threads shall have no laps at the root or on the flanks, as shown in Fig. 1(a). Laps are permitted at the crest (Fig. 1(c)) that do not exceed 25 % of the basic thread depth and on the flanks outside the pitch cylinder. Longitudinal seams rolled beneath the root of the thread and across the crests of cut threads are acceptable within the limits of 0.03 D or 0.2 mm, whichever is greater.

9.1.3.1 Witness marks remaining from thread rolling shall conform to F788/F788M, Supplementary Requirement.

**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 Screw Size	Shortest Nominal Screw Lengths Subject to Torque Testing for			Test Torque N-m, min
	Cup and Flat Points	Cone and Oval Points	Half Dog Points	
1.6	3	3	3	0.1
2	4	4	4	0.2
2.5	4	4	4	0.6
3	4	5	5	1.0
4	5	6	6	2.1
5	5	8	8	4.7
6	6	8	8	7.7
8	8	10	10	17.8
10	10	12	12	35
12	12	16	16	57
16	16	20	20	126
20	25	25	25	252
24	25	30	30	420

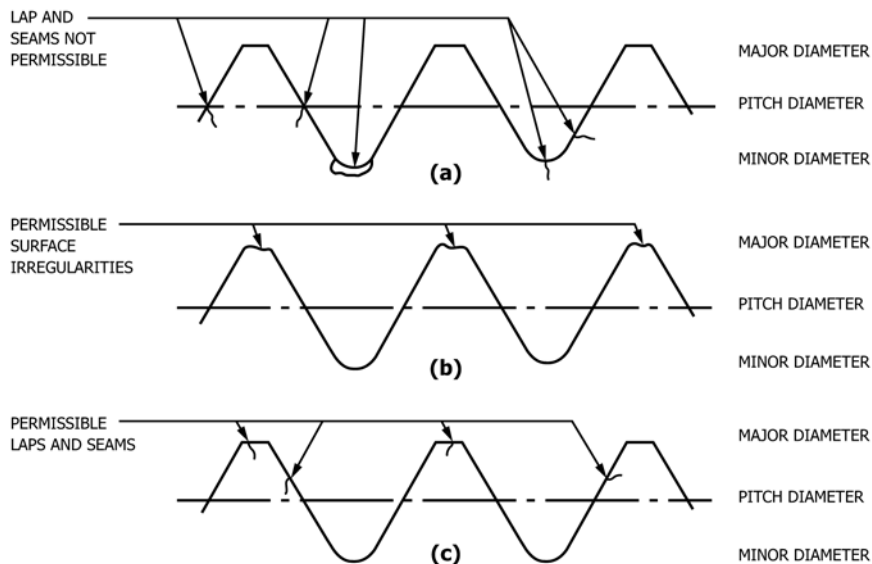


FIG. 1 Thread Discontinuities

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

**10. Number of Tests**

10.1 Practice F1470 shall be used to determine the necessary sampling plan and the number of tests that must be performed to demonstrate all the requirements of this specification are met for each lot.

**11. Test Methods**

11.1 Chemical analysis shall be conducted in accordance with Test Methods, Practices, and Terminology A751.

11.2 For socket strength torque test, the test screw shall be assembled into a tapped hole of 5H tolerance class in a steel block (see Fig. 2) until the face of the screw is flush with the

top surface of the test block and the set screw bears against a firm base, such as a hardened screw installed from the opposite side of the block. The applicable hexagon key bit shall be inserted to the full depth of the set screw socket and the test torque listed in Table 2 applied by means of a torque wrench. The screw shall be disassembled from the block and examined for compliance to the requirements of 6.1.

11.3 Hardness shall be determined in accordance with Test Methods F606M.

11.4 Decarburization tests shall be conducted in accordance with Test Method F2328M, Class 4.

11.4.1 Screw threads greater than 48 threads per inch, evaluation by the optical method as described in Test Method F2328M, shall determine conformance to specification requirements.

