Designation: C 474 – 97

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

This standard is issued under the fixed designation C 474; 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, and an assembly of joint compound and paper joint tape.

1.1.1 Joint treatment materials are specified in Specification C 475.

1.2 The test methods appear in the following order:

	Section
Joint Compound Tests:	
Viscosity	5
Shrinkage	6
Check Cracking	7
Putrefaction	8
Paper Joint Tape Tests:	
Tensile Strength	9
Dimensional Stability	10
Width	11
Thickness	12
Assemblages of Paper Joint Tape and Joint Compound:	
Bond of Paper Joint Tape to Joint Compound	13
Cracking of Joint Compound at Tape Edges	14

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

1.4 The text of this standard references notes and footnotes which 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:*

C 11 Terminology Relating to Gypsum and Related Building Materials and Systems[2]

C 36 Specification for Gypsum Wallboard[2]

C 472 Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete[2]

C 475 Specification for Joint Compound and Joint Tape for Finishing Gypsum Board[2]

D 685 Practice for Conditioning Paper and Paper Products for Testing[3]

D 828 Test Method for Tensile Properties of Paper and Paperboard Using Constant Rate-of-Elongation Apparatus[3]

E 100 Specification for ASTM Hydrometers[4]

2.2 *TAPPI Standard:*

T 410 Grammage of Paper and Paperboard (Weight Per Unit Area)[5]

3. Terminology

3.1 *Definitions*—For definitions of terms relating to gypsum, see Terminology C 11.

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*—A 0 % 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 C 472 but not more than 30 min, prior to remixing.

4.1.3 Measure the viscosity in accordance with Section 5.

[1] These test methods are under the jurisdiction of ASTM Committee C-11 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] *Annual Book of ASTM Standards*, Vol 04.01.

[3] *Annual Book of ASTM Standards*, Vol 15.09.

[4] *Annual Book of ASTM Standards*, Vol 14.03.

[5] Available from Technical Association of the Pulp and Paper Industry, Technology Park, P.O. Box 105113, Atlanta, GA 30348.

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. (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. (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 C 475.

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. (64 to 76 mm) and a height of 2½ to 3 in. (64 to 76 mm).

5.4.2 *Viscometer*[6], 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)
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 C 475.

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.[7]

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

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. (25.4 mm) wide by ⅛ in. (3.2 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 E 100.

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 *Minerals Spirits*, odorless.

6.5.1.2 *Kerosine*.

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 *M*.

6.8 *Determination of Wet Volume*:

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

[6] The Brabender "Visco-Corder" Model VC-3, manufactured by C.W. Brabender Instruments Inc., South Hackensack, NJ has been found satisfactory.

