Designation: C557 – 03 (Reapproved 2017)

Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing[1]

This standard is issued under the fixed designation C557; 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 includes properties and covers minimum performance standards for adhesives intended to bond the back surface paper of gypsum wallboard to wood framing members.

1.2 This specification also covers test requirements and test methods for the adhesive used for the application of all thicknesses of gypsum wallboard.

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 *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.*

1.5 *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]

C1396/C1396M Specification for Gypsum Board

D905 Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading

D907 Terminology of Adhesives

E4 Practices for Force Verification of Testing Machines

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

3. Terminology

3.1 *Definitions*—Many terms in this specification are defined in Terminology D907.

4. Significance and Use

4.1 The specification applies to adhesives for bonding the back surface paper of gypsum wallboard of any thickness to wood-framing members.

4.2 This specification provides a basis for ensuring the quality of the adhesives.

4.3 Although the bonds rendered by these adhesives shall have enough strength by themselves to maintain the bond between adherends, they are not intended as a substitute for the common practice of using mechanical fasteners to maximize integrity of drywall-wood-framing structures.

4.4 The tests are suitable for products performance certification and quality control programs and can be useful to the general public, adhesive manufacturers, distributors, specifiers, architects, contractors, testing laboratories and other businesses and professionals

4.5 The results do not include all possible conditions, which may occur during final assembly, but indicate a set of performance characteristics for laboratory controlled bonding variables.

5. Adhesive Physical Property Requirements

5.1 *Adhesives*—The adhesives shall be uniform, homogeneous mixtures of elastomeric polymers or viscoelastic resins, or both, free of lumps or foreign matter.

5.1.1 *Workability*—When applied to the framing member with a caulking gun or notched trowel, or both, in accordance with the manufacturer's instructions, the adhesive shall exhibit a consistency capable of ensuring non-sagging properties.

5.1.2 *Open Time*—The adhesive shall have an open assembly time of between 10 to 20 min to give the user sufficient

[1] This specification is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.70 on Construction Adhesives.

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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

time to apply and, if necessary, reposition the gypsum wallboard at ambient temperatures, ranging from 40 to 100°F (4 to 38°C).

5.1.3 *Storage Life*—The adhesive shall remain serviceable and meet all the requirements of this specification for not less than six months after delivery, when stored in original unopened containers at temperatures ranging from 40 to 85°F (4 to 30°C).

6. Adhesive Performance Property Requirements

6.1 The adhesives shall conform to the requirements summarized in Table 1.

7. Sampling

7.1 The test adhesive sample size of 1 qt (approximately 1 L) is a minimum amount to complete one full series of testing. The sample is to be handled and stored according to the manufacturers recommendations. For qualification testing, the sample is to be representative of the final product for which recognition is sought.

8. Materials and Apparatus for Conducting Tests

8.1 *Gypsum Wallboard*—½-in. (12.7-mm) thick, complying with Specification C1396/C1396M; the dimensions are specified in each test.

8.2 *Plywood*—⅝-in. (15.9-mm) or 19⁄32-in (15.1-mm) U.S. Product Standard PS-1-95 grade marked stamped commercial plywood, Group 1 Species, exterior glue, or sanded exterior grade plywood, underlayment type, with A grade face ply for the adhesion surface.

8.3 *Douglas-fir Dimension Lumber*—Nominal 2 by 4, 1½ by 1½ by 3½-in. (38.0 by 38.0 by 89.0 mm); No. 1, straight-grained, and knot-free; the dimensions are specified in each test.

8.4 *Polyvinyl Acetate Adhesive*—Any commercially available product.

8.5 *Spacers*—No. 20 gauge (American Standard or B&S) bronze or brass wire 1⁄32-in. (0.8-mm) diameter.

8.6 *Trowels*—Plastic or metal with 3⁄16-in. (4.76-mm) deep V-notches.

8.7 *Compression Shear Test Fixture*—A compression-shear apparatus that is similar to, but of a larger scale than the fixture recommended in Test Method D905. A similar fixture is shown in Fig. 1.

