



# Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing<sup>1</sup>

This standard is issued under the fixed designation C 557; 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 ( $\epsilon$ ) 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 minimum standards for adhesives intended for bonding the back surface 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.

## 2. Referenced Documents

### 2.1 ASTM Standards:

C 36 Specification for Gypsum Wallboard<sup>2</sup>

D 828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus<sup>3</sup>

D 907 Terminology of Adhesives<sup>4</sup>

D 1779 Specification for Adhesive for Acoustical Materials<sup>4</sup>

D 4338 Test Method for Flexibility Determination of Supported Adhesive Films by Mandrel Bend Test Method<sup>4</sup>

## 3. Terminology

3.1 *Definitions*—Many terms in this specification are defined in Terminology D 907.

3.1.1 *gap-filling adhesive, n*—an adhesive capable of forming and maintaining a bond between surfaces that are not close-fitting.

3.1.1.1 *Discussion*—Close-fitting is relative to a given material and industry; for example, standards in construction differ from standards in electronics. Some adhesives will bond by bridging without completely filling the gap; others by filling the gap completely.

3.1.2 *shear strength, n—in adhesive joint*, the maximum average stress when a force is applied parallel to the joint.

3.1.2.1 *Discussion*—In most adhesive test methods, the shear strength is actually the maximum average stress at failure

of the specimen, not necessarily the true maximum stress in the material.

3.1.3 *tensile strength, n—in an adhesive joint*, the maximum average stress when a force is applied perpendicular to the joint.

3.1.3.1 *Discussion*—In most adhesive test methods, the tensile strength is actually the maximum average stress at failure of the specimen, not necessarily the true maximum stress in the material.

### 3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *lot, n*—material from the same batch or blending operation that was processed in accordance with standard manufacturing conditions.

## 4. Significance and Use

4.1 The specification applies to organic adhesives for bonding the back surface 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.

## 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 time to apply and, if necessary, reposition the 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).

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D-14 on Adhesives and is the direct responsibility of Subcommittee D14.70 on Construction Adhesives.

Current edition approved April 10, 1999. Published June 1999. Originally published as C 557 – 65 T. Last previous edition C 557 – 93a.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 15.09.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 15.06.

## 6. Adhesive Performance Property Requirements

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

## 7. Sampling

7.1 Sample each selected lot of adhesives in accordance with Specification D 1779.

## 8. Materials for Conducting Tests

8.1 *Gypsum Wallboard*— $\frac{1}{2}$ -in. (12.7 mm) thick, complying with Specification C 36; the dimensions are specified in each test.

8.2 *Douglas Fir Plywood*— $\frac{3}{4}$ -in. (19.0 mm) thick plywood-grade PSI Exterior A-A or A-B; the dimensions are specified in each test.

8.3 *Douglas Fir Plywood*— $\frac{1}{4}$ -in. (6.3 mm) thick plywood grade PSI Exterior A-A or A-B; the dimensions are specified in each test.

8.4 *Douglas Fir Lumber*— $1\frac{1}{2}$  by  $1\frac{1}{2}$  by  $3\frac{1}{2}$  in. (38.0 by 38.0 by 89.0 mm) in cross section; No. 1 straight-grained, and knot-free; the dimensions are specified in each test.

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

8.6 *Steel Plates*— $\frac{1}{4}$ -in. thick steel with two  $\frac{1}{4}$ -in. diameter threaded holes; the dimensions are specified in the shear-strength test method.

8.7 *Turn Key  $\frac{1}{4}$ -in. Diameter Threaded Bolts*—With hex nuts; dimensions are specified in each test.

8.8 *Garnet Paper*—No. 120 grit, 3/0.

8.9 *Spacers*—No. 20 gage (American Standard or B&S) bronze or brass wire  $\frac{1}{32}$ -in. (0.8-mm) diameter.

8.10 *Trowels*—Plastic or metal with  $\frac{3}{16}$ -in. (4.76 mm) deep V-notches.

8.11 *Overlapping Steel Collar*—Two 2 by 1 in. (51.0 by 25.4 mm) U-channels welded to a  $\frac{1}{16}$ -in. (1.6-mm) thick galvanized-steel frame and assembled with a flathead screw, two washers, and a nut.

