AMERICAN SOCIETY FOR TESTING AND MATERIALS 1916 Race St. Ph'ladelph'a, Pa 19103 Reprinted from the Annual Book of ASTM Standards. Copyright ASTM If not listed in the current comb ned index, will appear in the next edition.

Standard Test Methods for Physical Testing of Gypsum Board Products and Gypsum Lath¹

a

This standard is issued under the fixed designation C 473; 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 gypsum board products and gypsum lath.

1.2 The test methods appear in the following order:

	Sections
Flexural Strength (Method A)	4 to 8
Core, End, and Edge Hardness (Method A)	9 to 17
Nail Pull Resistance (Method A)	18 to 23
Flexural Strength (Method B)	25 to 32
Core, End, and Edge Hardness (Method B)	33 to 40
Nail Pull Resistance (Method B)	41 to 48
Humidified Deflection	49 to 53
End Squareness	54 to 56
Nominal Thickness	57 to 61
Recessed- or Tapered-Edge Depth	62 to 66
Width	67 to 71
Length	72 to 76
Water Resistance of Core-Treated Water-Repellent Gypsum	
Boards	77 to 81
Surface Water Resistance of Gypsum Boards with Water-Repellent	
Face Paper	82 to 86

1.3 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are for information only.

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.

2. Referenced Documents

2.1 ASTM Standards:

- C11 Terminology Relating to Gypsum and Related Building Materials and Systems²
- E 4 Practices for Force Verification of Testing Machines³

3. Terminology

3.1 Definitions:

3.1.1 For useful definitions refer to Terminology C 11.

3 Annual Book of ASTM Standards, Vol 03.01.

opyright ASTM International ovided by IHS under license with ASTM o reproduction or networking permitted without license from IHS

Method A - Constant Rate of Loading

FLEXURAL STRENGTH

4. Significance and Use

4.1 This test method provides a procedure for evaluating the flexural strength of gypsum board or gypsum lath. This test method is used to determine compliance with gypsum board or gypsum lath specifications. The degree of correlation between this test method and service performance has not been determined.

5. Test Specimens

5.1 Cut test specimens from at least three gypsum boards or laths to comprise a sample. Cut four specimens, each 12 in. (305 mm) by approximately 16 in. (406 mm) from each board or lath in the sample, two having the 16-in. dimension parallel to the fiber of the surfacing material and two perpendicular thereto. Cut the specimens at least 4 in. (102 mm) away from the open ends and edges of the board or lath except in the case of the 16-in. wide lath, where it is impossible to do so.

5.2 Condition specimens to constant weight at a temperature of $85 \pm 15^{\circ}$ F (29.5 ± 8.5°C) and relative humidity of 50 \pm 2 % (Note 1). Test specimens individually after constant weight is reached.

NOTE 1-Laboratory test results indicate that conditioning temperatures may range from 70 to 100°F (21 to 38°C) without significantly affecting the results. However, relative humidity is critical. Therefore, specimens shall be tested within 10 min upon removal from the conditioning chamber.

6. Procedure

6.1 For specimens with fibers of the surfacing material parallel, test one specimen from each board face up and the other face down. For specimens with fibers of the surfacing material perpendicular, test one specimen from each board face up and the other face down.

6.2 Support each specimen centrally on fixed parallel bearings, 14 in. (356 mm) on centers, and apply the load on a similar bearing midway between the supports. All bearings and load surfaces shall be true, shall engage the full width of the test specimen, and shall be rounded to a radius of 1/8 in. (3.2 mm). Apply the test load at a uniformly increasing rate of 1 lbf/s (4.45 N/s), with a permissible variation of ± 10 % in the rate. Apply the load with a device independent of manual control of the rate of loading during an individual sample test and maintain the specified rate of loading over all finite time intervals during a test. The load is determined at the time of transverse failure of the paper and core through the

1

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 C11.01 on Specifications and Test Methods for Gypsum Products.

Current edition approved Jan. 15, 1995. Published March 1995. Originally published as C 473 - 61. Last previous edition C 473 - 94. ² Annual Book of ASTM Standards, Vol 04.01.

Designation: C 473 - 95

AMERICAN SOCIETY FOR TESTING AND MATERIALS 1916 Race St. Ph'ladelph'a, Pa 19103 Reprinted from the Annual Book of ASTM Standards. Copyright ASTM If not listed in the current combined index, will appear in the next edition.

Standard Test Methods for Physical Testing of Gypsum Board Products and Gypsum Lath¹

This standard is issued under the fixed designation C 473; 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 (e) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These test methods cover the physical testing of gypsum board products and gypsum lath.

1.2 The test methods appear in the following order:

	Sections
Flexural Strength (Method A)	4 to 8
Core. End. and Edge Hardness (Method A)	9 to 17
Nail Pull Resistance (Method A)	18 to 23
Flexural Strength (Method B)	25 to 32
Core, End, and Edge Hardness (Method B)	33 to 40
Nail Pull Resistance (Method B)	41 to 48
Humidified Deflection	49 to 53
End Squareness	54 to 56
Nominal Thickness	57 to 61
Recessed- or Tapered-Edge Depth	62 to 66
Width	67 to 71
Length	72 to 76
Water Resistance of Core-Treated Water-Repellent Gypsum	
Boards	77 to 81
Surface Water Resistance of Gypsum Boards with Water-Repellent	
Face Paper	82 to 86

1.3 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are for information only.

