Designation: C 1002 – 01

Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs[1]

This standard is issued under the fixed designation C 1002; 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.

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

1. Scope *

1.1 This specification covers steel self-piercing tapping screws for use in fastening gypsum panel products and metal plaster bases to cold-formed steel studs less than 0.033 in. (0.84 mm) in thickness and wood members and for fastening gypsum panel products to gypsum board.

1.2 This specification also covers test methods for determining performance requirements and physical properties.

1.3 The values stated in inch-pound units are to be regarded as the standard. The SI (metric) values given in parentheses are approximate and are for information only.

1.4 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 limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

A 548 Specification for Steel Wire, Carbon, Cold-Heading Quality for Tapping or Sheet Metal Screws[2]

C 11 Terminology Relating to Gypsum and Related Building Materials and Products[3]

C 36 Specification for Gypsum Wallboard[3]

C 645 Specification for Nonstructural Steel Framing Members[3]

C 847 Specification for Metal Lath[3]

3. Terminology

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

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *self-piercing, v*—the ability to penetrate without benefit of a pre-drilled hole with sharp-point angles of not more than 30°.

3.2.2 *spin-out, v*—for a screw, the continued rotation of a screw without further penetration into the substrate.

4. Classification

4.1 Steel screws covered by this specification are of four types of thread configurations:

4.1.1 *Type G*, course-pitch high-thread self-piercing screws for fastening gypsum board to gypsum board.

4.1.2 *Type S*, fine-thread screw for fastening gypsum board to cold formed steel members.

4.1.3 *Type W*, course-thread screw for fastening gypsum board to wood members.

4.1.4 *Type A*, course-pitch tapping screw thread for fastening metal plaster bases to wood or cold-formed steel.

5. Materials

5.1 *Steel Wire*, for manufacturing screws, Specification A 548, Grades 1013 to 1022.

6. Physical Properties

6.1 *Hardness*:

6.1.1 The surface of Type S, Type W, and Type A screws shall be case hardened to a depth of not less than 0.002 in. (0.05 mm) with case hardness not less than 45 HRC.

6.1.2 The surface of Type G screws is not required to be case hardened.

6.2 *Ductility*—The screws shall have sufficient ductility to be able to withstand a 15° bend without visible signs of fracture when tested as specified in 12.6.6.

7. Performance Requirements

7.1 *Type G Screws*:

7.1.1 Screws shall be able to self-pierce and drive into gypsum panel products.

7.1.2 Screw threads shall be adequate to pull the head of the screw below the surface of the gypsum panel product when tested as specified in 12.6.2.

[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] Discontinued; see *1990 Annual Book of ASTM Standards*, Vol 01.03.

[3] *Annual Book of ASTM Standards*, Vol 04.01.

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

7.2 *Type S Screws*:

7.2.1 *General*—Screws shall be able to self-pierce and drive into cold-formed steel members in less than 2 s, when tested as specified in 12.6.3.1.

7.2.2 *Screws for Fastening Gypsum Panel Products*—Screw threads shall be adequate to pull the head of the screw below the surface of the gypsum panel product, without spin-out, when tested as specified in 12.6.3.1.

7.3 *Type W Screws*:

7.3.1 *General*—Screw threads shall be able to self-pierce and drive into wood members.

7.3.2 *Screws for Fastening Gypsum Panel Products*—Screw threads shall be adequate to pull the head of the screw below the surface of the gypsum panel product, without spin-out when tested as specified in 12.6.4.1.

7.4 *Type A Screws*:

7.4.1 *General*—Screw shall be able to pierce and drive into wood or cold-formed steel members.

7.4.2 *Screws for Fastening Metal Plaster Bases*—Screw threads shall be adequate to pull a metal plaster base tightly enough against the face of a wood or steel stud, without spin-out, so that when subjected to a steady pull, the plaster base will tear before slipping out from under the screw head, when tested in accordance with 12.6.5.1 or 12.6.5.2.

8. Dimensions and Permissible Variations

8.1 *Head Diameter*:

8.1.1 *General*—Heads shall be permitted to be out of round not more than 0.02 in. (0.51 mm).

