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Standard Test Methods for Joint Treatment Materials for Gypsum Board Construction[1]

This standard is issued under the fixed designation C474; 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.

1. Scope*

1.1 These test methods cover the physical testing of joint compound, paper joint tape, glass-mesh joint tape, and an assembly of joint compound and paper joint tape.

1.1.1 Joint treatment materials are specified in Specification C475/C475M.

1.1.2 The joint treatment material described in this standard are for use with gypsum board installed in accordance with Specification C840.

1.2 The test methods appear in the following order:

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

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in brackets are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 The text of this standard references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.5 *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]

C11 Terminology Relating to Gypsum and Related Building Materials and Systems

C472 Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete

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

C840 Specification for Application and Finishing of Gypsum Board

C1396/C1396M Specification for Gypsum Board

D685 Practice for Conditioning Paper and Paper Products for Testing

D828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus

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[1] These test methods are under the jurisdiction of ASTM Committee C11 on Gypsum and Related Building Materials and Systems and are 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.**

D3699 Specification for Kerosine
D3882 Test Method for Bow and Skew in Woven and Knitted Fabrics
E100 Specification for ASTM Hydrometers
2.2 *TAPPI Standard:*
T 411 Thickness (Caliper) of Paper, Paperboard, and Combined Board[3]

3. Terminology

3.1 *Definitions*—For definitions of terms relating to gypsum, see Terminology C11.
3.2 *Definitions of Terms Specific to This Standard:*
3.2.1 *bond*, *n—in joint systems*, the quality of adhesion between the paper joint tape and joint compound.
3.2.1.1 *Discussion*—A0 % bond means that no paper fiber is adhering to the joint compound. A100 % bond means that there is cohesive failure of the paper joint tape.
3.2.2 *check cracking*, *n—in joint systems*, short, narrow cracks randomly oriented in the surface of the dried joint compound.
3.2.3 *joint compound, powder*, *n*—A drying-type or setting-type cementitious material to be mixed with water.
3.2.4 *joint compound, ready-mix*, *n*—A drying-type cementitious material that is factory mixed in ready-to-use form.

4. Specimen Preparation

4.1 *Joint Compound, Powder*:
4.1.1 Mix 300 g of joint compound, powder, with approximately 150 to 160 mL of water.
4.1.2 Allow the specimen to stand for 30 min (Note 1), remix and adjust the temperature to 77 ± 2°F [25 ± 1°C] by placing the container holding the specimen in warm or cool water.

NOTE 1—Allow setting type compounds to stand for one half of their setting times, as determined by Test Methods C472 but not more than 30 min, prior to remixing.

4.1.3 Measure the viscosity in accordance with Section 5.
4.1.4 If the measured viscosity is not between 480 and 520 Brabender units, repeat 4.1.1-4.1.3 through with an increase or decrease in water as necessary.
4.1.5 Record the volume of water used to adjust the viscosity to 500 ± 20 Brabender units (see Note 2).

NOTE 2—Making note of the volumes of water, in millilitres per 100 g of material, used to adjust the viscosity, will facilitate specimen preparation in other tests.

4.2 *Joint Compound, Ready-Mix*:
4.2.1 Remix joint compound, ready-mix, to reincorporate any separated ingredients. Adjust the temperature to 77 ± 2°F [25 ± 1°C] by placing the container holding the specimen in warm or cool water.
4.2.2 Measure the viscosity in accordance with Section 5.
4.2.3 If the viscosity is more than 520 Brabender units, add water to achieve a viscosity of 500 ± 20 Brabender units (see Note 2).
4.2.3.1 If the original sample viscosity is less than 480 Brabender units, test as received.