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.

2. Referenced Documents

2.1 ASTM Standards:

- C11 Terminology Relating to Gypsum and Related Building Materials and Systems²
- E 4 Practices for Force Verification of Testing Machines³

3. Terminology

3.1 Definitions:

- 3.1.1 For useful definitions refer to Terminology C 11.
- 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 C11.01 on Specifications and Test Methods for Gypsum Products.

² Annual Book of ASTM Standards, Vol 04.01.

3 Annual Book of ASTM Standards, Vol 03.01.

No reproduction or networking permitted without license from IHS

Copyright ASTM International ovided by IHS under license with ASTM

Method A - Constant Rate of Loading

FLEXURAL STRENGTH

4. Significance and Use

4.1 This test method provides a procedure for evaluating the flexural strength of gypsum board or gypsum lath. This test method is used to determine compliance with gypsum board or gypsum lath specifications. The degree of correlation between this test method and service performance has not been determined.

5. Test Specimens

5.1 Cut test specimens from at least three gypsum boards or laths to comprise a sample. Cut four specimens, each 12 in. (305 mm) by approximately 16 in. (406 mm) from each board or lath in the sample, two having the 16-in. dimension parallel to the fiber of the surfacing material and two perpendicular thereto. Cut the specimens at least 4 in. (102 mm) away from the open ends and edges of the board or lath except in the case of the 16-in. wide lath, where it is impossible to do so.

5.2 Condition specimens to constant weight at a temperature of $85 \pm 15^{\circ}$ F (29.5 ± 8.5°C) and relative humidity of 50 ± 2 % (Note 1). Test specimens individually after constant weight is reached.

NOTE 1-Laboratory test results indicate that conditioning temperatures may range from 70 to 100°F (21 to 38°C) without significantly affecting the results. However, relative humidity is critical. Therefore, specimens shall be tested within 10 min upon removal from the conditioning chamber.

6. Procedure

6.1 For specimens with fibers of the surfacing material parallel, test one specimen from each board face up and the other face down. For specimens with fibers of the surfacing material perpendicular, test one specimen from each board face up and the other face down.

6.2 Support each specimen centrally on fixed parallel bearings, 14 in. (356 mm) on centers, and apply the load on a similar bearing midway between the supports. All bearings and load surfaces shall be true, shall engage the full width of the test specimen, and shall be rounded to a radius of 1/8 in. (3.2 mm). Apply the test load at a uniformly increasing rate of 1 lbf/s (4.45 N/s), with a permissible variation of ± 10 % in the rate. Apply the load with a device independent of manual control of the rate of loading during an individual sample test and maintain the specified rate of loading over all finite time intervals during a test. The load is determined at the time of transverse failure of the paper and core through the

1

Order Number: 02130839 Sold to:ICE MILLER [185096] - MICHAEL.HOPKINS@ICEMILLER.COM, Not for Resale,2016-11-29 14:20:13 UTC Order Number: 02130839 .

.

NGC914-1009, Page 2

Current edition approved Jan. 15, 1995. Published March 1995. Originally published as C 473 - 61. Last previous edition C 473 - 94.

船)C 473

thickness of the board. The specimen shall not show a breaking of the bond between the surfacing and the core before transverse failure of the board.

7. Report

7.1 Calculate and report the average breaking load in pounds-force or newtons for each test condition. The test conditions are: (1) parallel, face up, (2) parallel, face down, (3) perpendicular, face up, and (4) perpendicular, face down.

8. Precision and Bias

8.1 No estimate of the precision or bias of this test method is available at this time.

CORE, END, AND EDGE HARDNESS

9. Significance and Use

9.1 These test methods provide a procedure for evaluating the relative ability of gypsum board or gypsum lath core, ends, and edges to resist crushing during handling or use of the material. These test methods are used to determine compliance with gypsum board or gypsum lath specifications. The degree of correlation between these test methods and service performance has not been determined.

10. Test Specimens

10.1 Cut test specimens from at least three gypsum boards to comprise a sample. For core hardness tests, cut specimens approximately 19 by 3 in. (483 by 76 mm) minimum from the center of each of three sample boards, with the 19-in. dimension perpendicular to the paper-bound edges of the gypsum boards. The dimension parallel to the paper surfacing fibers will vary depending on the specific punch length and opening in the testing machines. When the sample is placed in the tester, place the loading arm in a horizontal position with the punch resting on the sample. It is preferred that the specimens be sawed, rather than cut with a knife. Saw cuts along the 19-in. dimension shall be smooth and square with the 3-in. minimum dimension, as well as with the board surface.

10.2 Condition specimens to constant weight at a temperature of $85 \pm 15^{\circ}$ F (29.5 $\pm 8.5^{\circ}$ C) and relative humidity of 50 ± 2 % (Note 1). Test specimens individually after constant weight is reached.

