NFPA

255

TEST METHODS

SURFACE BURNING— BUILDING MATERIALS 1979

NATIONAL FIRE PROTECTION ASSOCIATION, INC.
470 Atlantic Avenue, Boston, MA 02210

3M-7-79-FP
Printed in U.S.A.

NOTICE

All questions or other communications relating to this document should be sent only to NFPA Headquarters, addressed to the attention of the Committee responsible for the document.

For information on obtaining Formal Interpretations of the document, proposing Tentative Interim Amendments, proposing amendments for Committee consideration, and appeals on matters relating to the content of the document, write to the Assistant Vice President- Standards, National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

Statement on NFPA Procedures

This material has been developed under the published procedures of the National Fire Protection Association, which are designed to assure the appointment of technically competent Committees having balanced representation. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

NFPA has no power or authority to police or enforce compliance with the contents of this document and any certification of products stating compliance with requirements of this document is made at the peril of the certifier.

See Official NFPA Definitions at the back of this pamphlet.

Method of Test of
Surface Burning Characteristics of Building Materials

NFPA 255-1979

1979 Edition of NFPA 255

This standard was adopted by the National Fire Protection Association, Inc. on May 16, 1979 on recommendation of the Committee on Fire Tests to supersede the standard adopted in 1972. It was released by the Standards Council for publication on June 11, 1979.

Changes from the 1972 edition included in this 1979 edition are the renumbering of sections and paragraphs to conform to the NFPA documents style manual. In addition, many changes have been made in the operational and design sections to bring this document in line with other publications.

Origin and Development of NFPA 255

The test procedure covered by this standard was originally developed by Underwriters Laboratories Inc., and a descriptive article thereon was published in the NFPA Quarterly for July, 1943. Subsequently the test method was considered by Committee E-5 of the American Society for Testing Materials and adopted by the ASTM as a tentative standard in 1950. Subsequent to NFPA action on this standard, on recommendation of the Committee on Building Construction in 1953, a new NFPA Committee on Fire Tests was created to provide the machinery for NFPA action on fire test standards in cooperation with the American Society for Testing and Materials. At the 1955 Annual Meeting the Committee on Fire Tests, by a divided vote, recommended continuing tentative status, but, in view of the recommendation of the NFPA Committee on Building Construction and also of the NFPA Committee on Safety to Life, which needed this standard for use in connection with interior finish requirements *(see NFPA 101®)*, the standard was officially adopted in 1955 and revised editions were released in 1958, 1961, 1966, 1969, 1972, and 1979.

Committee on Fire Tests

Herman H. Spaeth, *Chairman*
Insurance Services Office

M. S. Abrams, Portland Cement Association
Irwin A. Benjamin, National Bureau of Standards
John A. Blair, Society of the Plastics Industry
B. J. Callahan, Factory Mutual Research Corporation
Herbert B. Carlsen, Gypsum Association
Wells Denyes, Man Made Fiber Producers Association
Robert W. Dougherty, M & M Protection Consultants
Gerard R. Dufresne, U.S. Testing Company, Incorporated
Buell B. Dutton, Building Officials & Code Administrators, Int'l.
Richard G. Gewain, American Iron and Steel Institute
Gerald E. Lingenfelter, American Insurance Association
William H. McLain, Southwest Research Institute
E. E. Miller, Industrial Risk Insurers
Norman S. Pearce, Underwriters' Laboratories, Inc. of Canada
T. P. Pritsker, The Dallas Laboratories
Dr. A. F. Robertson, National Bureau of Standards
John Ed Ryan, National Forest Products Association
Louis Segal, Fire Marshals Association of North America
K. Sumi, National Research Council
Lewis W. Vaughan, Canadian Sheet Steel Building Institute

Alternates

J. S. Barritt, Industrial Risk Insurers (Alternate to E. E. Miller)
David Brackett, Gypsum Assn. (Alternate to H. B. Carlsen)
Peter B. McOrmond, Insurance Services Office (Alternate to H. H. Spaeth)
Alton T. Riddick, National Forest Products Assn. (Alternate to J. E. Ryan)
G. M. Watson, American Insurance Assn. (Alternate to G. E. Lingenfelter)

Nonvoting

A. J. Bartosic, ASTM D-20 Committee

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

Contents

Method of Test of
Surface Burning Characteristics of Building Materials

NFPA 255-1979

Chapter 1 General

1-1 Scope. This method of test of surface burning characteristics of building materials is applicable to any type of building material that, by its own structural quality or the manner in which it is applied, is capable of supporting itself in position or may be supported in the test furnace to a thickness comparable to its recommended use.

1-2 Purpose.

1-2.1 The purpose of the test is to determine the comparative burning characteristics of the material under test by evaluating the flame spread over its surface, when exposed to a test fire, and to thus establish a basis on which surface burning characteristics of different materials may be compared without specific consideration of all end use parameters that might affect the surface burning characteristics.

1-2.2 Smoke density as well as the flame spread rate are recorded in this test. However, there is not necessarily a relationship between these measurements.

1-2.3 It is the intent of this method of test to register performance during the period of exposure, and not to determine suitability for use after the test exposure.

NOTE: Reference may be made to the *Standard Methods of Fire Tests of Building Construction and Materials* (NFPA 251) for procedures for determining the performance, under fire exposure conditions, of building constructions and materials when incorporated in a test structure and subject to a standard exposing fire of controlled extent and severity.

1-2.4 This method does not establish ratings of standards of performance for specific uses, as these depend upon service requirements.

NOTE: The values stated in U.S. customary units are to be regarded as the standard.