8.1.2 *Screws for Fastening Gypsum Board*—Not less than 0.315 in. (8 mm).

8.1.3 *Screws for Fastening Metal Plaster Bases*—Not less than 0.437 in. (11.1 mm).

8.2 *Head Contour*:

8.2.1 *Screws for Fastening Gypsum Panel Products*—The top of the head shall be flat. The outer flange thickness shall be 0.025 ± 0.005 in. (0.64 ± 0.13 mm). The contour beneath the flange head shall be such that the screw head shall be able to be driven so that the head of the screw rests immediately below the surface of the gypsum panel product.

8.2.2 *Screws for Fastening Metal Plaster Bases*—The top of the screw shall be either flat or contoured. The underside of the head shall be flat or near flat. The threads shall extend to the underside of the head.

8.3 *Driving Recess*:

8.3.1 *Screws for Fastening Gypsum Board*—No. 2 "Phillips" design, depth of recess, not less than 0.104 in. (2.64 mm).

8.3.2 *Screws for Fastening Metal Plaster Bases*—No. 2 "Phillips" design, depth of recess, not less than 0.077 in. (1.95 mm).

8.3.3 Determine depth of recess with a Phillips penetration depth gage.

8.3.4 Other types of screw-driving recesses having performance values equal to those of the recesses specified are acceptable.

8.4 *Shank Diameter*—Not less than No. 6, with major diameter not less than 0.136 in. (3.45 mm).

8.5 *Length*:

8.5.1 *Nominal Length*—The nominal length shall be the minimum length.

8.5.2 Type W and Type A screws shall be long enough to penetrate wood members not less than ⅝ in. (15.9 mm).

8.6 *Threads*—Either single or multiple thread design.

8.7 *Points*—Self-piercing design.

9. Finish and Appearance

9.1 *Form*—The form shall be straight and neatly formed.

9.2 *Threads*—The threads shall be clean and smooth.

9.3 *Finish*—Screws shall have a corrosion-resistant treatment. The treatment shall not inhibit adhesion to finishing compounds nor bleed through field-applied decoration.

10. Sampling

10.1 Obtain not less than 90 screws from not less than five containers.

11. Number of Tests and Retests

11.1 Test a minimum of five screws for each test. If any of the first lot fails, test 25 more screws.

11.2 If two or more of the second lot fail the second test, then the represented lot fails to meet the specified requirements.

12. Test Methods

12.1 The following test methods set forth procedures used to determine the ability of the screws to pierce through gypsum panel and metal plaster base and into the backup material without spinout.

12.1.1 The test methods can also be used to determine whether or not alternate screw driving recesses will have performance values equal to those of the "Phillips" recess specified.

12.2 *Significance and Use*—The test methods provide procedures for evaluating the physical properties and performance requirements of steel self-piercing screws. The degree of correlation between these tests and service performance has not been determined.

12.3 *Apparatus*:

12.3.1 *Screw Gun*—Standard manufacture electric screw gun, turning at a minimum of 2500 r/min.

12.3.2 *Timing Device*—Standard stopwatch, calibrated in 1/10 s.

12.3.3 *Vice*—Standard machinists vice, not less than 3 in. (76 mm).

12.3.4 *Clamp*—Locking pliers ("Vice-Grip"), 6 in. (152 mm).

12.4 *Materials*:

12.4.1 *Gypsum Wallboard*—Specification C 36, Type X, ⅝ in. (16 mm) thick.

12.4.2 *Metal Lath*—As in Specification C 847, diamond mesh, weight 2.5 lb/yd^2(1.4 kg/m^2).

12.4.3 *Steel Stud*—As in Specification C 645, 0.0179 in. (0.455 mm) thick, hardness not less than 52 HRB, size 3⅝ in. (92.1 mm).

12.4.4 *Wood Stud*—Douglas fir, construction grade, 2 by 4 or 2 by 6, nominal, containing not less than 16 % nor more than 19 % free moisture as determined by a suitable moisture meter.

12.4.5 *Kraft Paper*—0.01 in. (0.25 mm) thick, 2 in. (51 mm) square.

