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NFPA 262 Test for Fire and Smoke Characteristics of Wires and Cables 1990 Edition

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There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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NFPA 262

Standard Method of Test for

Fire and Smoke Characteristics of Wires and Cables

1990 Edition

This edition of NFPA 262, *Standard Method of Test for Fire and Smoke Characteristics of Wires and Cables*, was prepared by the Technical Committee on Fire Tests and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 21-24, 1990 in San Antonio, TX. It was issued by the Standards Council on July 20, 1990, with an effective date of August 17, 1990, and supersedes all previous editions.

The 1990 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 262

The test procedure covered by this standard was originally developed by Underwriters Laboratories Inc. and published as UL 910. It is an adaptation of the Steiner tunnel test (NFPA 255/ASTM E84/UL 723) designed to provide information for evaluating the potential for fire spread along cables and wires housed in a plenum or other environmental space. The original 1985 edition was reconfirmed in 1990.

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Contents

NFPA 262

Standard Method of Test for

Fire and Smoke Characteristics of Wires and Cables

1990 Edition

Information on referenced publications can be found in Chapter 7 and Appendix A.

Chapter 1 General

1-1 Scope. This test method is for determining values of flame spread distance and smoke density for insulated and/or jacketed electrical wires and cables and optical fiber cables that are to be installed in plenums and other spaces used for environmental air without the wires and cables being enclosed in raceways, in accordance with the applicable provisions of Sections 725-2, 760-4, 770-7, 800-3, and 820-15 of NFPA 70, *National Electrical Code.*®

1-2 Significance. This test is designed to provide information for evaluating the possibility of fire spreading in a plenum or other environmental space along optical fiber cables or electrical wires or cables; or the possibility of high smoke levels being developed in the space when wiring is subject to fire exposure. The test method has been related to the results of tests on wiring exposed to fires in simulated plenums.

1-3 Purpose.

1-3.1 The purpose of the test is to measure and record the fire and smoke characteristics of wiring or cable by measuring the flame spread distance along the test specimens and the light transmittance of the smoke developed, when exposed to the test fire.

1-3.2 Smoke density as well as flame spread are recorded in this test. However, there is not necessarily a relationship between these measurements.

1-3.3 It is the intent of this method of test to register performance during the period of fire exposure and not to determine the suitability of the electrical wiring or cable for use after the test exposure.

1-4 Summary of Test Method. This test method uses an apparatus similar to that used in NFPA 255, *Method of Test of Surface Burning Characteristics of Building Materials.* A special specimen holder is used to expose the test specimens; the holder, 11¼ in. (286 mm)[1] wide and approximately 4¼ in. (108 mm) down from the ceiling of the test chamber, is filled with one layer of test specimens. The specimens are exposed to a 300,000 Btu/hr (87.9 kW) fire, 4½ ft (1.37 m) long, for a period of 20 minutes, with an initial draft of 240 ft/min (73 m/min) through the chamber. The travel distance of the flame along the specimen and the light transmittance at the end of the chamber are reported. The light transmittance is converted to a peak and average optical density.

NOTE: For procedures for determining the fire-resistive performance of building construction assemblies incorporating electrical wiring and cables, reference should be made to NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials.*

Chapter 2 Test Equipment

2-1 Fire-Test Chamber.

2-1.1 The fire-test chamber consists of a horizontal duct having the shape and size shown in Figures 2-1.1(a), (b), and (c). The sides and base of the duct are lined with insulating masonry as illustrated in Figure 2-1.1(b) faced with a row of refractory fire brick.[2] One side is provided with a row of double-pane [inside pane[3] mounted flush with inner wall —see Figure 2-1.1(b)] pressure-tight observation windows (as described in Sections 4-2 and 4-3) located so that the entire length of the specimen being tested can be observed from outside the fire-test chamber.