11. Procedure for Core Hardness

11.1 Clamp or secure the specimen in a fixed vertical position on its 19-in, (483-mm) dimension edge. Use a steel punch, 0.099 ± 0.003 in. (2.515 ± 0.076 mm) in diameter, with the bearing surface machined to a 90° angle in reference to the punch center line. Position the punch at a parallel plane to the board specimen paper surfaces and on the center of the gypsum core edge, equidistant from the paper covered surfaces of the board specimen. Apply the test load at a uniformly increasing rate of 1 lbf/s (4.45 N/s), with a permissible variation of $\pm 10\%$ in the rate. Apply the load with a device independent of manual control of the rate of loading during an individual sample test and maintain the specified rate of loading over all finite time intervals during a test. The core hardness shall be the load required to force the steel punch a distance of $\frac{1}{2}$ in. (13 mm) into the core of the

Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS specimen. (The flexural strength testing equipment may be modified to conduct the core hardness test.) Secure three tests on one 19-in. edge of each specimen at least 4 in. (102 mm) apart, and calculate the numerical average. Discard any single test that varies from the average by more than 15 % and repeat the test (see Fig. 1 for test setup schematic).

12. Report

12.1 Report core hardness as the average load in poundsforce or newtons from the average of the three sample boards.

13. Procedure for End Hardness

13.1 Use the same procedure for end hardness test as for core tests except cut the test specimens from each opposite mill cut end of the board, with the 19-in. (483-mm) dimension perpendicular to the paperbound edges of the gypsum boards, and run tests only on the mill cut edge of the samples (see Fig. 1 for test setup schematic).

14. Report

14.1 Report the end hardness as the average load in pounds-force or newtons for the two specimens from each of the three sample boards, a total of six test results.

15. Procedure for Edge Hardness

15.1 Use the same procedure for edge hardness test as for core tests except cut the 19 by 3-in. (483 by 76-mm) test specimens from the opposite edges of the board with the 19-in, dimension of the specimens parallel with the paperbound edges of the gypsum boards.

15.2 Cut a $\frac{1}{4}$ to $\frac{1}{2}$ -in. (6.4 to 13-mm) strip of paper from the paper-covered edge of the test specimens exposing the core for test. These test areas shall be at least 4 in. (102 mm) apart. Calculate the individual results and report for the three sample boards, making a total of six test results (see Fig. 1 for test setup schematic).

16. Report

16.1 Report the edge hardness as the average load in pounds-force or newtons for the two specimens from each of the three sample boards, a total of six test results.

17. Precision and Bias

17.1 No estimate of the precision or bias of this test method is available at this time.

NAIL PULL RESISTANCE

18. Significance and Use

18.1 This test method covers a procedure for evaluating the ability of gypsum board or gypsum lath to resist nail pull-through by determining the load required to force a standard nailhead through the board or lath. This test method is used to determine compliance with gypsum board or gypsum lath specifications. The degree of correlation between this test method and service performance has not been determined.

19. Test Specimens

19.1 Cut test specimens from at least three gypsum boards

²



FIG. 1 Apparatus Schematic for Core, End, and Edge Hardness Test

to comprise a sample. Cut five specimens 6 by 6 in. (152 by 152 mm), from a strip cut across the width of a 48-in. (1220-mm) gypsum board starting at least 4 in. (102 mm) in from the edge. Cut a total of five specimens from more than one full width strip from gypsum boards less than 38 in. (965 mm) wide. Do not cut the specimen closer than 3 in. (76 mm) from the gypsum board edges.

19.2 Drill a ⁷/₆₄-in. (2.778-mm) diameter pilot hole through the thickness of the gypsum board in the center of each test specimen and perpendicular to the surface.

19.3 Condition specimens to constant weight at a temperature of $85 \pm 15^{\circ}F(29.5 \pm 8.5^{\circ}C)$ and relative humidity of $50 \pm 2\%$ (Note 1). Test specimens individually after constant weight is reached.

20. Apparatus

20.1 Figure 2 shows a schematic of a nail-pull resistance apparatus adaptable to a typical flexural-strength apparatus commonly used in the gypsum industry. Key features of the adaptation involve use of a machined test "nail," meeting the requirements of 21.1, that can be fitted onto the load level arm of the flexural strength apparatus. The base plate, with a 3-in. (76-mm) diameter hole in the center, supports the gypsum board test specimen during the test.

21. Procedure

21.1 Center the specimen face up on the base plate and manually lower the test "nail" inserting the nail shank into the pilot hole until the nailhead is flush with the surface of the sample. The nail shank shall be 0.099 ± 0.003 in. (2.515 \pm 0.076 mm) in diameter and the nailhead shall be $0.250 \pm$ 0.005 in. (6.350 \pm 0.127 mm) in diameter. Apply the test load at a uniformly increasing rate of 1 lbf/s (4.45 N/s), with a permissible variation of ± 10 % in the rate. Apply the load with a device independent of manual control of the rate of loading during an individual sample test and maintain the





Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS

∰ C 473

specified rate of loading over all finite time intervals during a test.

22. Report

22.1 Calculate the average maximum load in poundsforce or newtons. Discard any single test that varies from the average by more than 15%. If more than 15% of the test values are discarded for any test condition, repeat the test.

23. Precision and Bias

23.1 No estimate of the precision or bias of this test method is available at this time.

Method B - Constant Rate of Cross Head Speed

INTRODUCTION

The following procedures are applicable to so-called Universal Testers. These instruments often use electronic load cells and data acquisition equipment to gather information about the specimen being tested. The instruments generally in use move the cross head at a constant speed, as opposed to having the deformation on the specimen control cross head speed, which would be a true constant rate of strain instrument.

24. Apparatus-Method B

24.1 Testing Machine, of any type that is of sufficient capacity and that is capable of providing a rate of loading at a strain rate of 1.0 in./min \pm 5 s (25 mm/min \pm 5 s). The load platform of the test equipment shall be of sufficient size to accept the specimen holder and load applying apparatus. The testing machine shall be power operated and shall apply the load continuously and without shock.