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

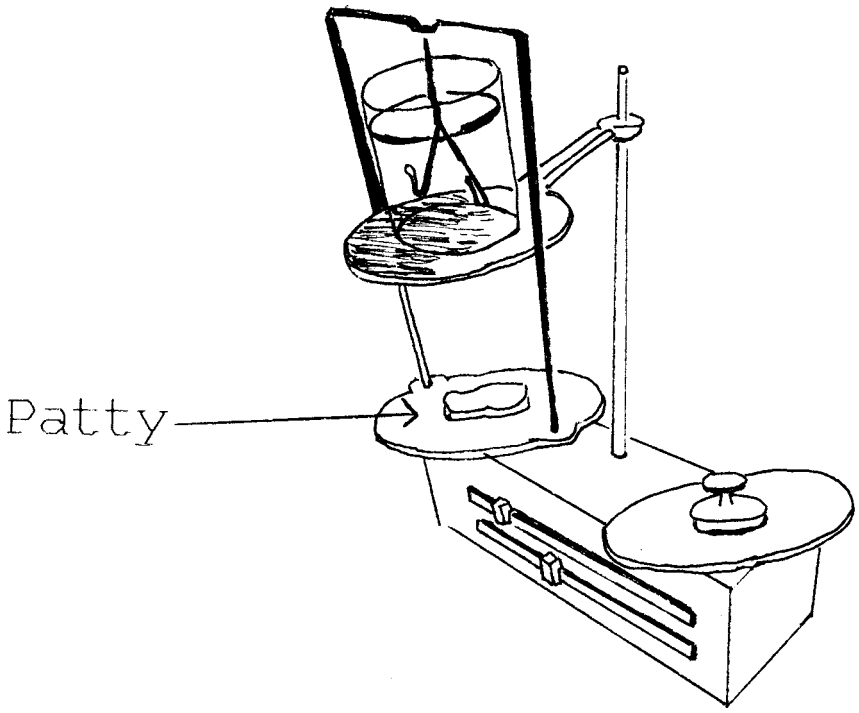

FIG. 1 Wire Cradle in Kerosine

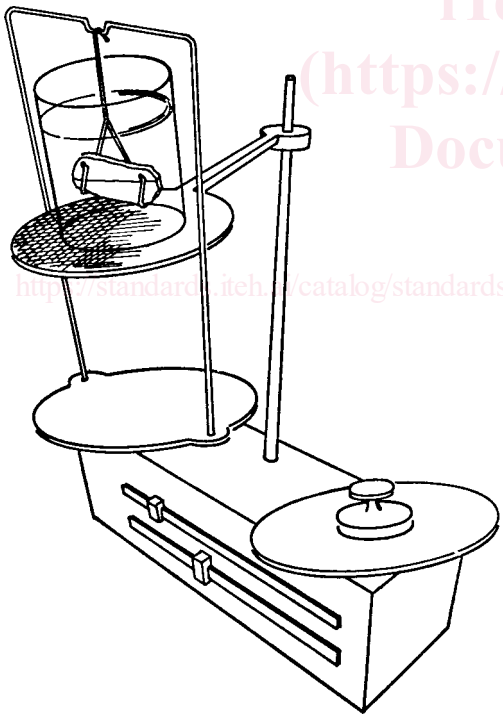

FIG. 2 Patty Immersed in Kerosine

6.8.1.1 Adjust the temperature to 77 ± 2°F (25 ± 1°C) by placing the container holding the specimen in warm or cool water.

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

6.8.1.3 Fill 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.

6.9 *Preparation of Specimen to Determine Dry Volume*:

6.9.1 Place approximately 30 g of specimen onto each prepared support plate.

6.9.1.1 Spread the specimen into an elongated patty 3⁄16 to ¼ in. (4.8 to 6.4 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 When testing setting type joint compounds, place the patties in the drying oven one h after the setting time has been reached as determined by Test Methods C 472.

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

6.9.2 Dry patties at a temperature between 100° and 120°F (32° to 49°C) for 16 to 24 h.

6.9.3 Strip off the plastic or rubber film, and continue to dry until constant weight is reached.

6.10 *Determination of Dry Volume*:

6.10.1 Immerse 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.

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

6.10.2 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 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 Next, weigh each patty in the wire cradle, making sure 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 *Calculation of Shrinkage*:

6.11.1 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.

6.11.2 Divide the net weight obtained in 6.11.1 by the volume of the container obtained in 6.7.1. Record the result as *G*, grams per millilitre.

$$G = \frac{\text{Total weight} - \text{Container tare weight}}{\text{Volume of Container}}$$

6.11.3 Determine 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.

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

$$V = \frac{\text{Dry weight} - \text{Support plate tare weight}}{G}$$

6.11.5 Subtract the immersed patty weight obtained in 6.10.4 from the air patty weight obtained in 6.10.3. Record as *D*, the weight difference.

6.11.6 Calculate the percent shrinkage as follows:

$$\% \text{ Shrinkage} = D(X/V),$$

where:

D = the difference in air and immersed weight,
X = 100/displacement fluids specific gravity, and
V = weight of wet patty/specific gravity of the compound.

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 C 475.

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. (178 mm) in length.

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

7.4.3 *Gypsum Wallboard*, Specification C 36.[8]

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 C 475.

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.[9]

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 (126°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 (144.8 kPa) and 260°F (126°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.

[8] 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. However, to determine compliance to Specification C 475, Specification C 36 gypsum wallboard shall be used.

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