Chapter 2 Test Equipment and Specimens

2-1 Fire Test Chamber.

2-1.1 The fire test chamber, Figures 1 and 2, shall consist of a horizontal duct having an inside width of 17¾ ± ¼ in. (451 ± 6.3 mm) measured at ledge location alongside walls and 17⅝ ± ⅜ in. (448 ± 10 mm) at all other points; a depth of 12 ± ½ in. (305 ± 13 mm) measured from the bottom of the test chamber to the ledge of the inner walls on which the specimen is supported [including the ⅛ in. (3.2 mm) thickness of asbestos fabric gasketing tape]; and a length of 25 ft (7.62 m). The sides and base of the duct shall be lined with insulating masonry as illustrated by Figure 2, consisting of A.P. Green, G-26[1] refractory fire brick or equivalent. One side shall be provided with double observation windows[2] with the inside pane flush mounted (*see Figure 2*). Exposed inside glass shall be 2¾ ± ⅜ by 11 plus 1, minus 2 in. (7.0 ± 10 by 29.7 plus 25, minus 50 mm). The centerline of the exposed area of the inside glass shall be in the upper half of the furnace wall, with the upper edge not less than 2.5 in. (63 mm) below the furnace ledge. The window shall be located such that not less than 12 in. (305 mm) of the specimen width can be observed. Multiple windows shall be located along the tunnel so that the entire length of the test sample may be observed from outside the fire chamber. The windows shall be pressure tight as described in 2-3.2.

2-1.2 The ledges shall be fabricated of structural materials[3] capable of withstanding the abuse of continuous testing, level with respect to the length and width of the chamber and each other, and maintained in a state of repair commensurate with the frequency, volume, and severity of testing occurring at any time.

2-1.3 To provide air turbulence for proper combustion, turbulence baffling shall be provided by positioning six A.P. Green, G-26[4] refractory fire bricks or equivalent [long dimension vertical, 4½ in. (114 mm) dimension along the wall] along the side walls of the chamber at distances of 7, 12, and 20 ± ½ ft (2.1, 3.7, and 6.1 ± 0.2 m) on the window side and 4½, 9½, and 16 ± ½ ft (1.3, 2.9, and 4.9 ± 0.2 m) on the opposite side.

---

[1]This method is based upon the use of G-26 fire brick manufactured by A.P. Green Refractories, Green Boulevard, Mexico, MO 65265.

[2]Heat-resistant glass. Vycor, 100 percent silica glass, nominal ¼ in. thick, has been found suitable for the interior pane; Pyrex glass, nominal ¼ in. thick, has been found suitable for the exterior pane.

[3]High temperature furnace refractory. Zircon has been found suitable for this purpose.

[4]This method is based upon the use of G-26 fire brick, manufactured by A.P. Green Refractories, Green Boulevard, Mexico, MO 65265.

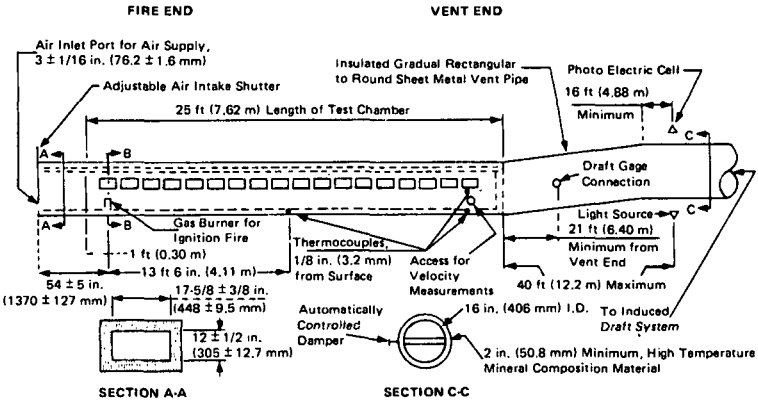

Figure 1

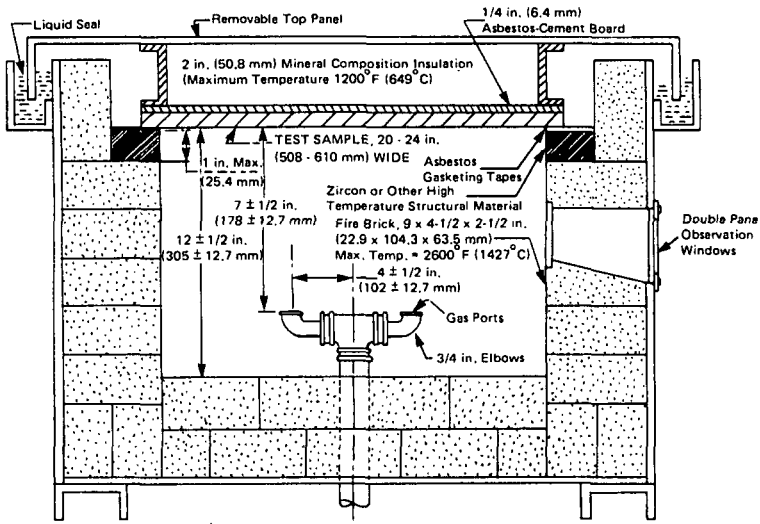

Figure 2

2-1.4 The top lid shall consist of a removable noncombustible (metal and mineral composite) structure, insulated with nominal 2-in. (51-mm) thick mineral composition material as shown in Figure 2 and of a size necessary to cover completely the fire test chamber and the test samples. The lid shall be maintained in an unwarped and flat condition. The mineral composition material shall have physical characteristics comparable to the following:

Maximum effective temperature	1200°F (649°C)
Bulk density	12.5 ± 1.5 pcf (196.1 ± 24.0 kg/m^3)
Thermal conductivity at 300 to 700°F (149 to 371°C)	0.45 to 0.65 Btu in h-ft^2°F (0.78 to 1.12 W/m.K)

The entire lid assembly shall be protected with flat sections of high-density (nominal 110 pcf or 1761 kg/m^3) ¼-in. (6.3-mm) asbestos cement board, maintained in an unwarped and uncracked condition through continued replacement. This protective board may or may not be secured to the furnace lid. When in place the top shall be completely sealed against the leakage of air into the fire test chamber during the test.

