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Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections¹

This standard is issued under the fixed designation C 1513; 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.

^{ε1} NOTE—The units statement in 1.2 was revised editorially in May 2009.

1. Scope

1.1 This specification covers steel self-drilling and self-piercing tapping screws for the connection of cold-formed steel members manufactured in accordance with Specifications C 645 and C 955. This specification also covers test methods for determining performance requirements and physical properties.

~~1.2 The values stated in inch-pound units are to be regarded as the standard. The SI equivalents of the inch-pound units are approximate.~~

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 The following safety hazards caveat pertains only to the test methods described in 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 requirements prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

B 117 Practice for Operating Salt Spray (Fog) Apparatus

C 11 Terminology Relating to Gypsum and Related Building Materials and Systems

C 645 Specification for Nonstructural Steel Framing Members

C 955 Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases

F 1941 Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))

2.2 ANSI/ASME Documents:

B18.18.1M Inspection and Quality Assurance for General Purpose Fasteners³

B18.6.4 Standard Specification for Thread Forming and Thread-Cutting Screws³

2.3 SAE Standards:

SAE J78-1998 Steel Self-Drilling Tapping Screws⁴

SAE J933 Mechanical and Quality Requirements for Tapping Screws⁴

3. Terminology

3.1 *Definitions*—For definitions relating to gypsum and related building materials and systems, use Terminology C 11.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bearing surface (of the screw), n*—the supporting or locating surface of a fastener with respect to the part which it fastens

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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, Vol 01.03, volume information, refer to the standard's Document Summary page on the ASTM website.

³ Annual Book of ASTM Standards, Vol 03.02.

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

⁴ Annual Book of ASTM Standards, Vol 04.01.

⁴ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

(mates). The loading of the fastener is usually through the bearing surface, (that is, the bearing surface of the hex washer head style is under the head, the part that touches the top material being fastened).

3.2.2 *case depth (of the screw), n*—the thickness of the hardened surface of the screw.

3.2.3 *countersunk head style (for a screw), n*—all screw head designs that sink into the top material being fastened and that have the bearing surface (see 3.2.1), at the top of the head (that is, flat and bugle).

3.2.4 *crest (of the screw thread), n*—the highest point of the screw thread.

3.2.5 *drill capacity (of the self-drilling screw), n*—the total thickness of material the fastener is designed to drill through, including any space between the layers.

3.2.6 *head styles (of the screw), n*—refer to Fig. 1 drawings.

3.2.6.1 *bugle head, n*—bugle shape countersinking head typically used for fastening gypsum panel products to wood and steel.

3.2.6.2 *hex washer face, n*—see *hex washer head*.

3.2.6.3 *hex washer head, n*—has an indented top surface and six flat sides formed integrally with a flat washer which projects beyond the sides and provides a flat bearing surface.

3.2.6.4

3.2.6.3 *lath head, n*—see *modified truss*.

3.2.6.5

3.2.6.4 *modified truss, n*—low profile round washer head.

3.2.6.6

3.2.6.5 *pan framing head, n*—flat top surface rounding into cylindrical sides and a flat bearing surface.

3.2.6.7

3.2.6.6 *pan head, n*—a slightly rounded top surface rounding into cylindrical sides and a flat bearing surface.

3.2.6.8

3.2.6.7 *pancake head, n*—lower profile head style than the hex washer and pan head with a larger flat bearing surface.

3.2.6.9

3.2.6.8 *wafer head, n*—a countersinking head style with a large lip at the top of the countersinking contour that will “flush” with the substrate creating a greater bearing surface, therefore a greater pull-over/pull-through value.

3.2.7 *point style, n*—of the self-drilling tapping screw is designated by a number (that is, 1, 2, 3, 4, or 5). The higher the number, the higher the drill capacity (see 3.2.5) of the screw.

3.2.8 *root (of the screw thread), n*—the lowest point of the screw thread.

3.2.9 *self-drilling tapping screw, n*—externally threaded fasteners with the ability to drill their own hole and form or cut their own internal mating threads without breaking.

3.2.10 *self-piercing tapping screw, n*—externally threaded fasteners with the ability to pierce metallic material 33 mils (0.84 mm), or less, form a sleeve by extruding metallic material and “tap” their own mating threads when driven. Self-piercing screws have a sharp point with the point angle not more than 30 degrees.

3.2.11 *spin-out (for a screw), n*—for a screw, the continued rotation of a screw without further penetration into the substrate.

3.2.12 *tapping screw, n*—externally threaded fasteners with the ability to “tap” their own internal mating threads when installed.

