Designation: C645 – 18

Standard Specification for Nonstructural Steel Framing Members[1]

This standard is issued under the fixed designation C645; 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 nonstructural steel framing members in interior construction assemblies.

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 portion, Sections 9 and 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, health, and environmental practices and determine the applicability of regulatory 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]

A1003/A1003M Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members

C11 Terminology Relating to Gypsum and Related Building Materials and Systems

C475/C475M Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

C754 Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

C1002 Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C1396/C1396M Specification for Gypsum Board

2.2 *AISI Standards:*[3]

S100 North American Specification for the Design of Cold-Formed Steel Structural Members, 2007 edition

S220 North American Standard for Cold-Formed Steel Framing—Nonstructural Members, 2015 Edition

2.3 *ICC-ES Document*[4]

ICC-ES-AC86 Acceptance Criteria for Cold-formed Steel Framing Members—Interior Nonload-bearing Wall Assemblies—Approved May 2012

3. Terminology

3.1 *Definitions*—Definitions shall be in accordance with Terminology C11.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *members, n*—in screw application of gypsum board, studs, runners (track), hat furring channels, main beams, and cross furring members of grid suspension systems or other items manufactured in accordance with this specification.

3.2.2 *nonstructural wall stud, n*—a member in a steel framed wall system which is limited to a lateral (transverse) load of not more than 10 lb/ft^2 (480 Pa), a superimposed vertical load, exclusive of sheathing materials, of not more than 100 lbf/ft (1460 N/m), or a superimposed vertical load of not more than 200 lbs (890 N).

4. Materials and Manufacture

4.1 Members shall be manufactured from steel meeting the requirements of Specification A1003/A1003M.

4.2 Members shall have a protective coating in accordance with AISI S220, Section A5.

[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.

Current edition approved June 1, 2018. Published June 2018. Originally approved in 1970. Last previous edition approved in 2014 as C645 – 14$^{\varepsilon 1}$. DOI: 10.1520/C0645-18.

[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 Iron and Steel Institute (AISI), 1140 Connecticut Ave., NW, Suite 705, Washington, DC 20036, http://www.steel.org.

[4] Available from ICC Evaluation Services, Inc., 5360 Workman Mill Road, Whittier, CA 90601, www.icc-es.org.

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

4.3 Members shall be manufactured from steel having a minimum thickness, individual measurement of 0.0179 in. (0.455 mm), before application of protective coating.

5. Dimensions and Permissible Variations

5.1 Studs and rigid furring channels shall have a configuration and steel thickness such that the system in which they are used will carry the design transverse loads without exceeding either the allowable stress of the steel or the allowable design deflection. Main beams and cross furring of grid suspension systems shall be limited to a deflection of L/240. The manufacturer shall supply sufficient data for calculating design performance.

NOTE 1—Allowable deflection varies depending on the cladding used and architectural requirements. Detailed requirements shall be specified in application specifications.

5.1.1 Members, except main beams of grid suspension systems, shall be sufficiently rigid to permit penetration of the screw.

5.1.2 Minimum width of face to which gypsum board is screw-attached shall be not less than 1¼ in. (32 mm).

5.1.3 Minimum lip dimension shall be 3⁄16 in. (5 mm). (See Fig. 1.)

5.2 Members shall comply with the manufacturing tolerances as listed in AISI S220, Section A6.4.

5.3 *Rigid Furring Channels*—Minimum depth shall be ⅞ in. (22 mm). Minimum width of furring attachment flanges (see Fig. 2) shall be ½ in. (12.7 mm).

5.4 Grid suspension systems include main beams and cross furring members which mechanically interlock to form a modular supporting network. Length tolerance for grid suspension members shall be ±1⁄16 in. (1.59 mm).

5.5 Runners (track) shall be formed in a U-shaped configuration, having web depth compatible with those of the studs of the same nominal size. The runners (track) shall be designed such that when the studs are placed in both the top and bottom runners (track), they are held by friction. Minimum height of flanges shall be 1 in. (25 mm).