2-1.5 One end of the test chamber, designated as the "fire end," shall be provided with two gas burners delivering flames upward against the surface of the test sample. The burners shall be spaced 12 in. (305 mm) from the fire end of the test chamber, and 7½ ± ½ in. (190 ± 13 mm) below the under surface of the test sample. The air intake shutter shall be located 54 ± 5 in. (1372 ± 127 mm) upstream of the burner, as measured from the burner centerline to the outside surface of the shutter. Gas to the burners shall be provided through a single inlet pipe, distributed to each port burner through a tee-section. The outlet shall be a ¾-in. (19 mm) elbow. The plane of the port shall be parallel to the furnace floor, such that the gas is directed upward toward the specimen. Each port shall be positioned with its centerline 4 ± ½ in. (102 ± 13 mm) on each side of the centerline of the furnace so that the flame is evenly distributed over the width of the exposed specimen surface (*see Figure 2*). The controls used to assure constant flow of gas to the burners during period of use shall consist of a pressure regulator, a gas meter calibrated to read in increments of not more than 0.1 ft^3 (2.8 L), a manometer to indicate gas pressure in inches of water, a quick-acting gas shutoff valve, a gas metering valve, and an orifice plate in combination with a water manometer to assist in maintaining uniform gas-flow conditions. An air intake fitted with a vertically sliding shutter extending the entire width of the test chamber shall be provided at the fire end. The shutter shall be positioned so as to provide an air

inlet port 3 ± 1/16 in. (76 ± 2 mm) high measured from the floor level of the test chamber, at the air intake point.

2-1.6 The other end of the test chamber, designated as the "vent end," shall be fitted with a gradual rectangular-to-round transition piece, not less than 20 in. (508 mm) by 200 sq in. (1290 cm^2) at any point. The transition piece shall, in turn, be fitted to a flue pipe 16 in. (406 mm) in diameter. The movement of air shall be by an induced draft system having a total draft capacity of at least 0.15 in. (3.8 mm) water column with the sample in place, the shutter at the fire end open the normal 3 ± 1/16 in. (76 ± 2 mm) and the damper in the wide open position. A draft gage to indicate static pressure shall be joined with the vent pipe using a surface mount connection upstream of the damper and photoelectric cell opening, and at a point of minimum air turbulence at least 16 diameters [approximately 21 ft (6.4 m)] from the vent end of the chamber.

2-1.7 A light source[1] shall be mounted on a horizontal section of the 16-in. (406-mm) diameter vent pipe at a point where it will be preceded by a straight run of pipe [at least 12 diameters or 16 ft (4.88 m) and not more than 30 diameters or 40 ft (12.19 m)] from the vent end of the chamber, and with the light beam directed upward along the vertical axis of the vent pipe. The vent pipe shall be insulated with at least 2 in. (51 mm) of high temperature mineral composition material, from the vent end of the chamber to the photometer location. A photoelectric cell of which the output is directly proportional to the amount of light received shall be mounted over the light source and connected to a recording device having a minimum operating chart width of 5 in. (127 mm) with an accuracy within ± 1 percent of full scale for indicating changes in the attenuation of incident light by the passing smoke, particulate, and other effluent. The distance between the light source lens and the photocell lens shall be 36 ± 4 in. (914 ± 102 mm). The cylindrical light beam shall pass through 3-in. (76-mm) diameter openings at the top and bottom of the 16-in. (406-mm) diameter openings at the top and bottom of the 16-in. (406-mm) diameter duct, with the resultant light beam centered on the photocell.

2-1.8 Linearity of the photometer system shall be verified periodically by interrupting the light beam with calibrated neutral density filters. The filters shall cover the full range of the recording instrument. Transmittance values measured by the photometer, using neutral density filters, shall be within plus or minus 3 percent of the calibrated value for each filter.

---

[1] A Weston Instruments No. 856BB Photronic cell and 12-V sealed beam, clear lens, auto spot lamp, with an overall light-to-cell path length of 36 ± 4 in. (914 ± 102 mm) has been found suitable for this purpose.

2-1.9 An automatically controlled damper to regulate the draft pressure shall be installed in the vent pipe downstream of the smoke indicating attachment. The damper shall be provided with a manual override.

2-1.10 Other manual and/or automatic draft regulation devices may be incorporated to maintain fan characterization and air-flow control throughout test periods.

2-1.11 A No. 18 AWG (1.02-mm) thermocouple with ⅜ ± ⅛ in. (9.5 ± 3.2 mm) of the junction exposed in the air shall be inserted through the floor of the test chamber so that the tip is 1 ± 1/32 in. (25.4 ± 0.8 mm) below the top surface of the asbestos gasketing tape and, 23 ft ± ½ in. (7.0 m ± 13 mm) from the centerline of the burner ports, at the center of its width.