24.2 The test apparatus shall be verified according to Practices E 4, Sections 16 through 18.

24.3 Load-Indicating Equipment, capable of reading to 1-lbf (4.45-N) increments, shall be provided for the test apparatus. A means shall be provided to indicate the maximum load attained during the test.

FLEXURAL STRENGTH

25. Summary of Test Method

25.1 Flexural properties of gypsum board and gypsum lath are evaluated by supporting the specimen near the ends and applying a transverse load midway between the supports. The present test method requires applying the load at a constant stress rate. A constant strain rate load is used with this modified test method.

26. Significance and Use

26.1 This test method covers a procedure for evaluating the ability of gypsum board or gypsum lath to withstand flexural stresses during handling or use of the material. The degree of correlation between this test and service performance has not been fully determined.

27. Apparatus

27.1 Specimen Supports—All bearing supports and load surfaces shall be true, shall engage the full width of the specimen, shall be of such strength they will not deform

3

(III) C 473

under the test load, and shall be rounded to a radius of 0.125 in, (3.2 mm). The specimen supports shall be spaced 14 \pm 0.016 in. $(356 \pm 0.4 \text{ mm})$ on center measured at the points of surface contact with the specimen'. The supports shall be attached to a plate that shall be rigidly attached to the test apparatus. Test specimen supports shall be parallel to each other and perpendicular to the long dimension of the test specimen. The bearing surface of the end supports shall be on the same plane to ensure contact along the entire bearing surfaces. Supports shall be not less than 12 in. (305 mm) in length. When a load is being applied, the loading bar shall be in contact with the full width of the specimen. The loadbearing surface shall be parallel to the bearing surface of the specimen supports. The specimen and specimen supports shall be located so that the vertical axis through the center of the load-bearing surface passes through the specimen at one half of the specimen width and one half of the distance between the supports.

NOTE 2-Figure 3 shows one machine configuration. Other configurations may be used as long as the load is applied to the specimen as specified in 30.1.

28. Sampling, Test Specimens, and Test Units

28.1 A test unit, for the purposes of these test methods, shall consist of at least 0.25 % of the number of gypsum wallboards or gypsum lath in a shipment, but no less than three boards or lath. The boards or lath shall be so selected as to be representative of the shipment.

NOTE 3—A piece of gypsum lath is often not large enough to obtain a full set of specimens for the various tests. It is therefore necessary to increase the number of lath pieces to obtain the test unit required.

28.2 Cut four specimens, each approximately 12 by 16 in. (305 by 406 mm) from each board or lath in the test unit. Two specimens shall have the 16-in. (406-mm) dimension parallel to the fiber of the surfacing material and two perpendicular thereto. Cut the specimens at least 4 in. (102 mm) away from the ends and edges of the board or lath except in the case of 16-in. (406-mm) wide lath where it is impossible to do so.

29. Conditioning

29.1 Condition specimens to constant weight at a temperature of $85 \pm 15^{\circ}F(29.5 \pm 8.5^{\circ}C)$ and relative humidity of $50 \pm 2\%$ (Note 1). Test specimens individually after constant weight is reached.

30. Procedure

30.1 Place the specimen either face up or face down as required on the specimen supports. The specimen ends shall overhang the supports approximately 1 in. (25 mm). Position perforated gypsum lath so that the load is not applied over perforations. After the specimen is in place, zero the load indicator. Apply the load at a strain rate of 1 in./min ± 5 s (25 mm/min ± 5 s). Apply the load until there is transverse failure of the paper and core through the thickness of the specimen.

31, Report

31.1 Calculate the average maximum load in poundsforce or newtons obtained for each test condition. The test conditions are (1) parallel, face up; (2) parallel, face down; (3) perpendicular, face up; and (4) perpendicular, face down.

NOTE 4-See individual gypsum board or gypsum lath specifications for failure criteria.

32. Precision and Bias

32.1 The precision and bias for this test method has not been determined.

CORE, END, AND EDGE HARDNESS

33. Summary of Test Method

33.1 The core, end, and edge hardness of gypsum board and gypsum lath is evaluated by determining the force required to push a steel punch into the area of test. The present test method requires applying the load at a constant stress rate. A constant strain rate load is used with this modified test method.



Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS

34. Significance and Use

34.1 This test method covers a procedure for evaluating the ability of the gypsum board and gypsum lath core, ends, and edges to resist crushing during handling or use of the material. The degree of correlation between this test method and service performance has not been fully determined.

35. Apparatus

35.1 A means of securing the specimen to the base of the test apparatus shall be provided. The face of the specimen shall be perpendicular to the base of the test apparatus and parallel to the movement of the steel punch. The steel punch shall be secured to the moving head of the test apparatus. It shall be positioned so that its center axis is parallel with the line of travel. It shall also be positioned so that the punch is inserted into the board or lath equidistant from the paper covered surfaces of the board specimen. The steel punch shall be 0.099 \pm 0.003 in. (2.515 \pm 0.076 mm) in diameter and more than $\frac{1}{2}$ in. (12.7 mm) long with the bearing surface machined to a 90° angle in reference to the punch center line. (See Figs. 4 and 5 for an example of a test set-up configurations may be used as long as the load is applied to the specimen as specified.)