JOINT COMPOUND

5. Joint Compound Viscosity

5.1 *Significance and Use*:
5.1.1 This test method provides a procedure for measuring joint compound viscosity.
5.2 *Sampling*:
5.2.1 Sampling shall be in accordance with Specification C475/C475M.
5.3 *Specimen Preparation*:
5.3.1 Prepare specimens in accordance with Section 4.
5.4 *Apparatus*:
5.4.1 *Viscosity Specimen Container*, metal or plastic with an open top having an inside diameter of 2½ to 3 in. [65 to 75 mm] and a height of 2½ to 3 in. [65 to 75 mm].
5.4.2 *Viscometer*[4], adjusted to operate at 78 ± 1 r/min, and with a 250 cm-g sensitivity cartridge.
5.4.3 *Viscometer Pin*, having dimensions as follows:

in. [mm]

[3] Available from Technical Association of the Pulp and Paper Industry, Technology Park, P.O. Box 105113, Atlanta, GA 30348.
[4] The sole source of supply of the apparatus known to the committee at this time is the Brabender "Visco-Corder" Model VC-3, manufactured by C.W. Brabender Instruments Inc., South Hackensack, NJ. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee , which you may attend.

Shaft diameter	0.187 ± 0.015 [4.75 ± 0.38]
Pin diameter	0.094 ± 0.015 [2.39 ± 0.38]
Immersion depth (from bottom of spindle)	1.625 ± 0.015 [41.3 ± 0.38]
Length of pin projecting from shaft	0.750 ± 0.015 [19.1 ± 0.38]
Upper pin from bottom of shaft	0.313 ± 0.015 [7.95 ± 0.38]
Lower pin from bottom of shaft	0.125 ± 0.015 [3.28 ± 0.38]

5.5 *Procedure*:

5.5.1 Fill the viscosity container with the mixed specimen until level with the top of the container.

5.5.1.1 Remove all air bubbles by puddling the sample container with a spatula and sharply rapping the bottom of the container on a hard flat surface.

5.5.2 Lock the filled container in the center of the viscometer spindle platform. Raise the platform until the level of the specimen reaches the mark on the viscometer pin and lock the platform in place.

5.5.3 Start the viscometer. Read the viscosity after the pen starts to trace a straight line (usually within 1 min). If the tracing remains inconsistent, estimate the average viscosity reading.

5.6 *Report*:

5.6.1 Report the viscosity of the joint compound specimen in Brabender units.

5.7 *Precision and Bias*:

5.7.1 Precision and bias of this test method have not been determined.

6. Shrinkage

6.1 *Significance and Use*:

6.1.1 This test is used to measure the amount of shrinkage in joint compound. The degree of correlation between this test and service performance has not been determined.

6.2 *Sampling*:

6.2.1 Sampling shall be in accordance with Specification C475/C475M.

6.3 *Specimen Preparation*:

6.3.1 Specimen preparation shall be in accordance with Section 4.

6.4 *Apparatus*:

6.4.1 *Plastic or Rubber Film*, approximately 5 by 5 in. [130 by 130 mm]. Any thin, flexible film that peels clean from a partially dried patty may be used.[5]

6.4.2 *Balance*, having a sensitivity of 10 mg (Fig. 1 and Fig. 2).

[5] Rubber dental dam dusted with talc, polyethylene, or PTFE films have been found satisfactory for this use.