2-1.12 A No. 18 AWG (1.02 mm) thermocouple embedded ⅛ in. (3.2 mm) below the floor surface of the test chamber shall be mounted in refractory or portland cement, carefully dried to avoid cracking, at distances of 13 ft ± ½ in. (3.96 m ± 13 mm) and 23 ft ± ½ in. (7.09 m ± 13 mm) from the centerline of the burner ports.

2-1.13 The room in which the test chamber is located shall have provision for a free inflow of air during test to maintain the room at atmospheric pressure during the entire test run.

2-2 Test Specimens.

2-2.1 The test specimen shall be at least 2 in. (51 mm) wider [nominally 20¼ ± ¾ in. (514 ± 19 mm)] than the interior width of the tunnel and a total of 24 ft ± ½ in. (7.32 m ± 13 mm) in length. The specimen may consist of a continuous, unbroken length, or of sections joined end-to-end. A 14 ± ⅛-in. (356 ± 3-mm) length of uncoated 16 gage (0.053- to 0.060-in.) steel sheet shall be placed on the specimen mounting ledge in front of and under the specimen in the upstream end of the tunnel. Specimens shall be truly representative of the material for which test results are desired. Properties adequate for identification of the materials or ingredients (or both) of which the test specimen is made shall be recorded.

2-2.2 The test specimen shall be conditioned to a constant weight at a temperature of 73.4 ± 5°F (23 ± 2.8°C) and at a relative humidity of 50 ± 5 percent.

2-3 Calibration of Test Equipment.

2-3.1 Place a ¼-in. (6.3-mm) asbestos cement board on the ledge of the furnace chamber then place the removable lid of the test chamber in position.

2-3.2 With the ¼-in. (6.3-mm) asbestos cement board in position on top of the ledge of the furnace chamber, and with the removable lid in place, establish a draft to produce a 0.15-in. (3.8-mm) water column reading on the draft manometer, with the fire end shutter open 3 ± 1/16 in. (76 ± 16 mm) by manually setting the damper as a characterization of fan performance. Then close and seal the fire end shutter without changing the damper position. The manometer reading shall increase to at least 0.375 in. (9.53 mm), indicating that no excessive air leakage exists.

2-3.3 In addition, conduct a supplemental leakage test periodically with the fire shutter and exhaust duct beyond the differential manometer tube sealed, by placing a smoke bomb in the chamber. The bomb shall be ignited and the chamber pressurized to 0.375- ± 0.125-in. (9.53- ± 3.18-mm) water column. All points of leakage observed in the form of escaping smoke particles are to be sealed. Establish a draft reading within the range of 0.055- to 0.085-in. (1.40- to 2.16-mm) water column. The required draft gage reading shall be maintained throughout the test by the automatically controlled damper.

2-3.4 Record the air velocity at seven points, 23 ft (8.28 m) from the centerline of the burner ports, 6 ± ¼ in. (168 ± 7 mm) below the plane of the specimen mounting ledge. Determine these seven points by dividing the width of the tunnel into seven equal sections and recording the velocity at the geometrical center of each section. During the measurement of velocity, remove the turbulence bricks (*see 2-1.3*) and exposed 23-ft (7.02-m) thermocouple and place 24-in. (670-mm) long straightening vanes between 16 and 18 ft (4.88 and 5.49 m) from the burner. The straightening vanes shall divide the furnace cross section into nine uniform sections. Determine the velocity with furnace air temperature at 73.4 ± 5°F (23 ± 2.8°C) using a velocity transducer.[1] The velocity, determined as the arithmetic average of the seven readings, shall be 240 ± 5 ft (7.32 ± 1.5 m)/min.

2-3.5 The air supply shall be maintained at 73.4 ± 5°F (23 ± 2.8°C) and the relative humidity of 50 ± 5 percent.

2-3.6 The fire test chamber shall be supplied with natural (city) or methane (bottled) gas fuel of uniform quality with a heating value of nominally 1000 Btu/ft³ (37.3 MJ/m³). Adjust the gas supply initially at approximately 5000 Btu (5.3 MJ)/min. Record the gas pressure, the pressure differential across the orifice plate, and the volume of gas used in each test. Unless otherwise corrected for, when bottled

[1]A Thermo Systems Inc. Model 1610 velocity transducer (thermal anemometer), using a readout device accurate to 0.001 v, has been found suitable for the purpose.

methane is employed, a length of coiled copper tubing shall be inserted into the gas line between the supply and metering connection to compensate for possible errors in the flow indicated due to reductions in gas temperature associated with the pressure drop and expansion across the regulator. With the draft and gas supply adjusted as indicated in 2-3.3 and 2-3.6, the test flame shall extend downstream to a distance of 4½ ft (1.37 m) over the specimen surface, with negligible upstream coverage.

2-3.7 Preheat the test chamber with the ¼-in. (6.3 mm) asbestos cement board and the removable lid in place and with the fuel supply adjusted to the required flow. The preheating shall be continued until the temperature indicated by the floor thermocouple at 23¼ ft (7.09 m) reaches 150 ± 5°F (66 ± 2.8°C). During the preheat test, record the temperatures indicated by the thermocouple at the vent end of the test chamber at intervals not longer than 15 sec and compare these readings to the preheat temperature shown in the time temperature curve in Figure 3. The preheating is for the purpose of establishing the conditions that will exist following successive tests and to indicate the control of the heat input into the test chamber. If appreciable variation from the temperature shown in the representative preheat curve is observed, suitable adjustments in the fuel supply may be made necessary based on red oak calibration tests.