36. Sampling, Test Specimens, and Test Units

36.1 The test unit, for purposes of this test method, shall consist of at least 0.25 % of the number of gypsum wallboards or gypsum lath in a shipment, but not less than three boards or lath. The boards or lath shall be so selected as to be representative of the shipment.

36.2 Specimens for Core Hardness—Cut a specimen not less than 12 by 3 in. (305 by 76 mm) from the center of each board. The 12-in. (305-mm) dimension shall be perpendicular to the paper bound edges of the gypsum boards or gypsum lath. (See Note 5.)

NOTE 5--Cuts along the 12-in. (305-mm) dimension shall be smooth and perpendicular to the face of the board or lath.

36.3 Specimens for End Hardness—Cut a specimen not less than 12 by 3 in. (305 by 76 mm) from each mill cut end of each board. The 12-in. (305-mm) dimension shall be perpendicular to the paper bound edges of the gypsum board or gypsum lath.

36.4 Specimens for Edge Hardness—Cut a specimen not less than 12 by 3 in. (305 by 76 mm) from each edge of each board. The 12-in. (305-mm) dimension shall be parallel to the paper bound edge of the gypsum board or gypsum lath. Three test areas spaced approximately 4 in. (101.6 mm) apart shall be prepared on the paper-covered edge of each board or lath specimen. The test area shall be prepared by cutting a $\frac{1}{4}$ to $\frac{1}{2}$ -in. (6.4 to 13.0-mm) strip of paper from the paper-covered edge exposing the core for test. Remove as little of the core as possible when removing the paper.

37. Conditioning

37.1 Condition specimens to constant weight at a temperature of $85 \pm 15^{\circ}F(29.5 \pm 8.5^{\circ}C)$ and relative humidity of $50 \pm 2\%$ (Note 1). Test specimens individually after constant weight is reached.

38. Procedure

38.1 Place the specimen in the holder with the edge to be tested facing the steel punch. This test surface shall be a minimum of 1 in. (25 mm) above the grip of the specimen holder. The portion to be tested is as follows:

38.1.1 Core Hardness-Test either of the 12-in. (305-mm) edges.

38.1.2 End Hardness-Test the 12-in. (305-mm) mill-cut end.

38.1.3 *Edge Hardness*—Test the areas along the edge where paper has been removed.

38.2 After the specimen is in place zero the load indicator. Three tests spaced approximately 4-in. (101.6-mm) apart shall be made on each specimen. Position the steel punch over the test area and apply the load at a strain rate of 1 in./min. ± 5 s (25 mm/min ± 5 s). The core, end, or edge



5

Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS Order Number: 02130839 Sold to:ICE MILLER [185096] - MICHAEL.HOPKINS@ICEMILLER.COM, Not for Resale,2016-11-29 14:20:13 UTC

NGC914-1009, Page 6

🛞 C 473



FIG. 5 Test Setup-Sample Holder for Hardness Test

hardness shall be the load required to push the steel punch a distance of $\frac{1}{2}$ in, (13 mm) into the core of the specimen.

39. Report

39.1 Calculate the average maximum load in poundsforce or newtons obtained for each test condition, that is, core hardness, end hardness, and edge hardness. Discard any single test that varies from the average by more than 15 % and repeat the test.

40. Precision and Bias

40.1 Precision and bias of this test method has not been determined.

NAIL PULL RESISTANCE

41. Summary of Test Method

41.1 The ability of gypsum board or gypsum lath to resist nail pull-through is evaluated by determining the load required to push a standard nail head through the board or lath. The present test method requires applying the load at a constant stress rate. A constant strain rate load is used with this modified test method.

42. Significance and Use

42.1 This test method provides a procedure for evaluating the ability of the gypsum board or gypsum lath to resist nails being pulled through the board or lath. The degree of correlation between this test method and service performance has not been fully determined.

43. Apparatus

43.1 Specimen Support Plate, shall be true, and have a 3-in. (76-mm) diameter hole in the center. The support plate shall be at least 6 by 6 in. (152 by 152 mm). It shall be attached to the apparatus as necessary to maintain the surface of the plate perpendicular to the travel of the test nail. The support plate must also be located so that the vertical axis through the center of the nail shank passes through the center of the hole in the support plate. The test nail shank shall be 0.099 ± 0.003 in. $(2.515 \pm 0.076 \text{ mm})$ in diameter and the nail head shall be 0.250 ± 0.005 in. (6.350 \pm 0.127 mm) in diameter. The nail shall be attached at the head to the movable cross head of the test apparatus. This attachment shall not exceed the diameter of the nail head and shall be placed directly over the head. It shall also be attached so that the vertical axis through the nail shank is parallel with the travel. See Figs. 4 and 6 for examples of the test set-up configuration.

44. Sampling, Test Specimens, and Test Units

44.1 The test unit, for the purposes of these test methods, shall consist of at least 0.25 % of the number of gypsum wallboards or gypsum lath in a shipment, but not less than three boards or lath. The boards or lath shall be so selected as to be representative of the shipment.

44.2 Cut five specimens approximately 6 by 6 in. (152 by 152 mm) from across each board starting at least 4 in. (102 mm) in from the edge. Drill a $\frac{7}{64}$ -in. (2.778-mm) diameter pilot hole through the thickness of the gypsum board in the

Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS 6

Order Number: 02130839 Sold to:ICE MILLER (185096) - MICHAEL.HOPKINS@ICEMILLER.CON Not for Resale,2016-11-29 14:20:13 UTC

NGC914-1009, Page 7

.