8.8 *Tensile Test Fixture*—An assembly of one 5 by 5 by ½-in. (127 by 127 by 12.7-mm) thick steel plate and two 1½ by 1½-in. by ¼-in. thick by 6-in. long (38.1 by 38.1 by 6.4-mm thick by 152-mm long) steel angle sections. See Fig. 2.

8.9 *Scaffold Nails*—6d, common, double-head, smooth shaft, 0.113-in. (2.87-mm) diameter, 2 in. (51 mm) long.

8.10 *Testing Machine*—Any suitable testing machine that is capable of operation at a constant rate of motion of the moveable head and has a force measurement accuracy of ±1 % when calibrated in accordance with Practices E4.

8.11 *Wood Screw with Eyelet*—#6 by 1½-in. (38.1-mm) long, with a 3⁄8-in. (9.5-mm) inside diameter eyelet.

8.12 *Plywood Shim*—⅝-in. (15.9-mm) or 19⁄32-in. (15.1-mm) thick plywood with dimensions of 4 by 3½ in. (101.6 by 88.9-mm) for shear test specimens and 4 by 4 in. (101.6 by 101.6-mm) for tensile test specimens.

9. Conditioning of Materials and Specimens (Standard Conditions)

9.1 Condition the gypsum wallboard, plywood, and Douglas-fir, lumber to a constant weight at 73 ± 2°F (23 ± 1°C) and 50 ± 5 % relative humidity, unless specified otherwise.

TABLE 1 Adhesive Properties and Performance Requirements

Test Method	Reference Number	Property	Condition	Requirements
Rate of shear strength development	10.1.4	shear strength	24 h at Std. Cond.	10 psi (69 kPa) min
	10.1.5	shear strength	14 days at Std. Cond.	40 psi (276 kPa) min
	10.1.6	shear strength	14 days at Std. Cond., + cyclic lab exposure, + 2 days at Std. Cond.	32 psi (220 kPa) min
	10.1.7	shear strength	(a) 178 N (40 lbf) for 24 h at Std. Cond.	no bond separation
			(b) 89 N (20 lbf) for 24 h at 100°F	no bond separation
Rate of tensile strength development	10.2.3	tensile strength	24 h at Std. Cond.	15 psi (103 kPa) min
	10.2.4	tensile strength	14 days at Std. Cond.	25 psi (172 kPa) min
Adhesive open-time determination	10.3	open-time	24 h at Std. Cond.	75 % paper transfer, min
Substrate wet-out by adhesive				
1. Plywood	10.4.1	wet-out	spatula applied	good wetting property
2. Wallboard	10.4.2	wet-out	spatula applied	good wetting property
Bridging	10.5	gap filling	48 h at Std. Cond.	adhesive bond line is maintained - report paper failure %
Accelerated adhesive aging	10.6	accelerated aging	500 h at 70°C (158°F)	no fracture into separate pieces
Freeze-thaw stability	10.7	low-temperature storage	3 cycles of: 24 h at -17°C (0°F) + 24 h at Std. Cond.	no change in workability; 10 psi (69 kPa) shear strength, min
Suitability as a laminating adhesive for vinyl-covered wallboard	10.8.1	compatibility	24 h at 38°C (100°F)	no blistering, vinyl-film discoloration, or bond failure
	10.8.2	staining	1 h at Std. Cond.	no swelling or discoloration