2-3.8 Allow the furnace to cool after each test. When the floor thermocouple at 13 ft (3.96 m) shows a temperature of 105 ± 5°F (40.5 ± 2.8°C), place the next specimen in position for test.

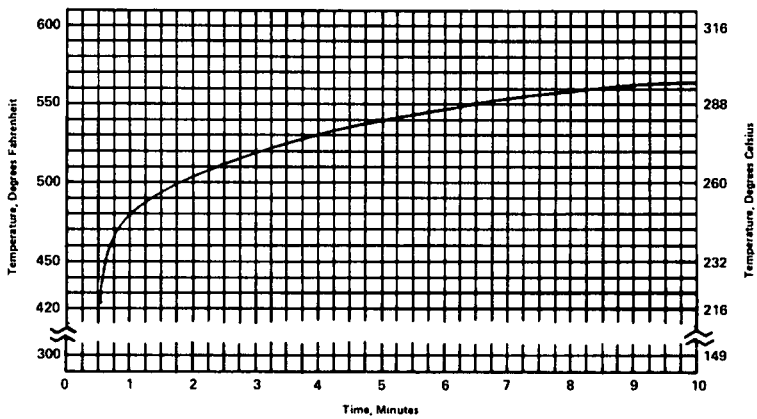

Figure 3 Time-Temperature Chart for Preheat Temperature.

2-3.9 With the test equipment adjusted and conditioned as described in 2-3.2 through 2-3.8, make a test or series of tests, using nominal $^{23}/_{32}$-in. (18.3-mm) select grade red oak flooring as a sample, conditioned to 6 to 8 percent moisture content as determined by the 221°F (105°C) oven dry method described in ASTM D2016. Make observations at distance intervals not in excess of 2 ft (0.6 m) and time intervals not in excess of 30 sec and record the time when the flame reaches the end of the specimen, that is 19½ ft (5.94 m) from the end of the ignition fire. The end of the ignition fire shall be considered as being 4½ ft (1.37 m) from the burners. The flame shall reach the end point in 5½ min ± 15 sec. Automatically record the temperatures measured by the thermocouple near the vent end at least every 15 sec. Automatically record the photoelectric cell output immediately prior to the test and at least every 15 sec during the test.

NOTE: The flame may be judged to have reached the end point when the vent end thermocouple registers a temperature of 980°F (527°C).

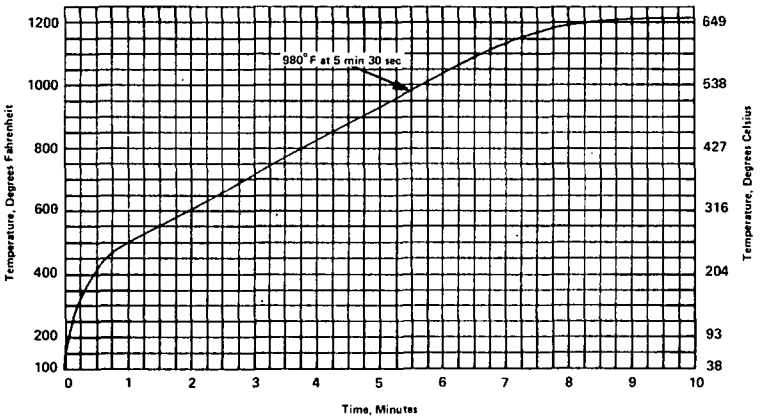

Figure 4 Time-Temperature Chart for Red Oak.

2-3.10 Plot the flame spread distance, temperature, and change in photoelectric cell readings separately on suitable coordinate paper. Figures 5 and 7 are representative curves for red oak smoke density and flame spread distance time temperature development respectively. Flame spread shall be determined as the observed distance minus 4½ ft (1.37 m).

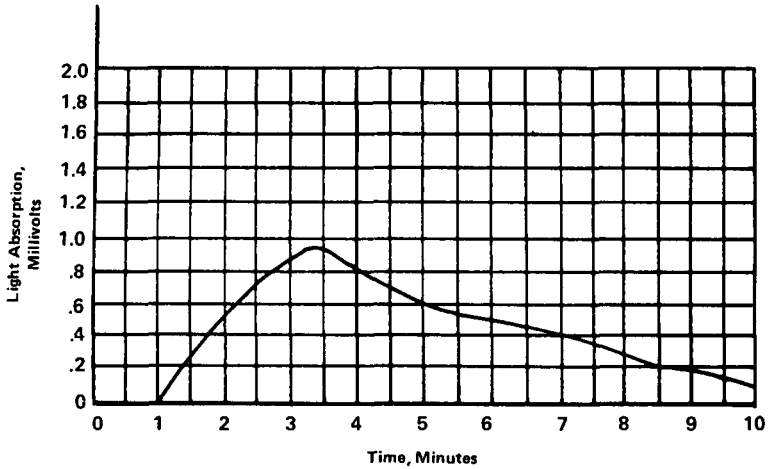

Figure 5 Time-Absorption Curve for Smoke Density of Red Oak.

