Designation: C954 – 15

Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness[1]

This standard is issued under the fixed designation C954; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification covers minimum requirements for steel drill screws for use in fastening gypsum panel products or metal plaster bases to steel members from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in thickness.

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

1.3 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.

1.4 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:*[2]

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

C11 Terminology Relating to Gypsum and Related Building Materials and Systems

C847 Specification for Metal Lath

C955 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

C1396/C1396M Specification for Gypsum Board

C1513 Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions relating to gypsum and related building materials and systems, see Terminology C11.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *steel drill screw, n*—self-drilling tapping screw with the ability to drill its own hole, form or cut mating threads without deforming its own threads or breaking during assembly.

4. Materials

4.1 Screws shall be manufactured from Grade 1018 to 1022 steel wire manufactured in accordance with Specification A510.

5. Physical Properties

5.1 *Metallurgical Requirements:*

5.1.1 The surface of the screw shall be carbonitrided to a depth of 0.004 to 0.008 in. (0.10 to 0.20 mm).

5.1.2 The core hardness shall be 32 to 40 HRC after being drawn at a minimum temperature of 625°F (330°C).

5.1.3 The screw shall have no band of free ferrite between the case and core nor shall the case contain appreciable amounts of retained austenite or other soft constituents.

5.1.4 Surface hardness shall be determined by a micro hardness instrument at "the root of the thread profile," as exposed by removal of enough material to form a flat surface along the length of the screw.

5.1.5 *Ductility*—Screws shall have sufficient ductility to be able to withstand a 5° bend without visible signs of fracture when tested as specified in paragraph 8.2.1 of Specification C1513.

5.2 *Dimensions and Permissible Variations:*

[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.

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

5.2.1 *General:*

5.2.1.1 *Head Diameter*— The head of the screw shall not be out of round more than 0.021 in. (0.51 mm) and have the following shape and dimensions:

5.2.1.2 *Screw Diameter*— Screws shall have a major diameter not less than 0.136 in. (3.45 mm).

5.2.1.3 *Points,* shall provide for self-drilling into steel studs from 0.333 in. (0.84 mm) to 0.112 in. (2.84 mm) in thickness and meet the performance tests in Section 6.

5.2.1.4 *Driving Recess,* shall be a No. 2 "Phillips" design with a minimum depth of 0.104 in. (2.64 mm) as determined with a "Phillips" penetration depth gage or a recess of equal performance.

5.2.1.5 *Length*—Nominal lengths shall be minimum length.

5.2.2 *Screws for Fastening Gypsum Board:*

5.2.2.1 Screw-head minimum diameter shall be 0.3145 in. (8.00 mm).

5.2.2.2 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 products.

5.2.2.3 For screws less than 1½ in. (38 mm) overall length, the threads shall extend to the lower edge of the head contour.

5.2.3 *Screws for Fastening Metal Plaster Bases:*

5.2.3.1 Screw head minimum diameter shall be 0.437 in. (11.1 mm).

5.2.3.2 The top of the head shall be flat or contoured. The underside of the head shall be flat.

5.2.3.3 The threads shall extend to the underside of the head.

6. Performance Requirements

6.1 *Spin-Out:*

6.1.1 Screws shall self-drill and drive into a stud 0.0538 in. (1.4 mm) thick with an approximate hardness of 65 HRB without spin-out.

6.1.2 Screws shall self drill and drive into a stud 0.0966 in. (2.5 mm) thick, with a hardness of 80 HRB without spin-out.

6.2 *Performance:*

6.2.1 When tested in accordance with Section 10 and 11, screws shall meet the requirements as follows:

6.2.1.1 *Gypsum Panel Products*—When tested in accordance with Section 11, screw threads shall be capable of pulling the head of the screw below the surface of the gypsum board

6.2.1.2 *Metal Plaster Bases*—When tested in accordance with Section 10, screw threads shall be adequate to pull metal lath tight against the flange of a steel stud 0.033 in. (0.84 mm) thick so that when subjected to a steady pull, the lath will tear and not slip out from under the screw head when tested in accordance with 10.5.1.

7. Finish and Appearance

7.1 Screws shall be corrosion-resistant treated with a material which will not inhibit adhesion to joint compounds or plaster and will not bleed through decorative finishes.

7.2 Screws shall be straight, clean, smooth, neatly formed, and free of defects such as burrs and deformations.

8. Sampling

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

9. Number of Tests and Retests

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

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

10. Metal Lath Test Method

10.1 *Summary of Test Method:*

10.1.1 This test method utilizes steel screws designed for use to hold metal plaster base materials applied with power-driven screw guns of 2500 rpm maximum to steel studs.

10.2 *Significance and Use:*

10.2.1 This test method evaluates the ability of steel drill screws used to secure metal plaster bases to certain steel framing members.

10.2.2 The test shall be conducted in a laboratory or on-site.

10.3 *Apparatus:*

10.3.1 *Power-Driven Drill Screw Gun,* capable of 2500 rpm (free spindle speed) with a depth-sensitive nose piece, supplied with a screw driving bit to fit the screw used in the test.