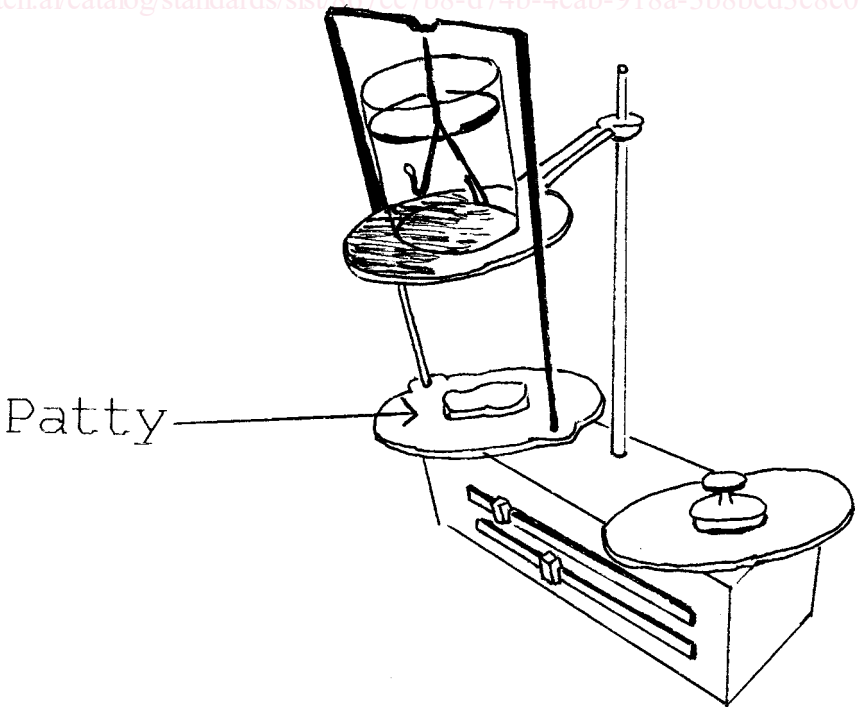

FIG. 1 Wire Cradle in Kerosine

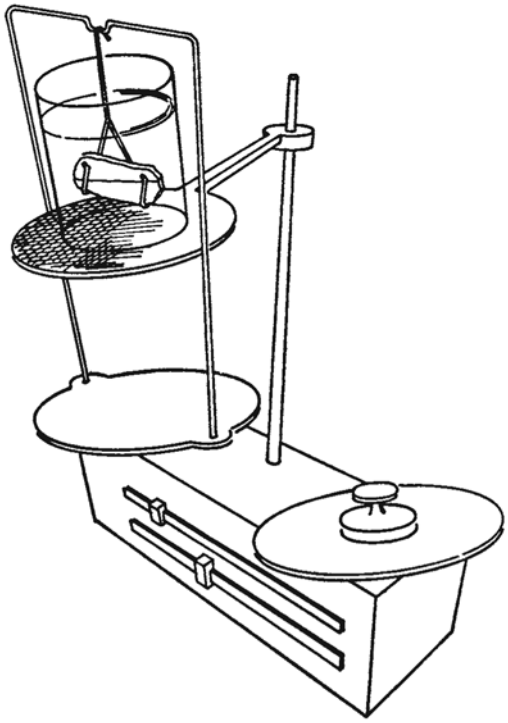

FIG. 2 Patty Immersed in Kerosine

6.4.3 *Beaker, Ring Stand, and Wire Cradle* (see Fig. 1).

6.4.4 *Forced Air Drying Oven*, capable of being maintained at 90 to 120°F [32 to 49°C].

6.4.5 *Spatula*, having a blade approximately 4 in. by ½ in. [100 by 13 mm].

6.4.6 *Steel-Reinforced Broad Knife*, a 5 to 8 in. [130 by 200 mm] drywall broad knife reinforced by a steel bar, 1 in. [25 mm] wide by ⅛ in. [3 mm] thick, by the knife width, attached to the back of the knife blade ¼ in. [6 mm] from the edge.

6.4.7 *Hydrometer*, having a range of 0.7 to 0.8 sp gr, in accordance with Specification E100.

6.4.8 *Volumetric Container*, a container which has a volume between 25 and 300 cm^3.

6.5 *Reagents and Materials*:

6.5.1 *Displacement Fluids*.

6.5.1.1 *Mineral Spirits*, odorless.

6.5.1.2 *Kerosine* ~~.~~ (see Specification D3699).

6.6 *Preparation of Apparatus*:

6.6.1 *Support Plates*—Cover three plastic or glass plates with plastic or rubber film.

6.6.2 Obtain and record the tare weight of each assembly.

6.7 *Calibration*:

6.7.1 *Volumetric Container*—Determine the container volume in cubic centimetres and its tare weight in grams.

6.7.2 *Mineral Spirits, Kerosine*—Using the hydrometer, determine the specific gravity and record the result as density *M*~~.~~, g/mL.

6.8 ~~*Determination of Wet Volume*~~Determination of Density of Wet Compound:

6.8.1 Prepare a specimen to determine the ~~wet specific gravity~~ density of wet compound by weighing the specimen in the volumetric container.

6.8.1.1 Adjust the temperature to ~~77~~70 ± ~~2 °F [25~~ 2°F [21 ± 1°C] by placing the container holding the specimen in warm or cool water.

6.8.1.2 Puddle the specimen within the container with the spatula to remove entrapped air bubbles.

6.8.1.3 Finish filling the container ~~completely~~ and strike off the surface flush with the top using the steel-reinforced broad knife.