2-3.11 Following the calibration tests for red oak, conduct a similar test or tests on samples of ¼-in. (6.3-mm) asbestos cement board. The results shall be considered as representing a classification of

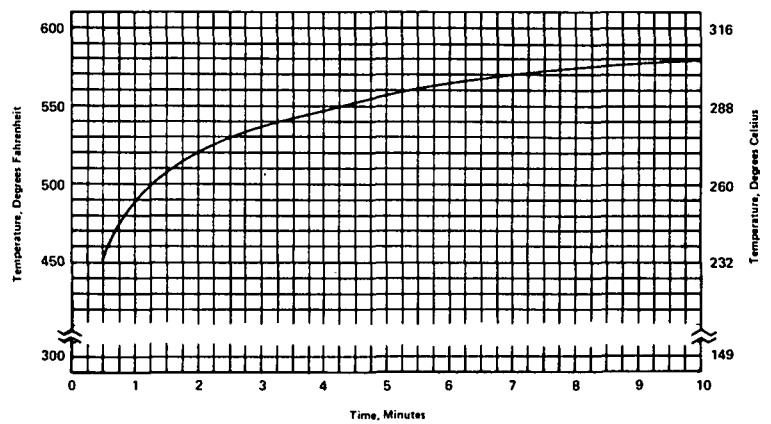

Figure 6 Time-Temperature Chart for Asbestos Cement Board.

zero. The temperature readings shall be plotted separately on suitable coordinate paper. Figure 6 is a representative curve for time temperature development for asbestos cement board.

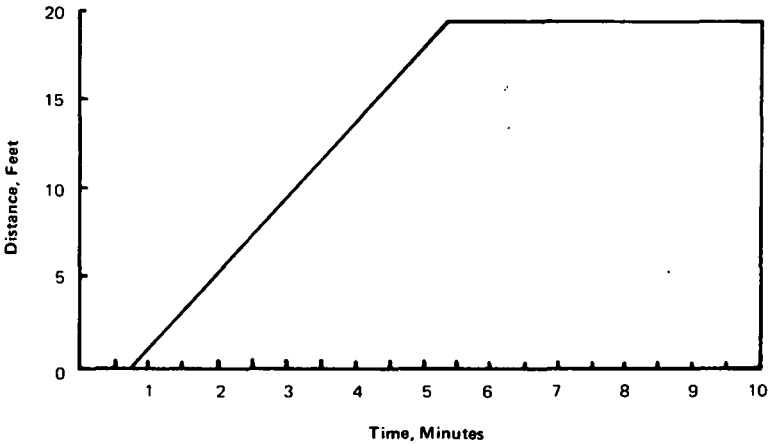

Figure 7 Time-Distance Curve for Flame Spread of Red Oak.

Chapter 3 Conduct of Tests

3-1 Test Procedure.

3-1.1 With the furnace draft operating, place the test specimen on the test chamber ledges which have been completely covered with nominal ⅛-in. (3.2-mm) thick by 1½-in. (38-mm) wide woven asbestos tape. Place the specimen as quickly as is practical. Place the removable lid in position over the specimen.

3-1.2 The completely mounted specimen shall remain in position in the chamber with the furnace draft operating for 120 ± 15 sec prior to the application of the test flame.

3-1.3 Ignite the burner gas. Observe and record the distance and time of maximum flame front travel with the room darkened. Continue the test for a 10 min period. The test may be terminated prior to 10 min if the specimen is completely consumed in the fire area and no further progressive burning is evident and the photoelectric cell reading has returned to the baseline.

3.1.4 Record the photoelectric cell output immediately prior to the test and at least every 15 sec during the test.

3-1.5 Record the gas pressure, the pressure differential across the orifice plate, and the volume of gas used for each test.

3-1.6 When the test is ended, shut off the gas supply, observe smoldering and other conditions within the test duct, and remove the specimen for further examination.

3-1.7 Plot the flame spread distance, temperature, and change in photoelectric cell readings separately on the same type of coordinate paper as used in 2-3.10 for use in determining the flame spread and smoke developed classifications as outlined in Section 3-3. The flame spread observations must be recorded at distance intervals not in excess of 2 ft (0.6 m) or time intervals not in excess of 30 sec. In addition, the peak must be noted with the time of occurrence. Flame spread distance shall be determined as the observed distance minus 4½ ft (1.37 m).

3-2 Analysis of Products of Combustion. Although not required as a part of this method, products of combustion may be drawn from the test duct during the progress of the test for chemical analysis.

3-3 Classification. The flame spread classification (FSC) shall be determined as follows:

3-3.1 The total area (A_T) under the flame spread time distance curve shall be determined by ignoring any flame front recession. For example, in Figure 8, the flame spread is 10 ft (3.05 m) in 2½ min and then receded. The area is calculated as if the flame had spread to 10 ft (3.05 m) in 2½ min and then remained at 10 ft (3.05 m) for the remainder of the test or until the flame front again passed 10 ft (3.05 m). This is shown by the dashed line in Figure 8. The area (A_T) used for calculating the flame spread classification is the sum of areas A_1 and A_2 in Figure 8.

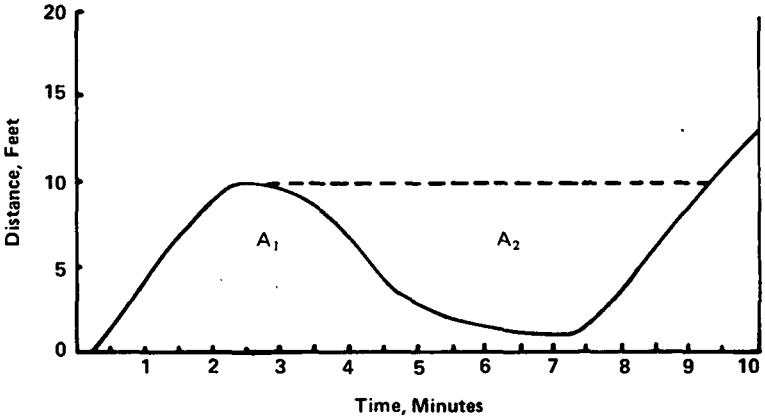

Figure 8 Example of Time-Distance Curve with Flame Front Recession.