12.5 *Specimen Preparation*:

12.5.1 Cut 6-in. (152-mm) square specimens from a sheet of gypsum wallboard not less than 12 in. (305 mm) away from the edge or end.

12.5.1.1 Weigh the specimens to within 1 g, and then condition at a temperature of 85 ± 15°F (29.5 ± 5.5°C) in an atmosphere having a relative humidity of 50 ± 2 %. Individually test the specimens after constant weight is reached.

12.5.2 Cut 6 in. (152 mm) square specimens from a sheet of metal lath not less than 4 in. (102 mm) away from the edge or end.

12.5.3 Cut 12 in. (305 mm) long specimens from a length of a steel stud.

12.5.4 Cut 12 in. (305 mm) long specimens from a length of wood stud.

12.6 *Procedure*:

12.6.1 *General:* Drive the screws not closer than ⅝ in. (16 mm) from the edges of the gypsum wallboard and not closer than 2 in. (50 mm) from the edges of the metal lath.

12.6.2 *Type G Screw Test*—Rigidly support two pieces of gypsum board sandwiched together. With a screw gun, drive the screw specimen into the gypsum boards, so that the head of the screw is below the surface of the gypsum board.

12.6.2.1 When driving Type G screw specimens, use the force of less than 20 lbf (89 N).

12.6.2.2 *Interpretation of Results*—Observe if the screws are pulled below the surface of the gypsum board. If any of the five screws fail, the lot has failed the test. Retest in accordance with Section 11.

12.6.2.3 *Report*—Report whether the lot has passed or failed the test.

12.6.2.4 *Precision and Bias*—No information is presented about either the precision or the bias for the Type G screw test for pulling the screw head below the surface of the gypsum board because the test result is non-quantitative.

12.6.3 *Type "S" Screws Test for Fastening Board to Steel*:

12.6.3.1 When driving Type S screws use a force of 30 lbf (133N).

12.6.3.2 Rigidly support a piece of gypsum wallboard as described in 12.4.1 over a length of steel stud as described in 12.4.3. With a screw gun as described in 12.3, drive five screw specimens through the wallboard and into the steel. Measure the length of time it takes to drive each screw so that the screw head is below the surface of the gypsum board and observe if there was spinout.

12.6.3.3 *Interpretation of Results*—Calculate the average time to drive the five screw specimens through the wallboard and into the steel. If any of the five specimens fail to pull the screw head below the surface of the gypsum board or spins out, or if the average time is more than 2 s, the lot has failed. Retest in accordance with Section 11.

12.6.3.4 *Report*—Report whether the lot has passed or failed the test and the reason for failure.

12.6.3.5 *Precision and Bias*—No information is presented about either the precision or the bias for the Type S screw test for measuring spinout or pulling the screw head below the surface of the gypsum board, because the test result in non-quantitative. No information is presented about either the precision or the bias for the Type S screw test for measuring the time to drive the screw because no material having an acceptable reference value is available.

12.6.4 *Type A Screws for Fastening Metal Lath to Steel*:

12.6.4.1 When driving Type A screws, use a force of 30 lbf (133 N).

12.6.4.2 Rigidly support a piece of metal lath over a steel stud specimen. With a screw gun, as described in 12.3, drive the five screw specimens through each of the five pieces of metal lath, and into the steel. Measure the length of time it takes to drive the screws and observe if there was spinout. Grasp the metal lath with the locking pliers and pull steadily in a plane parallel to the plane of the lath. Observe whether the lath tears before it slips out from under the screw head.

12.6.4.3 *Interpretation of Results*—Calculate the average time to drive the five screw specimens through the metal lath into the steel. If any of the five specimens fails to pull the screw head through the metal lath and into the steel, or spins out, or if the average time is more than 2 s, or if the metal lath fails to tear when pulled, the lot has failed.

12.6.4.4 *Precision and Bias*—No information is presented about either the precision or the bias for the Type A screw test for measuring spinout or pulling the screw head below the surface of the gypsum board, because the test result is non-quantitative. No information is presented about either the precision or the bias for the Type A screw test for measuring the time to drive the screw because no material having an acceptable reference value is available.