6. Edges

6.1 Members shall be manufactured in such a fashion as to minimize burrs and sharp edges.

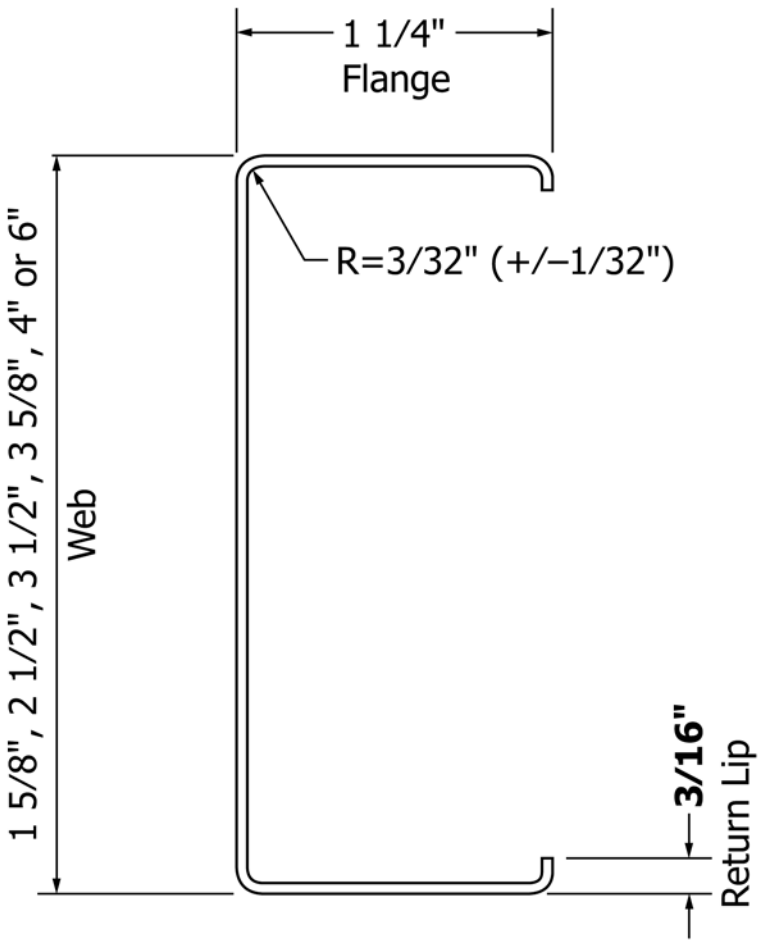


FIG. 1 Minimum Drywall Stud Cross Section

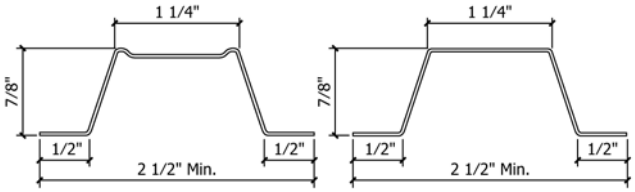


FIG. 2 Hat Furring Channel Cross Section

7. Cutouts

7.1 Cutouts shall not reduce the performance of the members in the gypsum board construction assembly below the specified performance requirements.

8. Sectional Properties

8.1 The sectional properties of members shall be computed in accordance with AISI S100 (see Tables 1 and 2 and Figs. 1 and 2).

9. Performance Requirements

9.1 *Penetration*—When tested in accordance with Section 10, members shall be capable of pulling the head of the screw below the surface of the gypsum board in less than 2 s without spin out.

9.2 Members that can show certified third party testing in accordance with ICC-ES-AC86 (Approved May 2012), and conform to the limiting height tables in Specification C754, need not meet the minimum thickness limitation set forth in subsection 4.3 or the minimum section properties set forth in subsection 8.1.

10. Penetration Test

10.1 *Significance and Use*—This test method provides a procedure for evaluating the member's ability 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.