3-3.2 If this total area (A_T) is less than or equal to 97.5 min-ft (29.7 min-m), the flame spread classification shall be 0.564 times the total area (FSC = 0.564 A_T).

3-3.3 If the total area (A_T) is greater than 97.5 min-ft (29.7 min-m), the flame spread classification shall be 5363, divided by the difference of 195 minus the total area (A_T) [FSC = 5363/(195-A_T)].

3-3.4 The test results for smoke shall be plotted, using the same coordinates as in 2-3.9. The area under the curve shall be divided by the area under the curve for red oak, and multiplied by 100, to establish a numerical classification by which the performance of the material may be compared with that of asbestos cement board and select grade red oak flooring, which have been arbitrarily established as 0 and 100, respectively.

NOTE: Allowance should be made for accumulation of soot and dust on the photoelectric cell during the test, by establishing a revised base line. The revised base line shall be a straight line drawn from the zero point (point on base line where incipient light attenuation occurs) to the point established after the sample has been removed.

3-4 Report. The report shall include the following:

(a) Description of the material being tested,

(b) Test results as calculated in Section 3-3,

(c) Details of the method used in placing the specimen in the test chamber, and

(d) Observations of the burning characteristics of the specimen during test exposure, such as delamination, sagging, shrinkage, fall-out, etc.

Appendix A Guide to Mounting Methods

This Appendix is not part of this NFPA Standard . . . but is included for information purposes only.

A-1 Introduction.

A-1.1 This guide has been compiled as an aid in selecting a method for mounting various building materials in the fire test chamber. These mountings are suggested for test method uniformity and convenience; they are not meant to imply restriction in the specific details of field installation.

A-1.2 For some building materials none of the methods described may be applicable. In such cases, other means of support may have to be devised.

A-1.3 These suggested mounting methods are grouped according to building materials to be tested which are broadly described either by usage or by form of the material.

A-1.4 Whenever asbestos cement board is specified as a backing in subsequent paragraphs, the material should be nominal ¼ in. (6.3 mm) thick, high density [110 ± 5 lb/ft^3 (1762 ± 80 kg/m^3)] and uncoated. When metal rods are specified as supports, ¼-in. (6.3-mm) metal rods spanning the width of the tunnel should be used. Rods should be placed approximately 2 in. (50.8 mm) from each end of each panel and additional rods placed approximately at 2-ft (0.6-m) intervals starting with the first rod at the fire end of each panel.

A-2 Acoustical and Other Similar Panel Products less than 20 in. (508 mm).

A-2.1 For acoustical materials and other similar panel products whose maximum dimension is less than 20 in. (508 mm), metal splines or wood furring strips and metal fasteners should be used.

A-2.2 Steel tee splines for mounting kerfed-acoustical tile should be nominal ½-in. (13-mm) web by ¾-in. (19-mm) flange, formed No. 24 MS gage sheet metal.

A-2.3 Wood furring frames for mounting acoustical materials and other similar panel products less than 20 in. (508 mm) should be nominal 1- by 2-in. (20- by 41-mm) wood furring joined with corrugated metal fasteners. Use two frames as shown in Figure A-2.3.

A-3 **Adhesives.** To determine the surface burning characteristics of adhesives, they must be mixed as specified in the manufacturer's instructions and applied to asbestos cement board in the thickness or

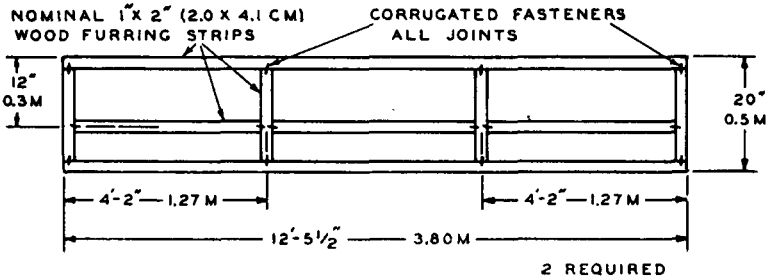

Figure A-2.3 Wood Frame for Acoustical Materials and Other Similar Panel Products less than 20 in. (508 mm).

at the coverage rate recommended by the manufacturer. The adhesive application shall be cured prior to testing.

A-4 Batt or Blanket-type Insulating Materials. Batt or blanket materials which do not have sufficient rigidity or strength to support themselves shall be supported by metal rods inserted through the material and positioned such that the bottom of the rod is approximately ¼ in. (6.3 mm) from the surface to be exposed to the flame. It is recommended that batt or blanket materials less than 1 in. (25.4 mm) thick not be mounted for testing in this manner.

A-5 Coating Materials, Cementitious Mixtures, and Sprayed Fibers.

A-5.1 Coating materials, cementitious mixtures, and sprayed fibers must be mixed and applied to the substrate as specified in the manufacturer's instructions at the thickness, coverage rate, or density recommended by the manufacturer.

A-5.2 Materials intended for application to wood surfaces should be applied to a substrate made of 1 by 4 in. (20 by 92 mm) nominal "C" and better VG Douglas fir flooring (FSC 70 to 90) or to other species for which the surface burning characteristic is to be measured. Paragraph 104-C of Issue 16 of *Standard Grading Rules for West Coast Lumber,* published by the West Coast Inspection Bureau, should apply in identifying the Douglas fir flooring. The pieces are placed side by side and secured with 4 nailing strips spaced approximately 3½ ft (1.07 m) apart holding the pieces together (*see Figure A-5.2*). Two decks placed end to end are to be used.