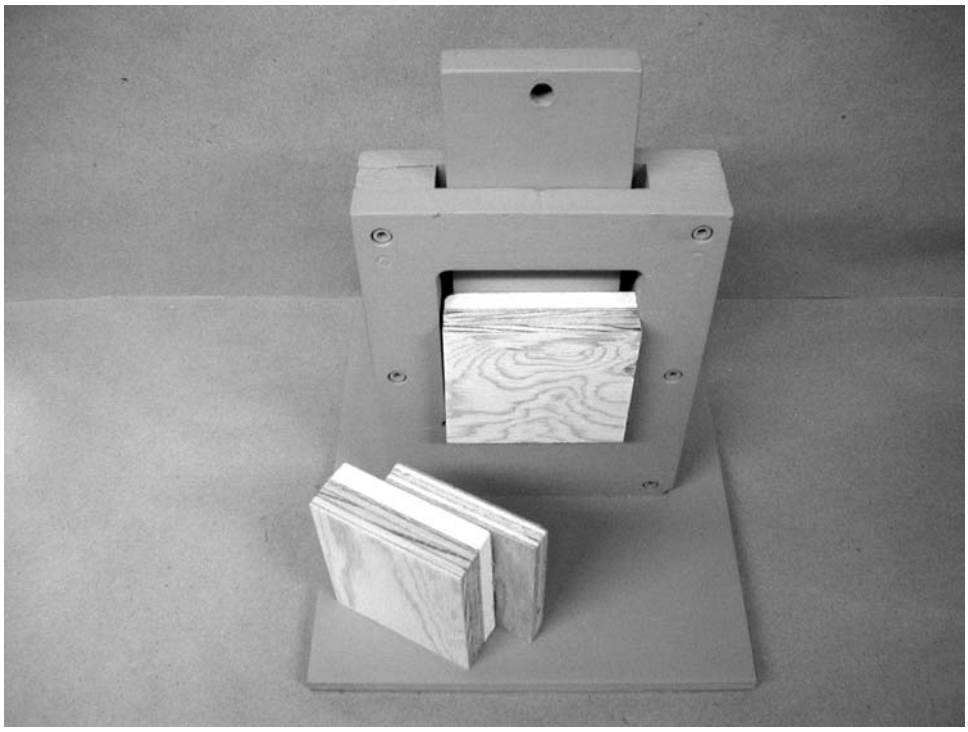

FIG. 1 Shear Strength Test Specimen in Text Fixture

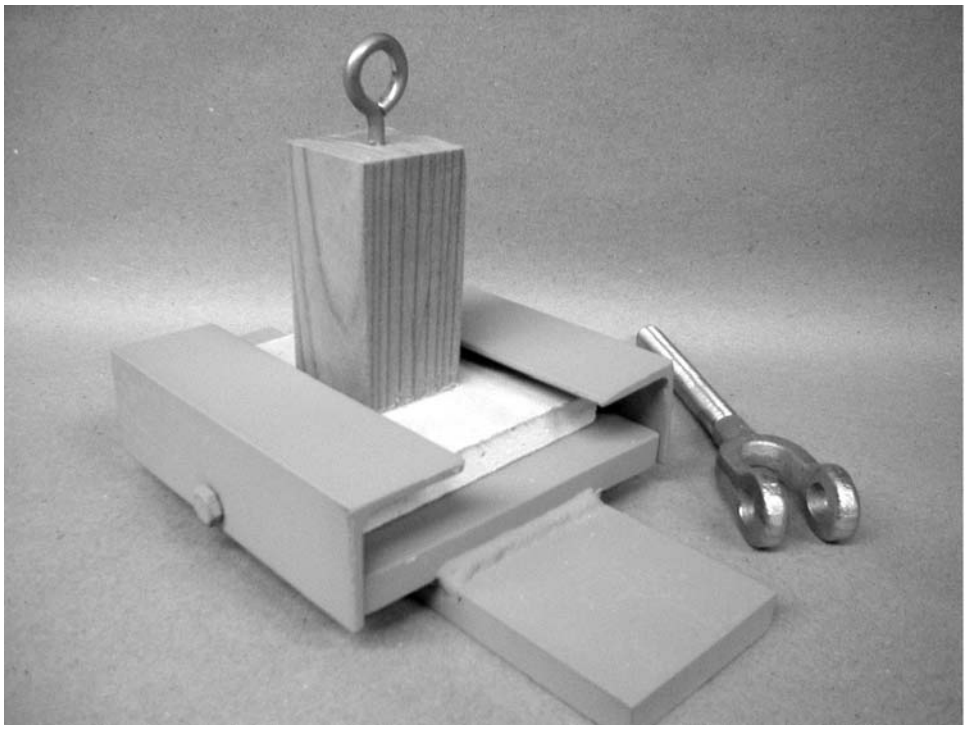

FIG. 2 Tensile Strength Specimen in Text Fixture

9.2 Subject all test adhesives and test specimens to standard conditioning for time period indicated at 73 ± 2°F (23 ± 1°C) and 50 ± 5 % relative humidity unless specified otherwise.

10. Test Methods

10.1 *Shear Strength (Rate-of-Shear Strength Development):*