



Designation: **C1513—13 C1513 – 18**

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

This standard is issued under the fixed designation C1513; 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.

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 **C645** and **C955**. 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 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, health, and environmental practices and determine the applicability of regulatory requirements/limitations prior to use.*

1.4 *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

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

A1040 Guide for Specifying Harmonized Standard Grade Compositions for Wrought Carbon, Low-Alloy, and Alloy Steels

B117 Practice for Operating Salt Spray (Fog) Apparatus

C11 Terminology Relating to Gypsum and Related Building Materials and Systems

C645 Specification for Nonstructural Steel Framing Members

C955 Specification for Cold-Formed Steel Structural Framing Members

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

F1941 Specification for Electrodeposited Coatings on Threaded Fasteners (Metric) F1941_F1941M

2.2 ANSI/ASME Documents:

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

ANSI/ASME B18.18 Quality Assurance for Fasteners³

2.3 SAE Standards:

SAE J78 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 **C11**.

3.2 *Definitions of Terms Specific to This Standard:*

¹ This specification is under the jurisdiction of ASTM Committee **C11** on Gypsum and Related Building Materials and Systems and is the direct responsibility of Subcommittee **C11.02** on Specifications and Test Methods for Accessories and Related Products.

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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.

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

*A Summary of Changes section appears at the end of 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 (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 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.

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

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

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

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

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

3.2.6.8 *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 ~~A510~~—minimum grade 1018.

5.1.1 Chemical composition shall be in accordance with Specification A1040, minimum Grade 1018.

6. Physical Properties

6.1 *Dimensions:*

6.1.1 Self-drilling tapping screws shall be in accordance with SAE J78 based upon nominal size or basic diameter. Threads per inch (TPI) shall be as shown in Table 1.








 Bugle	 Hex Washer	 Pan	 Pancake
 Wafer	 Modified Truss	 Pan Framing	

FIG. 1 Head Styles

TABLE 1 Threads Per Inch (TPI)

Nominal Screw Size	Threads Per Inch, max	Threads Per Inch, min
6	20	10
8	20	12
10	24	12
12	24	14
¼ in.	28	14

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

6.2 *Total Case Depth*—Screws shall have a total case depth conforming to the tabulation in **Table 2**.

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—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 C50 and core hardness of not less than Rockwell C32 as tested in accordance with SAE J78.

8.1.2 The self-piercing screws shall have a surface hardness of not less than Rockwell C45 and core hardness of not less than Rockwell C28 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 ANSI/ASME B18.6.4.

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 3**, 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 4**, 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 5**.

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.

TABLE 2 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)