A-5.3 Materials intended for application to particular combustible surfaces, but not wood, are applied to the specific surfaces for which they are intended.

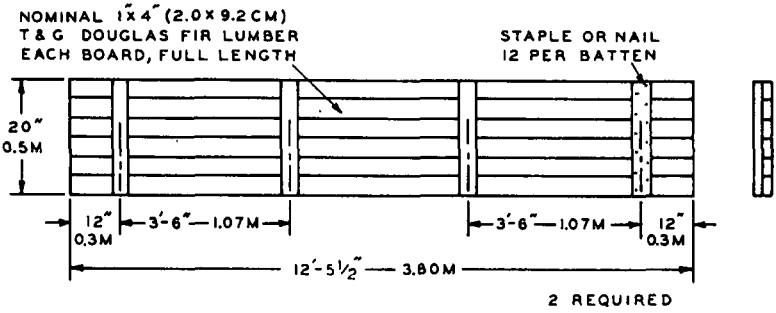

Figure A-5.2 Wood Deck for Coating Material.

A-5.4 Materials intended for only field application to noncombustible surfaces are to be applied to ¼-in. (6.3-mm) asbestos cement board.

A-6 **Loose Fill Insulation.** Loose fill insulation is placed on galvanized steel screening with approximate $\frac{3}{64}$-in. (1.2-mm) openings supported on a test frame 20 in. (508 mm) wide by 2 in. (51 mm) deep, made from 2- by 3- by $\frac{3}{16}$-in. (51- by 76- by 5-mm) steel angles. Three frames are required *(see Figure A-6)*. The insulation is packed to the density specified by the manufacturer.

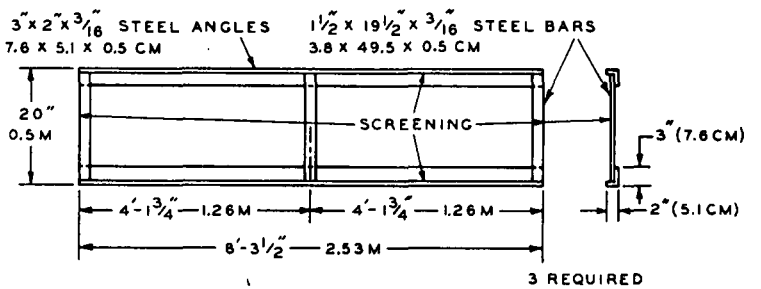

Figure A-6 Steel Frame for Loose Fill Materials.

A-7 Plastics.

A-7.1 The term plastics includes foams, reinforced panels, laminates, grids, and transparent or translucent sheets.

A-7.2 When any plastic will remain in position in the tunnel during a fire test, no additional support will be required. Thermoplastic materials and other plastics which will not remain in place are to be supported by ¼-in. (6.3-mm) round metal rods, or 3/16- by 2-in. (5- by 51-mm) wide steel bars or 2-in. (50.8-mm) galvanized hexagonal wire mesh supported with metal bars or rods spanning the width of the tunnel.

A-8 Thin Membranes. Single layer membranes of thin laminates consisting of a limited number of similar or dissimilar layers may be supported on poultry netting placed on metal rods as provided in Section A-4. Netting should be 20 gage (51-mm) hexagonal galvanized steel poultry netting conforming to specification A390. The specimen should be additionally tested, bonded to a substrate representative of a field installation.

A-9 Wall Coverings. Wall coverings of various types are to be mounted to ¼-in. (6.3-mm) asbestos cement board with the adhesive specified by the manufacturer in a manner consistent with field practice.

Appendix B Derivation of Flame Spread Area Formulas Appearing in Section 3-3

This Appendix is not part of this NFPA Standard . . . but is included for information purposes only.

B-1 Introduction.

B-1.1 This Appendix contains an abbreviated discussion of the derivations of the flame spread area formulas used to calculate the flame spread value in this test method. This Appendix will show not only the derivations of the formulas, but will illustrate the relationship between this method of flame spread calculation and a previous method.

B-1.2 In these calculations, it is assumed that the flame front never recedes. Hence, in Figure B-1 there is an imaginary line bounding the upper edge of area A_2.

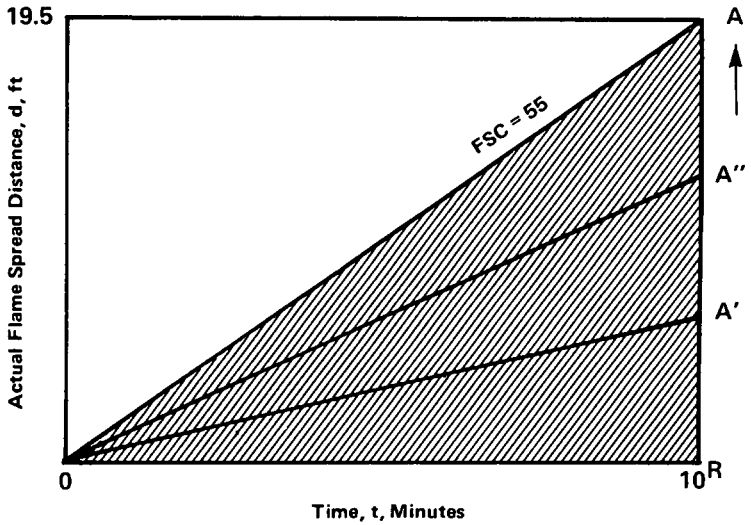

Figure B-1 Idealized Straight-Line Flame Spread Distance-Time Curve for Total Areas Less than or Equal to 97.5 min-ft.