10.2 *Apparatus Shall Satisfy the Following:*

TABLE 1 Minimum Section Properties for Various Studs

Section Designator[A]	Stud Depth		Design Thickness		Minimum Base Steel Thickness[B]		Gross Area[C]		Effective Properties[C,D]			
									Ix[E]		Mn/Ω[F]	
	in.	(mm)	in.	(mm)	in.	(mm)	in^2	(mm^2)	in^4	(1000 mm^4)	(in-k)	(N-m)
162S125-18	1.625	41	0.0188	0.478	0.0179	0.454	0.080	52	0.034	14	0.61	69
162S125-30	1.625	41	0.0312	0.792	0.0296	0.752	0.132	85	0.060	25	1.19	134
162S125-33	1.625	41	0.0346	0.879	0.0329	0.835	0.145	94	0.066	27	1.37	155
250S125-18	2.500	64	0.0188	0.478	0.0179	0.454	0.097	63	0.910	38	1.03	116
250S125-30	2.500	64	0.0312	0.792	0.0296	0.752	0.159	102	0.159	66	2.09	236
250S125-33	2.500	64	0.0346	0.879	0.0329	0.835	0.176	114	0.175	73	2.40	272
350S125-18	3.500	89	0.0188	0.478	0.0179	0.454	0.115	74	0.203	84	1.42	161
350S125-30	3.500	89	0.0312	0.792	0.0296	0.752	0.190	123	0.346	144	2.96	335
350S125-33	3.500	89	0.0346	0.879	0.0329	0.835	0.210	135	0.382	159	3.45	390
362S125-18	3.625	92	0.0188	0.478	0.0179	0.454	0.118	76	0.221	92	1.48	167
362S125-30	3.625	92	0.0312	0.792	0.0296	0.752	0.194	125	0.376	157	3.08	348
362S125-33	3.625	92	0.0346	0.879	0.0329	0.835	0.215	138	0.415	173	3.59	406
400S125-18[G]	4.000	102	0.0188	0.478	0.0179	0.454	0.125	81	0.281	117	1.64	185
400S125-30	4.000	102	0.0312	0.792	0.0296	0.752	0.206	133	0.474	197	3.44	388
400S125-33	4.000	102	0.0346	0.879	0.0329	0.835	0.228	147	0.524	218	4.01	453
600S125-30	6.000	152	0.0312	0.792	0.0296	0.752	0.268	173	1.223	513	5.39	609
600S125-33	6.000	152	0.0346	0.879	0.0329	0.835	0.297	192	1.378	574	6.32	714

[A] The section designator defines the cold-formed steel framing member dimensions.
Example: 350S125-18
350 designates the member web depth in 100ths of an inch, 350 = 3.50 in. (88.9 mm)
S designates the type of member, S = Stud
125 designates the member flange width in 100ths of an inch, 125 = 1.25 in. (31.8 mm)
-18 designates the minimum base metal thickness in mils, 18 = 0.0179 in. (0.454 mm)
-30 designates the minimum base metal thickness in mils, 30 = 0.0296 in. (0.752 mm)
-33 designates the minimum base metal thickness in mils, 33 = 0.0329 in. (0.836 mm)
[B] Minimum base steel thickness is 95 % of Design Thickness.
[C] Properties are based on a centerline radius of 3⁄32 in. (2.38 mm), see Fig. 1.
[D] Effective properties are calculated in accordance with AISI S100 and are based on a yield strength, Fy = 33 ksi.
[E] Moment of inertia, Ix, given is for deflection calculations.
[F] Allowable moment is taken as the lowest value based on local or distortional buckling. For distortional buckling, K_Φ = 0 and β = 1.
[G] Where noted, member web height-to-thickness ratio exceeds 200, web stiffeners required at supports.

TABLE 2 Hat Furring Channel Section Properties

Design Thickness		Minimum Base Steel Thickness[A]		Gross Area[B]		Effective Properties[B,C,D]			
						I_x[E]		Mn/Ω[F]	
in	(mm)	in	(mm)	in^2	(mm^2)	in^4 [D]	(mm^4)[D]	in-k	(N-m)
0.0188	0.477	0.0179	0.453	0.0702	45.29	0.0086	3563	0.32	36.16
0.0283	0.719	0.0269	0.683	0.1046	67.48	0.0131	5440	0.54	61.02
0.0312	0.792	0.0296	0.752	0.1152	74.32	0.0143	5953	0.61	68.98
0.0346	0.879	0.0329	0.835	0.1270	81.94	0.0157	6531	0.66	74.58

[A] Minimum base steel thickness is 95 % of Design Thickness.
[B] Properties are based on a centerline radius of 3/32 in. (2.38 mm).
[C] Effective properties are given as the minimum value for either positive or negative bending.
[D] Effective properties calculated in accordance with AISI S100 and are based on Fy = 33 ksi (227 MPa).
[E] Moment of inertia given is for deflection calculations.
[F] Allowable moment based on local buckling.

10.2.1 *Power-Driven Drill Screw Gun,* capable of 4000 rpm (free spindle speed) with a depth-sensitive nose piece, supplied with a screw driving bit to fit the screw used in the test.

10.2.2 *Stop Watch,* capable of being read to the nearest 0.1 s.

10.3 *Materials Shall Satisfy the Following:*

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

10.3.2 *Screws*—Specification C1002, Type S, minimum 1 in. (25.4 mm) long.

10.3.3 *Paper Joint Tape*—Specification C475/C475M.