12.6.5 *Type A Screws for Fastening Metal Lath to Wood*:

12.6.5.1 When driving type A screws, use a force of 30 lbf (133 N).

12.6.5.2 Rigidly support a piece of metal lath over a length of wood stud as described in 12.4.4. With a screw gun as described is 12.3, drive the five screw specimens through each of the five pieces of metal lath and into the wood stud. Observe if there was spinout. Grasp the metal lath with the locking pliers and pull steadily in a plane parallel to the plane of the lath. Observe whether the lath tears before it slips out from under the screw head.

12.6.5.3 *Interpretation of Results*—If any of the five specimens fails to pull the screw head through the metal lath and into the wood, or spins out, or if the metal lath fails to tear when pulled, the lot has failed. Retest in accordance with Section 11.

12.6.5.4 *Precision and Bias*—No information is presented about either the precision or the bias for the Type A screw test for pulling the screw head through the metal lath and into the wood, or spinout, or tearing of the metal lath, because the test results are non-quantitative.

12.6.6 *Type W Screw Test for Fastening Gypsum Board to Wood*:

12.6.6.1 When driving type W screws, use a force of 30 lbf (133 N).

12.6.6.2 Rigidly support a piece of gypsum wallboard as described in 12.4.1 over a length of wood as described in 12.4.4. With a screw gun as described in 12.3, drive five screw

specimens through the wallboard and into the wood so that the head of the screw is below the surface of the wallboard, and observe if there was spinout.

12.6.6.3 *Interpretation of Results*—If any of the five specimens fails to pull the head of the screw below the surface of the wallboard or spins out, the lot has failed the test. Retest in accordance with Section 11.

12.6.6.4 *Precision and Bias*—No information is presented about either the precision or the bias for the Type G screw test for pulling the screw head below the surface of the gypsum board because the test result is non-quantitative.

12.6.7 *Ductility Test*:

12.6.7.1 Place a screw specimen into a specified hole in a hardened block having a 10-degree angle on its face, then strike the part on the head with a hammer. If the head separates completely from the body, the part is either too hard in its core, the case hardness is too deep, the thread has cut the underhead radius, or the recess is too deep. Any of these problems can result in screws that break during assembly. If any of the five specimens fail, retest in accordance with Section 11.

12.6.7.2 *Interpretation of Results*—If any of the five screw specimens shows signs of fracture or complications as noted in 12.6.7.1, the lot has failed. Retest in accordance with Section 11.

12.6.7.3 *Report*—Report whether the lot has passed or failed the test and the reason for failure.

12.6.7.4 *Precision and Bias*—No information is presented about either the precision or the bias of the ductility test because the test results are non-quantitative.

13. Inspection

13.1 Inspection of the screws shall be agreed upon between the purchaser and the producer or the supplier as part of the purchase agreement.

14. Rejection

14.1 Rejection of screws that fail to conform to the requirements of this specification shall be reported to the producer or supplier promptly and in writing. The notice of rejection shall contain a statement documenting how the screws have failed to conform to the specification requirements.

15. Certification

15.1 When specified in the purchase agreement, a producer's or supplier's report shall be furnished at the time of shipment, certifying that the screws are in compliance with this specification.

16. Packaging and Marking

16.1 *Packaging*:

16.1.1 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, to the point of delivery.

16.1.2 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.

16.2 *Marking*—Individual packages and shipping containers shall be marked with the type, size, use, and quantity of screws contained therein, the name, brand, or trademark of the producer or supplier, and the ASTM designation.

17. Keywords

17.1 drill screw; gypsum board; lath; metal plaster base; self-pierce; self-piercing screw

SUMMARY OF CHANGES

Committee C11 has identified the location of selected changes to this standard since the last issue (C 1002 – 00) that may impact the use of this standard.

(*1*) The testing sections 12.6.1-12.6.7 were revised.

(*2*) Paragraphs 10.1, 11.1, 11.2, 12.1, and 12.3.1 were revised.