_



FIG. 6 Test Setup—Sample Holder for Nail Pull Resistance

center of each test specimen and perpendicular to the surface.

45. Conditioning

45.1 Condition specimens to constant weight at a temperature of $85 \pm 15^{\circ}$ F (29.5 $\pm 8.5^{\circ}$ C) and relative humidity of 50 ± 2 % (Note 1). Test specimens individually after constant weight is reached.

46. Procedure

46.1 Place the specimen on the specimen support plate so that the drilled hole is aligned with the nail shank tip. After the specimen is in place, zero the load indicator. Insert the nail shank into the specimen hole and apply the load at a strain rate of 1 in./min $\pm 5 \text{ s}$ (25 mm/min $\pm 5 \text{ s}$). Continue to apply the load until the maximum load is exceeded. Normally, this will occur as the nail head breaks through the board or lath paper covering and is followed by a very significant decrease in load.

47. Report

47.1 Calculate the average maximum load in poundsforce or newtons. Discard any single test that varies from the average by more than 15 %. If more than 15 % of the test values are discarded for any test condition, repeat the test.

48. Precision and Bias

48.1 Precision and bias has not been determined for this test method.

HUMIDIFIED DEFLECTION

49. Significance and Use

49.1 This test method covers a procedure for evaluating the deflection of gypsum board or gypsum lath when horizontally suspended and subjected to high humidity. This test method is used to determine compliance with gypsum board or gypsum lath specifications. Since job factors other than high humidity influence the deflection of gypsum board or gypsum lath, the degree of correlation between this test method and service performance has not been determined.

∰) C 473

50. Test Specimens

50.1 Cut test specimens from at least three gypsum boards to comprise a sample. Cut two specimens 12 by 24 in. (305 by 610 mm) from each board in the sample. The 12-in. dimension shall be parallel to the fiber of the surfacing material. Take specimens at least 12-in. away from the ends and edges of gypsum boards 36 in. (914 mm) or more in width. Cut specimens from the center of gypsum boards that are narrower than 36 in. (914 mm) as noted in Fig. 7.

50.2 Condition the specimens in an atmosphere of $85 \pm 15^{\circ}$ F (29.5 $\pm 8.5^{\circ}$ C) and relative humidity of $50 \pm 2\%$ (Note 1). Test specimens individually after constant weight is reached.

51. Procedure

51.1 Suspend each specimen face down on parallel and level bearing edges, having $\frac{1}{12}$ in. (3.2-mm) radii, 12 in. (305 mm) long, and 23 in. (584 mm) apart in an atmosphere of 90 \pm 3°F (32 \pm 1.7°C) and 90 \pm 3 % relative humidity for 48 h.

51.2 Measure the humidified deflection of each specimen as the distance between a straightedge placed on the top end edges of the board and the upper surface of the board at its center. Take measurements to the nearest V_{16} in. (1.6 mm).

52. Report

52.1 Report the humidified deflection as the average of the specimens to the nearest $\frac{1}{8}$ in. (3.2 mm).

53. Precision and Bias

53.1 No estimate of the precision and bias of this test method is available at this time.

END SQUARENESS

54. Test Specimens

54.1 Use at least three gypsum boards or gypsum lath as a sample. Use full-size gypsum boards or gypsum lath with undamaged ends for test specimens.

55. Procedure

55.1 For this procedure, the term square shall be defined as a T-shaped or L-shaped instrument for drawing or testing right angles. Place one edge of a square flush against the edge of the board with the apex of the square at one corner of the board. Determine the distance b, to the nearest V_{16} in. (1.6 mm), at the specified distance a. Distance is measured from the apex of the square (see Fig. 8).

56. Report

56.1 Report the average of distance b.

NOMINAL THICKNESS

57. Significance and Use

57.1 This test method covers a procedure for determining the thickness of gypsum board or gypsum lath, and is used to determine compliance with gypsum board or gypsum lath specifications. The degree of correlation between this test method and service performance has not been determined.

58. Test Specimens

. .

58.1 Use at least three gypsum boards or gypsum lath as a

Order Number: 02130839 Sold to:ICE MILLER [185096] - MICHAEL.HOPKINS@ICEMILLER.COM, Not for Resale,2016-11-29 14:20:13 UTC

NGC914-1009, Page 8

ASTM C473 95 🔳 0759510 0554744 T26 🖿

船)C 473







FIG. 8 End Squareness Determination

sample. Use full-size gypsum boards or gypsum lath for test specimens.

58.2 Mark the individual boards or lath to be tested, score on both sides, and break at 12 in. (305 mm) from each end, discarding the two ends prior to testing. Retain the remaining part of each gypsum board or gypsum lath as a test specimen.

59. Procedure

59.1 Use a micrometer gage for determining the thickness measurement to 0.001 in. (0.025 mm). The micrometer shall be a 1-in. (25.4-mm) hand micrometer with $\frac{1}{4}$ -in. (6.35-mm) diameter anvils graduated to 0.01 in. (0.025 mm).