4. Classification

4.1 Steel tapping screws covered by this specification are two types:

4.1.1 Self-drilling.

4.1.2 Self-piercing.

5. Materials

5.1 Steel wire, Specification A 510—minimum grade 1018.

6. Physical Properties

6.1 *Dimensions:*

6.1.1 Self-drilling tapping screws shall be in accordance with SAE J78.

6.1.2 Self-piercing tapping screws shall be in accordance with head dimensions as shown in ANSI/ASME B18.6.4.

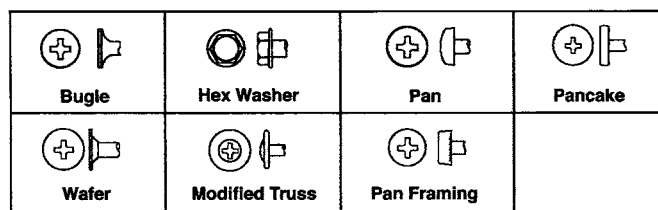


FIG. 1 Head Styles

6.2 *Total Case Depth*—Screws shall have a total case depth conforming to the tabulation in Table 1.

6.2.1 Case depth shall be measured at the mid-point between crest and root on the thread shank.

7. Packaging and Head Marking

7.1 Screws shall be marked with manufacturer’s/supplier’s head marking for traceability.

7.2 Screws shall be packaged in substantial commercial shipping containers, constructed so as to preserve the contents in good condition and to ensure acceptance and safe delivery by common or other carriers.

7.2.1 Individual packages shall be so constructed that the contents shall be able to be partially removed without destroying the container’s ability to serve as a receptacle for the remainder of the contents.

7.2.2 Individual packages and shipping containers shall be marked with the type, size, use, and quantity of the screws contained therein, the name brand headmarking example and trademark of the producer or supplier, the ASTM designation, and any or all appropriate evaluation reports . Boxes shall be marked with the drill capacity of the self-drilling tapping screws.

8. Performance Requirements

8.1 *Hardness:*

8.1.1 The self-drilling tapping screws shall have a surface hardness of not less than Rockwell C 50 and core hardness of not less than Rockwell C 32 as tested in accordance with SAE J78.

8.1.2 The self-piercing screws shall have a surface hardness of not less than Rockwell C 45 and core hardness of not less than Rockwell C 28 as tested in accordance with SAE J933.

8.2 *Ductility:*

8.2.1 The self-drilling tapping screws shall have sufficient ductility to be able to withstand a 5° bend without visible signs of fracture as tested in accordance with SAE J78.

8.2.2 The self-piercing tapping screws shall have sufficient ductility to be able to withstand a 10° bend without visible signs of fracture as tested in accordance with SAE J933.

8.3 *Torsional Strength:*

8.3.1 Self-drilling tapping screws shall not fail the application of torque less than or equal to the torsional strength specified in Table 2, when tested in accordance with SAE J78.

8.3.2 Self-piercing tapping screws shall not fail with the application of torque less than the torsional strength specified in Table 3, as tested in accordance with ANSI/ASME B18.6.4, Section 2.9.1.2, for tapping screws.

8.4 *Drill Drive Performance Requirement:*

8.4.1 Self-drilling tapping screws shall not fail the drill-drive test requirements as noted in SAE J78 and shown in Table 4.

8.4.2 Self-drilling tapping screws shall be tested in accordance with SAE J78 as shown in Fig. 2.

8.5 *Self-Drilling Tapping Screw Drill Capacity:*

8.5.1 Screws shall be able to self-drill and thread into cold-formed steel thicknesses without breaking or stripping as specified by each specific manufacturer’s published recommendations. Manufacturers shall provide a min-max recommendation with the drill capacity of each self-drilling point style screw.

9. Finish and Appearance

9.1 The threads shall be clean, smooth, and neatly formed.

9.2 Each fastener shall have manufacturer’s/supplier’s head marking for traceability.

9.3 Screws shall have a corrosion-resistant treatment. The finish shall not inhibit adhesion to finishing materials nor bleed through field-applied decoration. The screws shall meet a minimum requirement as listed in Specification F 1941 as tested in accordance with Practice B 117.

10. Sampling

10.1 Obtain not less than one randomly selected specimen of each type of screw to be tested from each of five containers, with not less than five screws per 250 000 screws, to constitute a lot for testing.

11. Test Methods

11.1 Screws shall be tested per SAE J78 Table number 4, Section 8.4, to determine the ability of the screws to self-drill through cold-formed steel without spinout, thread deformation, or breaking.

11.2 *Significance and Use:*

TABLE 1 Total Case Depth

Nominal Screw Size	Total Case Depth, Maximum, in. (mm)	Total Case Depth, Minimum, in. (mm)
8 through 12	0.009 (.2286 mm)	0.004 (.1016 mm)
¼ in.	0.011 (.2794 mm)	0.005 (.1270 mm)