11.4.2 Interpret Microhardness Readings as Follows:

11.4.2.1 A decrease of more than 30 hardness points from Reading No. 1 to Reading No. 2 shall be regarded as decarburization and indicates the screw does not conform to specification requirements.

**12. Inspection**

12.1 The inspector representing the purchaser, upon reasonable notice, shall have free entry to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests and inspections required by the specification that are requested by the purchaser's representative shall be made before shipment, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

**13. Rejection and Rehearing**

13.1 The disposition of nonconforming lots shall be in accordance with Practice F1470.

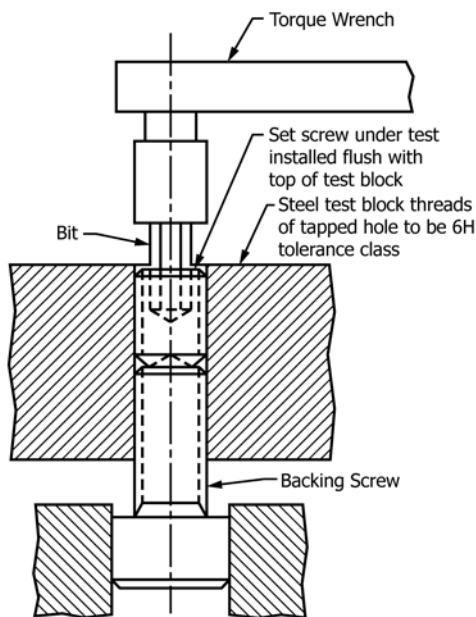


FIG. 2 Typical Torque Test Fixture

## 14. Certification

14.1 Upon request for the purchaser in the contract or order, the manufacturer or supplier, as applicable, shall furnish a test report or certificate of conformance as specified by the purchaser.

14.2 When a test report is specified, it shall include the heat number and the results of chemical composition, mechanical properties, metallurgical requirements, and workmanship requirements.

14.3 When a certificate of conformance is specified, it shall include a statement certifying the fasteners have been manufactured, tested, and inspected, and that they conform or do not conform to the requirements of this specification.

## 15. Responsibility

15.1 The party responsible for the fastener shall be the organization that supplies the fastener to the purchaser.

## 16. Packaging and Package Marking

### 16.1 Packaging:

16.1.1 Unless otherwise specified, packaging shall be in accordance with the manufacturers practice to prevent damage before and during shipment.

16.1.2 When special packaging requirements are required, they shall be defined at the time of the inquiry and order.

### 16.2 Package Marking:

16.2.1 Each shipping unit shall include or be plainly marked with the following information:

16.2.1.1 ASTM designation,

16.2.1.2 Name and brand or trademark of the manufacturer,

16.2.1.3 Number of pieces,

16.2.1.4 Purchase order number (when specified in the order), and

16.2.1.5 Country of origin.

## 17. Keywords

17.1 alloy; metric; screws; set; socket; steel

## SUMMARY OF CHANGES

Committee F16 has identified the location of selected changes to this standard since the last issue (F912M–04) that may impact the use of this standard.

(1) Revised **2.1** and **5.4**, to clean up grammar and correct names of standards.

(2) Removed 3.1.5 (lot testing is now always required and not an option).

(3) Revised **7.1.2**.

(4) Added **F2328M** to **2.1**.

(5) Added **9.1.3.1**.

(6) Complete revision of Section **10** (referred to **F1470**).

(7) Revised **11.3** to use Test Methods **F606M** and added Test Methods **F606M** to **2.1**.

(8) Revised **11.4** decarburization test methods (referred to **F2328M**) and added **F2328M** to **2.1**.

(9) Revised **11.4.1**.

(10) Removed sections 11.4.2 to 11.4.4.2.

(11) **14.1**, revised to refer to **F1470** and added **F1470** to **2.1**.

(12) Revised section **14.1**; added sections **14.2** and **14.3**.

(13) Revised section **16.1.1** and **16.2.1.4**.

(14) Removed existing Figure 1 and Table 3. Renumbered existing Figure 2 to Figure 1. Renumbered figures in text.

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