10.4 *Sampling*—One member shall be selected from each bundle or package, but not more than ten from any one shipment for testing.

10.5 *Specimen Preparation:*

10.5.1 Each member to be tested shall be cut into test specimens not less than 18 in. (460 mm) long.

10.5.2 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.

10.5.3 For each test, four pieces of paper joint tape, 2 in. (50 mm) square shall be cut.

10.6 *Procedure:*

10.6.1 Assemble the member, gypsum wallboard, and paper joint tape on a rigid, flat surface. (See Fig. 3 for studs, Fig. 4 for furring channels.)

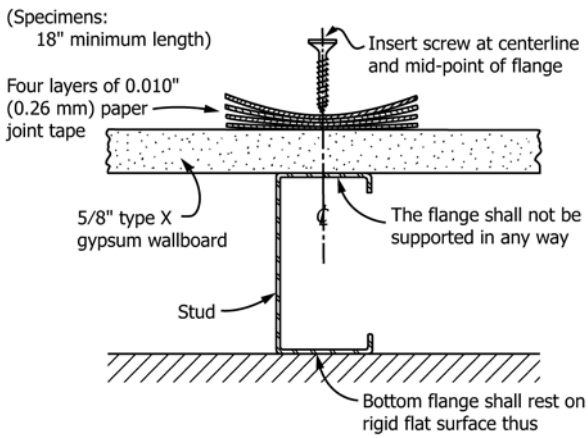
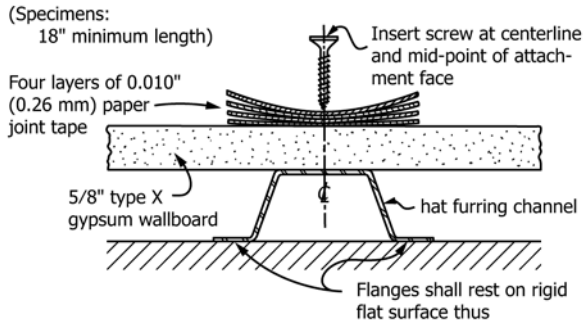


FIG. 3 Studs



NOTE 1—Wallboard specimens shall be taken a minimum of 12 in. (305 mm) from either edge and either end of wallboard panel.

FIG. 4 Hat Furring Channels

10.6.2 Prior to performing the test, drive several screws without the paper joint tape 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.

10.6.3 Drive the screw through the paper joint tape, using the screw gun, while applying a force (dead weight and applied force) of 30 lbf (112.2 N). Drive the screw until the nosepiece of the screw gun has either stopped and seated the screw or the screw spins out. Record if the screw has spun out and if it exceeds 2 s to seat the screw in the gypsum wallboard.

10.7 *Number of Tests and Retests:*

10.7.1 A sample consisting of five specimens of members shall be tested.

10.7.2 If not more than one of the test specimens fails to meet the requirements, the sample has met the requirements.

10.7.3 If two of the five test specimens fail to meet the requirements, two additional test specimens shall be chosen for retesting. If either of the two additional test specimens fail, the sample has failed to meet the requirements of this test.

10.8 *Report*—Report shall indicate the total number of specimens tested and the number of specimens meeting the requirements of this specification.

10.9 *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.

11. Inspection

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

12. Rejection

12.1 When specified in the purchase agreement, members that fail to conform to the requirements of the specification shall be rejected. Rejection shall be reported to the producer or supplier promptly and in writing. The notice of rejection shall contain a statement documenting how the member has failed to conform to the requirements of this specification and the purchase agreement.

13. Certification

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

14. Marking and Identification

14.1 See AISI S220, Section A6.5—Product Identification.

15. Protection

15.1 Material shall be protected during shipment as required. When specified in the purchase order, the members shall be packaged in accordance with the purchaser's instructions.

15.2 When materials are stored, they shall be stored off the ground and be properly supported on a flat surface.

16. Keywords

16.1 furring channels; grid suspension systems; gypsum board; runners; screws; section properties; spinout; studs

SUMMARY OF CHANGES

Committee C11 has identified the location of selected changes to this standard since the last issue (C645 – $14^{\varepsilon 1}$) that may impact the use of this standard. (Approved June 1, 2018.)

(1) Revised year date for AISI Reference Document S220 (updated to the most recent edition).
(2) Revised 4.2 and 5.2 (inserted reference to AISI S220, Section A5).
(3) Removed previous Table 1 and Fig. 2.