



Designation: F2882 – 12

Standard Specification for Screws, Alloy Steel, Heat Treated, 170 ksi Minimum Tensile Strength¹

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1. Scope

1.1 This specification covers the requirements for quenched and tempered alloy steel screws 0.060 through 1½ inches in diameter having a minimum ultimate tensile strength of 170 KSI.

NOTE 1—This specification is the inch companion of Specification F2882M.

1.2 *The following hazard caveat pertains only to the test method portion, Section 10, 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:*²

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

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

[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](#)

[F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection](#)

[F1940 Test Method for Process Control Verification to Prevent Hydrogen Embrittlement in Plated or Coated Fasteners](#)

[F2282 Specification for Quality Assurance Requirements for Carbon and Alloy Steel Wire, Rods, and Bars for Mechanical Fasteners](#)

¹ This test method 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.

[F2328 Test Method for Determining Decarburization and Carburization in Hardened and Tempered Threaded Steel Bolts, Screws and Studs](#)

2.2 *ASME Standards:*³

[B18.2.1 Square and Hex Bolts and Screws](#)

[B18.2.5 12 Point Flange Screws](#)

[B18.3 Socket Cap, Shoulder, and Set Screws, Hex and Spline Keys \(Inch Series\)](#)

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

3. Ordering Information

3.1 Orders for high strength screws under this specification shall include the following information:

3.1.1 Quantity (number of screws),

3.1.2 Nominal dimensions, including diameter, thread designation, thread, pitch, and nominal screw length,

3.1.3 Name of the screw including specification,

3.1.3.1 ASME B18.2.1, Square and Hex Bolts and Screws,

3.1.3.2 ASME B18.2.5, 12 Point Flange Screws,

3.1.3.3 ASME B18.3, Socket Cap, Shoulder, and Set Screws, Hex and Spline Keys (Inch Series),

3.1.4 ASTM designation and year of issue.

3.2 Orders for high strength screws may include the following optional requirements:

3.2.1 Inspection at point of manufacture.

3.2.2 Coating, if required (see 4.6).

3.2.3 Additional Testing (see 11.1).

3.2.4 Special Packaging (see 14.1.2).

3.2.5 Supplementary Requirement (see S1).

3.2.6 Special Requirements.

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

4. Materials and Manufacture

4.1 The screws shall be fabricated from steel made to fine grain practice and shall have an austenitic grain size of 5 or finer. In the event of controversy over grain size, referee tests on finished screws conducted in accordance with Test Methods E112 shall prevail.

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

4.2 High strength screws shall be heat treated by quenching in oil from above the transformation temperature and then tempered by reheating to at least 797°F to within the hardness range specified in [Table 1](#).

4.2.1 The minimum tempering temperature may be verified by submitting screws to 777°F for 30 min at temperature. The mean cross-section hardness of three readings on the screw before and after retempering shall not differ by more than 2 points HRC.

4.3 Re-heat-treatment of screws for the purpose of carbon restoration is not permitted except for set screws.

4.4 Unless otherwise specified, threads of screws shall be rolled for diameters through 0.625 in. and for screw lengths through 1.5 in. For diameters and lengths other than this, threads may be rolled, cut, or ground with the exception of socket set screws. Set screws with thread diameters up to and including #5 and all other diameters with lengths less than seven thread pitches may be rolled, cut, or ground. Thread diameters #6 and larger with a minimum of seven thread pitches in length shall be rolled.

4.5 *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.

4.6 *Protective Coatings:*

4.6.1 When a protective finish other than as specified in 4.5 is required, it shall be specified on the purchase order with the applicable finish specification.

4.6.2 When protective or decorative coatings are applied to the screws, precautions specified by the coating requirements to minimize internal hydrogen embrittlement shall be exercised. When specified in the purchase order, testing shall be conducted in accordance with Test Methods [F606](#) or [F1940](#). In the event that hardness reductions occur in test specimens due to coating curing times and temperatures, testing shall be conducted alternatively in accordance with Test Method [F1624](#).

5. Chemical Composition

5.1 The screws shall be alloy steel conforming to the chemical composition specified in [Table 2](#) and the require-

TABLE 1 Mechanical Requirements

Grade	170
Full-size screws:	
Tensile or wedge strength, min, KSI	170
Proof load (stress), min, KSI	135
Machined test specimen:	
Yield strength at 0.2 % offset, min, KSI	153
Tensile strength, min, KSI	170
Elongation in 5D, min, %	10
Reduction of area, min, %	35
Product hardness:	
Rockwell	37 to 42 HRC
Vickers	372 to 434 DPH

TABLE 2 Chemical Requirements

Element	Composition, %	
	Heat Analysis	Product Analysis
Carbon	0.33 to 0.48	0.31 to 0.50
Manganese, max	1.25	1.25
Phosphorus, max	0.035	0.040
Sulfur, max	0.040	0.045
Alloying elements	See 5.2	

ments in Specification [F2882](#). See Supplementary Requirement S1 when additional alloy steel grades are required.

5.2 One or more of the following alloying elements: chromium, nickel, molybdenum, or vanadium shall be present in sufficient quantity to ensure that the specified strength properties are met after oil quenching and tempering. As a guide for selecting material, an alloy steel should be capable of meeting the specified mechanical requirements if the “as oil quenched” core hardness one diameter from the point is equal to or exceeds 25 HRC + (55 × carbon content).

5.3 When product analyses are made by the purchaser from finished screws representing each lot, the chemical composition shall conform to the requirements for product analysis in [Table 2](#).

5.4 Steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be permitted for cold headed parts.

5.5 Chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology [A751](#).

6. Mechanical Properties

6.1 Screws shall be tested meet the mechanical requirements in [Table 1](#), and [Table 3](#) or [Table 4](#).

6.2 Screws other than set screws and flat countersink head screws in sizes 0.060 through 1½ in. diameter shall be wedge tensile tested using wedge angles as specified in [Table 5](#).

6.3 The hardness limits shall be met anywhere on the cross section through the threads, one diameter from the screw point.

6.4 Mechanical properties shall be determined using Test Methods [F606](#).

7. Dimensions

7.1 Unless otherwise specified, the product shall conform to the dimensional specification detailed in the purchase order.

8. Workmanship, Finish, and Appearance

8.1 There shall be no evidence of carburization or gross decarburization on the surfaces of the heat-treated screws when measured in accordance with [F2328](#).

8.2 The depth of partial decarburization shall be limited to the values in [F2328](#) (Class 3 Product).

8.3 The surface discontinuities for these products shall conform to Specification [F788/F788M](#).