10.3.2 *Vice,* or similar device, to support the stud during the test.

10.3.3 *Clamp*—Locking pliers (for example, Vise-Grips), 6 in. (152 mm).

10.4 *Materials:*

10.4.1 *Steel Stud*—Specification C955, one section of 0.033-in. thick stud (0.84 mm).

10.4.2 *Gypsum Wallboard*— Specification C1396/C1396M, Type X, ⅝ in. (16 mm) thick.

10.4.3 *Screw Specimens,* to be tested.

10.4.4 *Diamond Mesh Metal Lath,* Specification C847, diamond mesh, weight 2.5 lb/yd^2 (1.4 kg/m^2).

10.5 *Procedure for Performance Tests:*

10.5.1 Using the screw specimen, attach metal lath to center of a flange of a steel stud which has been securely and rigidly supported.

10.5.1.1 Grasp the metal lath with 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.

10.6 *Precision and Bias*—No statement is made regarding the precision and bias of this test method, since the result of the test method is reported in nonnumerical terms.

11. Penetration Test Method

11.1 *Significance and Use*—This test method provides a procedure for evaluating the ability of steel drill screws to pull the head of a screw below the surface of gypsum wallboard. It shall be used to determine compliance with this specification.

The degree of performance of this test method with service performance has not been determined.

11.2 *Apparatus*—Apparatus shall satisfy the following:

11.2.1 *Power-Driven Drill Screw Gun,* capable of 2500 rpm (free spindle speed) with a depth-sensitive nose piece, supplied with a screw driving bit to fit the screw used in the test.

11.3 *Materials*—Materials shall satisfy the following:

11.3.1 *Gypsum Wallboard*—Specification C1396/C1396M, Type X, 5⁄8 in. (16 mm) thick.

11.3.2 *Steel Stud*—Specification C955, one section of 0.033-in. thick stud (0.84 mm), one section of 0.0538-in. (1.4 mm) thick stud with an approximate hardness of 65 HRB, one section of 0.0966 in. (2.5 mm) thick stud, with an approximate hardness of 80 HRB.

11.4 *Sampling*—As in Section 8.

11.5 *Specimen Preparation:*

11.5.1 Each steel stud shall be cut into test specimens not less than 18 in. (460 mm) long.

11.5.2 For each test, one piece of gypsum wallboard, 6 in. (150 mm) square, shall be cut from not less than 12 in. (300 mm) from the edge or end of the gypsum wallboard.

11.6 *Procedure:*

11.6.1 Assemble the steel stud and gypsum wallboard on a rigid, flat surface.

11.6.2 Prior to performing the test, drive several screws to set the depth of the nose piece on the screw gun, allowing the screws to be driven below the surface of the wallboard without breaking the gypsum wallboard face paper.

11.6.3 Drive the screw using the screw gun, while applying a force (dead weight and applied force) of 30 lbf (112.2 N). Drive the screw to below the surface of the gypsum wallboard. Record if the screw has spun out and if the head of the screw was pulled below the surface of the gypsum wallboard.

11.7 *Number of Tests and Retests:*

11.7.1 Five specimens of members shall be tested.

11.7.2 If more than one test specimen fails to meet the requirements, two more test specimens shall be chosen for retesting.

11.8 *Report*—Report shall indicate all specimens meeting the requirements of this specification if the screw did not spin out; or shall indicate all failing if the screw spun out.

11.9 *Precision and Bias*—No statement is made about either the precision or bias of this test method since the result merely states whether or not there is conformance to the criteria for success specified in the procedure.

12. Inspection

12.1 Inspection of steel drill screws shall be agreed upon by the purchaser and the producer or supplier as part of the purchase agreement.

13. Rejection and Rehearing

13.1 Rejection of steel drill screws that fail to conform to the requirements of this specification shall be reported to the producer or supplier promptly and in writing within ten working days from receipt of shipment by the purchaser. Notice of rejection shall contain a specific statement as to the respects in which the screws have failed to conform to the requirements of this specification. In case of dissatisfaction with the results of the test, and at the request of the producer or supplier, such notice of rehearing shall be supported by results of a test conducted by a mutually agreeable independent laboratory.

14. Certification

14.1 When specified in the purchase agreement, the producer or supplier shall furnish a report certifying that, at time of shipment, the screws were in compliance with the requirements of this specification.

15. Packaging and Marking

15.1 Screws shall be packaged in substantial commercial containers constructed so as to preserve the contents in good condition and to ensure acceptance and safe delivery by common or other carriers, at the lowest rate, to the point of delivery.

15.2 The containers shall be so constructed that the contents can be partially removed without destroying the container's ability to serve as a receptacle for the remainder of the contents.

15.3 Individual packages and shipping containers shall be marked with the type and length of screw and the name of the manufacturer or distributor.

16. Keywords

16.1 steel drill screw; steel self-drilling tapping screw

SUMMARY OF CHANGES

Committee C11 has identified the location of selected changes to this standard since the last issue (C954 – 11) that may impact the use of this standard. (June 1, 2015.)

(1) Revised subsection 5.2.2.3.