8.12 *Wood Shim*— $\frac{3}{4}$ -in. (19.0 mm) thick plywood with dimensions of 4 by  $1\frac{1}{4}$ -in. (102.0 by 89.0 mm) with two  $\frac{1}{4}$ -in. (6.3 mm) diameter drilled holes.

8.13 *T-bar Steel Pin*— $4\frac{1}{2}$  by  $\frac{3}{8}$  in. (114.0 by 9.5 mm) for insertion into perforated tensile wood block.

8.14 *Aluminum Tensile Test Jig*—4 by  $1\frac{5}{8}$  in. (102.0 by 41.0 mm) T-bar perforated aluminum fixture with 1-in. (25.4 mm) long and  $\frac{1}{4}$ -in. (6.3 mm) diameter screw and hex nut for insertion of looped steel cable with a collar (Fig. 1).

## 9. Conditioning of Materials and Specimens

9.1 Condition the Douglas fir, lumber, plywood, and wallboard to a constant weight at  $73 \pm 2^\circ\text{F}$  ( $23 \pm 1^\circ\text{C}$ ) and  $50 \pm 5\%$  relative humidity, unless specified otherwise.

9.2 Subject all test assemblies and adhesives to be evaluated to standard conditioning (24 h at  $73 \pm 2^\circ\text{F}$  ( $23 \pm 1^\circ\text{C}$ ) and  $50 \pm 5\%$  relative humidity) unless specified otherwise.

## 10. Test Methods

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

10.1.1 *Preparation of Wallboard-Plywood Laminates*—Prepare each test assembly individually from plywood and a wallboard-plywood laminate. Each laminate is made by bonding a piece of 4 by  $3\frac{1}{2}$  by  $\frac{1}{2}$  in. (102.0 by 89.0 by 12.7 mm) wallboard to a  $\frac{3}{4}$ -in. thick (19.0 mm) plywood piece of the same dimensions with a commercially available PVA adhesive. The grain of the wallboard facing paper shall run lengthwise in the  $3\frac{1}{2}$ -in. (89.0) direction. After conditioning the precut  $\frac{3}{4}$ -in. (19.0 mm) plywood pieces and wallboard-plywood laminates as indicated in 9.2, drill at the extremities of each two  $\frac{1}{4}$ -in. (6.3-mm) diameter holes as shown in Fig. 2. The distance of these holes from the pertinent edges is approximately 1.0 in. (25.4 mm).

10.1.2 *Preparation of Test Assembly*—Prepare the test assembly by bonding a 4 by  $3\frac{1}{2}$  by  $\frac{3}{4}$  in. (102.0 by 89.0 by 19.0 mm) piece of the described plywood to the previously prepared laminate as follows:

10.1.2.1 Sand the face of the  $\frac{3}{4}$ -in. (19.0-mm) thick plywood smooth with garnet paper and wipe the sanded surface free of dust.

10.1.2.2 Spread the adhesive on the sanded surface with a trowel having  $\frac{3}{16}$ -in. (4.8-mm) deep V-notches so that the adhesive ridges are parallel to the grain of wood. The trowel

**TABLE 1 Adhesive Properties and Performance Requirements**

Test Method	Reference Number	Property	Condition	Requirements
Rate of shear strength	10.1.4	shear strength	24 h at RT	10 psi (69 kPa) min
	10.1.5	shear strength	14 days at RT	40 psi (276 kPa) min
	10.1.6	shear strength	14 days at RT, + cyclic lab exposure, + 2 days at RT	32 psi (220 kPa) min
	10.1.7	shear strength	(a) 40 lb (178 N) for 24 h at RT (b) 20 lb (89 N) for 24 h at 100°F	no bond separation no bond separation
Rate of strength development	10.2.3	tensile strength	24 h at RT	15 psi (103 kPa) min
	10.2.4	tensile strength	14 days at RT	25 psi (172 kPa) min
Adhesive open-time determination	10.3	open-time	24 h at RT	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 RT	continuous (adhesive) bond line
Adhesive aging	10.6	accelerated aging	500 h at 158°F 3 cycles of:	no cracking or chipping
Freeze-thaw stability	10.7	low-temperature storage	24 h at 0°F + 24 h at RT	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 100°F	no blistering, vinyl-film discoloration, or bond failure
	10.8.2	staining	1 h at RT	no swelling or discoloration