59.2 Mark measurement points at approximately equal points across the width at each end of the board or lath excluding the tapered, beveled, or recessed edges if applicable. The micrometer contact shall be firm but shall not indent the paper. Measure the thickness of the gypsum board or gypsum lath with the micrometer at least $\frac{1}{2}$ in. (13 mm) from cut ends. Take a minimum of seven readings at each end of the 54-in. (1370-mm) wide gypsum board, six readings at each end of the 48-in. (1220-mm) wide gypsum board or gypsum lath, four readings at each end of the 22-in. (813-mm) wide gypsum board or gypsum lath, four readings at each end of the 24-in. (610-mm) wide gypsum board or gypsum lath, or three readings at each end of the 16-in. (406-mm) wide gypsum board or gypsum lath.

60. Report

60.1 Calculate the nominal thickness of each specimen as the average of the individual micrometer readings taken on each board. Calculate and report the sample thickness as the average nominal thickness of three gypsum board or gypsum lath specimens in the sample.

....

61. Precision and Bias

61.1 The precision and bias of this test method has not been determined.

RECESSED- OR TAPERED-EDGE DEPTH

62. Significance and Use

62.1 This test method provides a procedure for determining the depth of the recess or taper on the edge of gypsum board, and is used to determine compliance with gypsum board specifications. The degree of correlation between this test method and service performance has not been determined.

63. Test Specimens

63.1 Use at least three gypsum boards as a sample.

63.2 Mark the individual boards to be tested, score on both sides, and break 12 in. (305 mm) from each end, discarding the two ends prior to testing. Retain the remaining part of each gypsum board as a test specimen.

64. Procedure

64.1 Use the micrometer gage described in 59.1. The micrometer gage shall firmly engage but shall not indent the paper. All readings shall be taken to the nearest 0.001 in. (0.025 mm) of specimen thickness.

64.2 At one corner of the specimen, determine thickness $\frac{1}{2}$ in. (12.7 mm) from the cut end and 6 in. (152.4 mm) from the edge.

64.3 At the same corner, also determine the thickness 6 in. (152.4 mm) from the cut end and $\frac{3}{6}$ in. (9.5 mm) from the edge.

64.4 Subtract the specimen thickness 6 in. (152.4 mm) from the cut end and $\frac{1}{2}$ in. (9.5 mm) from the edge (as in 64.3) from the specimen thickness at $\frac{1}{2}$ in, (12.7 mm) from the cut end and 6 in. (152.4 mm) from the edge (as in 64.2) to determine the individual recessed or taper-edge depth at that specimen corner.

64.5 Repeat the procedure in 64.2, 64.3, and 64.4 on the remaining three corners of the specimen and on the remaining two specimens of the sample.

64.6 Determine the average recessed or tapered-edge depth from the twelve individual recessed or tapered-edge depths (as in 64.4).

64.7 Determine the variation of any individual recessed or

Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS Order Number: 02130839 Sold to:ICE MILLER [185096] - MICHAEL.HOPKINS@ICEMILLER.COM Not for Resale,2016-11-29 14:20:13 UTC

8

船》C 473

tapered-edge depth from the average as determined in 64.6 using the subtraction method.

64.8 Reject or discard any individual recessed- or taperededge depth calculation (as in 64.4) if the variation from average (as in 64.7) exceeds 0.050 in. (1.27 mm). Not more than three individual calculations shall be discarded to constitute a valid sample.

65. Report

65.1 Report the average recessed- or tapered-edge depth as in 64.6 after any adjustments for exclusions of data as in 64.7 and 64.8.

66. Precision and Bias

66.1 The precision and bias of this test method has not been determined.

WIDTH

67. Significance and Use

67.1 This test method provides a procedure for determining the width of gypsum board or gypsum lath, and is used to determine compliance with gypsum board or gypsum lath specifications.

68. Test Specimens

68.1 A sample shall consist of a minimum of three gypsum boards or gypsum lath.

69. Procedure

69.1 Measure the width of an individual board or lath to the nearest $\frac{1}{32}$ in. (1 mm) with an accurate T-square, straight rule, or pocket rule. Place the rule perpendicular to the paper bound edges of the gypsum boards or gypsum lath, when measurements are taken. The width of the board or lath is the distance between extremities of the edges, so in cases where the edge or edges are beveled (slope in or out) with the face or back of the board or lath, or are round, determine the overall distance. One exception is tongue and groove edge board, the width of which is the distance between the tip of the tongue and the bottom of the groove.

69.2 The width of an individual board or lath shall be the maximum of two readings taken at least 48 in. (1220 mm) apart and about 6 in. (152 mm) away from both ends of the board or lath. Cut off 6 in. (152 mm) from both ends before taking measurements at ends of tongue and groove-edge boards.

70. Report

70.1 Report the width as the average width of a minimum of three specimens.

71. Precision and Bias

71.1 The precision and bias of this test method has not been determined.

LENGTH

72. Significance and Use

72.1 This test method provides a procedure for determining the length of gypsum board or gypsum lath and is used to determine compliance with gypsum board or gypsum lath specifications.

73. Test Specimens

73.1 A sample shall consist of a minimum of three gypsum boards or gypsum lath.

74. Procedure

74.1 Measure the length of an individual board or lath to the nearest V_{16} in. (1.59 mm) with an accurate rule. Place the rule parallel with board or lath edges when measurements are taken. The length of the board or lath shall be the distance between extremities of the ends, so in cases where the ends are beveled, determine the overall distance.

74.2 The length of an individual board or lath shall be the maximum of two readings taken about 3 in. (76 mm) away from both edges.