6.8.1.4 Weigh the filled container to the nearest 0.01 g. Record the weight of the filled container.

6.8.1.5 Determine the net weight of the compound in the volumetric container by subtracting the weight obtained in 6.8.1.4 from the weight obtained in 6.7.1.

6.8.1.6 Divide the net weight obtained in 6.8.1.5 by the volume of the container obtained in 6.7.1. Record the result as wet compound density *G*, g/mL.

(1) G = *total weight – container tare weightvolume of container*

6.9 *Preparation of Specimen to Determine Wet and Dry Volume*:

6.9.1 Place approximately 30 g of specimen onto each prepared support plate (see 6.6.1).

6.9.1.1 Spread the specimen into an elongated patty 3⁄16 to 1⁄4 in. [5.0 to 6.5 mm] thick with a spatula.

6.9.1.2 Remove any specimen remaining on the spatula and add to the patty.

NOTE 3—The patty may be scored across its narrowest width to facilitate breaking the patty after it is dry.

6.9.1.3 Weigh and record the total weight of each patty, film, and plate.

6.9.1.4 Determine the net weight of each specimen by subtracting the tare weight of its support plate weight and the weight obtained in 6.9.1.3.

6.9.1.5 Divide the net weight obtained in 6.9.1.4 by *G*. Record as wet volume of patty *V*, mL.

$$V = \frac{\textit{wet patty weight} - \textit{support plate tare weight}}{G} \quad (2)$$

6.10 *Determination of Dry Volume*:

~~6.10.1Immerse each patty in a beaker of the displacement fluid, such that they do not touch the sides of the beaker, until constant weight is reached.~~

6.10.1 Dry patties at a temperature between 100 and 120°F [32 to 49°C] for 16 to 24 h.

6.10.1.1 When testing setting type joint compounds, place the patties in the drying oven 1 h after the setting time has been reached as determined by Test Methods C472.

6.10.1.2 When testing drying type joint compounds, place the patties in the drying oven immediately after weighing.

6.10.2 Strip off the plastic or rubber film, and continue to dry under the conditions specified in 6.10.1 until constant weight is reached.

6.10.3 Immerse each patty in a beaker of the displacement fluid, such that they do not touch the sides of the beaker, for a minimum of 4 h, until constant weight is reached.

NOTE 4—Each patty may be broken into two or three pieces to fit in the beaker without touching the sides.

6.10.~~2~~4 Remove each patty from the displacement fluid. Using a cloth moistened in the same fluid, lightly blot off the excess fluid from the surface of the patty.

~~6.10.3~~6.10.5 With the wire cradle suspended in the beaker of displacement fluid, weigh each patty in air on the pan of the balance (Fig. 1), and record as its air weight.

~~6.10.4~~6.10.6 Next, weigh each patty in the wire cradle, ~~making sure~~ensuring that the patty is completely immersed in the liquid and that it does not touch the sides of the beaker (Fig. 2). Record these weights as the immersed weight.

~~6.11~~

6.10.7 Subtract the immersed patty weight obtained in 6.10.6 from the air patty weight obtained in 6.10.5. Record as *D*, the weight difference, which is the weight of fluid displaced by the dried and then saturated patty.

6.10.8 Divide *D*, the weight difference, by *M*, the density of the displacement fluid determined in 6.7.2, and record as dry volume of patty, *R*, mL.

(3) $R = D/M$

6.11 *Calculation of Shrinkage*:

6.11.3Determine the net weight of each specimen by subtracting the tare weight of its support plate weight and its weight obtained in 6.9.1.3.

6.11.4Divide the net weight obtained in 6.11.3 by *G*. Record as *V*, volume of patty.

6.11.1 Calculate the percent shrinkage as follows:

where:

R = volume of the dry patty, and

V = volume of the wet patty.

6.12 *Report*:

6.12.1 Take the average of the three patties tested. If there is a difference between the percent shrinkage of the three patties of more than 1.5 %, completely retest an additional three specimens and take the average of the six.

6.13 *Precision and Bias*:

6.13.1 Precision and bias of this test method have not been determined.

7. Check Cracking of Joint Compound

7.1 *Significance and Use*

7.1.1 This test method is used to measure the degree and type of field and edge cracking of joint compound. The degree of correlation between this test and service performance has not been determined.

7.2 *Sampling*:

7.2.1 Sampling shall be in accordance with Specification C475/C475M.

7.3 *Specimen Preparation*:

7.3.1 Prepare specimens in accordance with Section 4, except use a quantity of 100 g.

7.4 *Apparatus*:

7.4.1 *Rod*, metal or glass, ⅛ in. [3.2 mm] in diameter by 7 in. [180 mm] in length.

7.4.2 *Steel-Reinforced Broad Knife*, as defined in 6.4.6.

7.4.3 *Gypsum Wallboard*, Specification C1396/C1396M.

7.4.3.1 To determine compliance to Specification C475/C475M, Specification C1396/C1396M gypsum wallboard shall be used.[6]

7.4.4 *Electric Fan*, capable of forcing a continuous current of air at a velocity of 350 to 450 ft/min [1.8 to 2.3 m/s] at a distance of approximately 3 ft [1 m].

7.5 *Procedure*:

7.5.1 Place the rod on a piece of gypsum wallboard and place some of the specimen next to the rod.

7.5.2 Form a 3½ to 4 in. [90 to 100 mm] wide wedge of the specimen with the steel-reinforced broad knife, with the rod on one side and the wallboard on the other side to guide the knife.

7.5.2.1 Hold the broad knife at an angle less than 45° with respect to the plane of the wallboard. Draw the broad knife over the specimen two or more times to leave the surface smooth.

7.5.3 Remove the rod and adjust the wedge to a 5 in. [130 mm] length.

7.5.4 Immediately place the wedge-shaped specimen in front of the fan blowing over the surface of the wedge for 8 to 16 h. The current of air shall be maintained at 70 to 85°F [21 to 29°C] and 45 to 55 % relative humidity.

7.6 *Report*:

7.6.1 Report the type and amount of cracking in both the thick half and the thin half of the wedge.

7.7 *Precision and Bias*:

7.7.1 Precision and bias of this test method have not been determined.

8. Putrefaction

8.1 *Significance and Use*:

8.1.1 This test method is used to evaluate the tendency of the joint compound to putrefy. The degree of correlation between this test and service performance has not been determined.

8.2 *Sampling*:

8.2.1 Sampling shall be in accordance with Specification C475/C475M.

8.3 *Apparatus*:

8.3.1 *Humidity Cabinet*, a chamber capable of maintaining 85 to 95°F [29 to 35°C] and 85 to 95 % relative humidity.

8.3.2 *Glass Container*, capable of being sterilized in an autoclave, having a minimum volume of 250 mL.[7]

8.3.3 *Cover*, made of glass or aluminum foil large enough to cover the glass container and capable of being sterilized in an autoclave.

8.3.4 *Autoclave*, capable of maintaining 260°F [130°C] at 21 psi [145 kPa] steam pressure for not less than 15 min.

8.4 *Preparation of Apparatus*:

8.4.1 Sterilize the glass container and cover in an autoclave at 21 psi [145 kPa] and 260°F [130°C] for 15 min or more.

8.5 *Procedure*:

8.5.1 *Joint Compound, Powder*—Mix 50 g of joint compound with water, as determined in 4.1 in the glass container. Allow it to soak 30 min and then remix. Place the cover over the glass container and place in the humidity cabinet.

8.5.2 *Joint Compound, Ready-mix*—Select an unopened container that has not exceeded the producer's specified shelf life.

8.5.2.1 Open the container. If the material in the container has separated, mix thoroughly.

8.5.2.2 Remove 100 g of joint compound, ready-mix, from the container.

8.5.2.3 Put the specimen in the glass container and cap with the cover.

8.5.2.4 Place in the humidity cabinet.

8.6 *Interpretation of Results*:

8.6.1 Observe daily for putrefaction.

8.7 *Report*:

8.7.1 Report the number of days required to produce putrefaction.

8.8 *Precision and Bias*:

8.8.1 Precision and bias of this test method have not been determined.

JOINT TAPE

9. Tensile Strength

9.1 *Significance and Use*:

[6] Other substrates may be used to evaluate the effect that they have on the performance of the joint compound and assemblies of joint compound and joint tape.

[7] Deep Petri dishes and 250 mL beakers have been found suitable for this purpose.