75. Report

75.1 Report the length as the average length of a minimum of three specimens.

76. Precision and Bias

76.1 The precision and bias of this test method has not been determined.

WATER RESISTANCE OF CORE-TREATED WATER-REPELLENT GYPSUM BOARDS

77. Significance and Use

77.1 This test method provides a procedure for evaluating the ability of core-treated gypsum board to resist water penetration. This test method is used to determine compliance with gypsum board specifications.

78. Test Specimens

78.1 Use at least three gypsum boards as a sample.

78.2 Prepare a 12 by 12-in. (305 by 305-mm) test specimen cut from the center of the gypsum board being tested by scoring and breaking. Cut specimens approximately centered between both edges and at least 6 in. (152 mm) from either end. Do not treat the edges of the specimen nor damage the surface paper.

78.3 Condition the specimens to constant weights, within 0.1 %, at a temperature of $70 \pm 5^{\circ}F$ (21 \pm 2°C), in an atmosphere having a relative humidity of 50 ± 2 %, and then weigh to within 0.5 g.

79. Procedure

79.1 Immerse the sample flatwise in a bath of water at a constant temperature of $70 \pm 1^{\circ}F(21 \pm 0.5^{\circ}C)$ with a head of 1 in. (25.4 mm) of water over the top of the sample, which shall be positioned in the water bath so that it does not lie flat on the bottom of the container.

79.2 After 2 h have elapsed, remove sample from the bath, wipe excess water from the surfaces and edges of the specimen and weigh immediately to within 0.5 g.

80. Report

Order Number: 02130839

80.1 Calculate the gain in weight for each specimen as a percentage of the original weight as determined in 78.3 and

Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS 9

Order Koninder: 02 100002 | MICHAEL HOPKINS@ICEMILLER.COM, Not for Resale,2016-11-29 14:20:13 UTC

ASTM C473 95 🖿 0759510 0554746 8T9 🔳

()) C 473

report the average percentage as the water absorption of the gypsum board.

81. Precision and Bias

81.1 No estimate of the precision or bias of this test method is available at this time.

SURFACE WATER RESISTANCE OF GYPSUM BOARDS WITH WATER-REPELLENT FACE PAPER

82. Significance and Use

82.1 This test method provides a procedure for evaluating the ability of gypsum board water-repellent-paper surfacing to resist water penetration. This test method is used to determine compliance with gypsum board specifications.

83. Test Specimens

83.1 Use at least three gypsum boards as a sample.

83.2 Cut three specimens 5 in. (127 mm) square from the field of each sample board.

83.3 Condition the specimens to constant weight, within 0.1 %, at a temperature of $70 \pm 5^{\circ}$ F (21 $\pm 2^{\circ}$ C), in an atmosphere having a relative humidity of 50 ± 2 %, and then weigh to within 0.05 g.

84. Procedure

84.1 Place the conditioned test specimens in the Cobb

Tester,⁴ previously conditioned to $70 \pm 2^{\circ}F(21 \pm 1^{\circ}C)$, with the side to be exposed to water facing up. Fill the Cobb ring with tap water adjusted to a temperature of $70 \pm 1^{\circ}F(21 \pm 0.5^{\circ}C)$, resulting in a 1-in. (25.4-mm) head of water above the test area of the specimen.

84.2 After 2 h have elapsed, pour the water out of the Cobb ring and remove the test specimen from the Cobb Tester. Immediately remove excess water from the specimen by blotting and weigh the specimen to the nearest 0.05 g.

85. Report

85.1 Calculate the average difference between the dry and wet weights of the test specimens and report this as the surface water absorption of the board samples.

86. Precision and Bias

86.1 No estimate of the precision or bias of this test method is available at this time.

87. Keywords

87.1 absorption testing; core hardness testing; dimension measurements; edge hardness testing; end hardness testing; flexural strength; gypsum board; gypsum lath; humidified sag; nail pull testing

⁴ Cobb Size Tester, with 100-cm² cylinder and neoprene gasket, is available from W. & L. E. Gurley, Troy, NY.

APPENDIX

(Nonmandatory Information)

INTRODUCTION

ASTM specifications for gypsum board and gypsum lath do not contain a specification for weight. However, the procedure is referenced in other industry standards and is therefore retained as an appendix item.

X1. WEIGHT

where:

X1.1 Test Specimens

X1.1.1 A sample shall consist of a minimum of three gypsum boards or gypsum lath.

X1.2 Procedure

X1.2.1 Measure the length and width of each specimen in accordance with Sections 42 to 51. Weigh the specimens on a suitable scale and record the weight to the nearest $\frac{1}{4}$ lb (0.1 kg).

X1.3 Calculation

X1.3.1 Calculate the weight in accordance with the following:

 $W = K \times P/L \times B$

W = weight per calculated area, lb/1000 ft² (kg/100 m²),

- L =length of specimen, in. (mm),
- B = width of specimen, in. (mm),
- P = weight of specimen, lb (kg), and
- $K = 1.44 \times 10^5 \text{ in.}^2 (9.29 \times 10^7 \text{ mm}^2).$

X1.4 Report

X1.4.1 Report the weight, as the average calculated weight, in lb/1000 ft² (kg/100 m²) of the three gypsum boards or gypsum lath in the sample.

Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS 10

∰ C 473

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

- -- --

Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS

_ -

11

_....

Order Number: 02130839 Sold to:ICE MILLER (185096) - MICHAEL.HOPKINS@ICEMILLER.COM, Not for Resale,2016-11-29 14:20:13 UTC

.....