2-1.2 The ledges are to be fabricated of structural metal.[4]

2-1.3 To provide air turbulence for combustion, turbulence-inducing baffling is provided by positioning six refractory fire bricks[2] [long dimension vertical and 4.5 inch (110 mm) dimension parallel to the wall] along the side walls of the chamber at distances of 7.0, 12.0, and 20.0 ft, ± 0.5 ft (2.1, 3.6, and 6.1 m, ± 0.2 m) on the window side and 4.5, 9.5, and 16.0 ft, ± 0.5 ft (1.4, 2.9, and 4.9 m, ± 0.2 m) on the opposite side.

2-1.4 The top consists of a removable metal-and-mineral insulation composite unit with insulation consisting of nominal 2.0-in. (50-mm) thick mineral-composition material. The top unit, shown in Figure 2-1.1(b), shall completely cover the fire-test chamber. The mineral-composition material shall have physical characteristics comparable to the following:

Maximum effective use temperature of at least	1200°F (650°C)
Bulk density	21 lb/ft^3 (336 kg/m^3)
Thermal conductivity at 300 to 700°F (149 to 371°C)	0.50-0.71 Btu • in/h • ft^2 • °F (0.072-0.102 W/m^2•K)
KpC product*	1 to 4 Btu^2 • in/ft^5 • h • °F^2 (1×10^4 to 4×10^4 W^2 • s/m^4 • K)

*KpC is equal to the thermal conductivity times the density times the specific heat.

[1] The values stated in U.S. customary units are to be regarded as the standard.

[2] The operation and calibration of this equipment is based on the use of A.P. Green G-26 refractories.

[3] A glass acceptable for this purpose is Vycor 100-percent silica glass nominally 0.25 in. thick (6 mm), or its equivalent.

[4] Water-cooled structural-steel tubing is acceptable for this purpose.

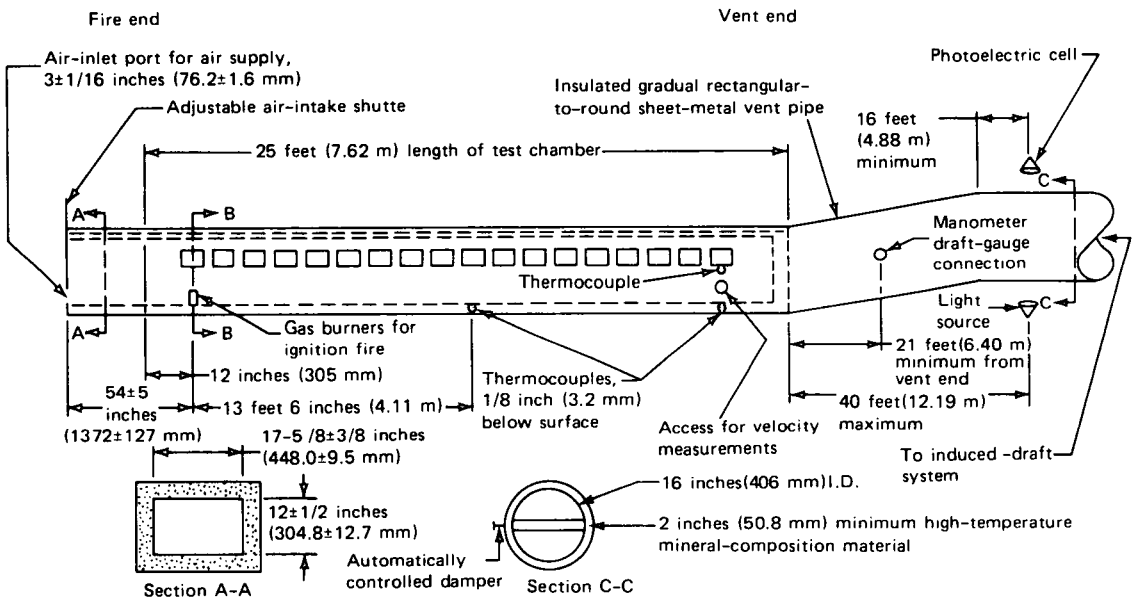

Figure 2-1.1(a) Details of fire-test chamber.

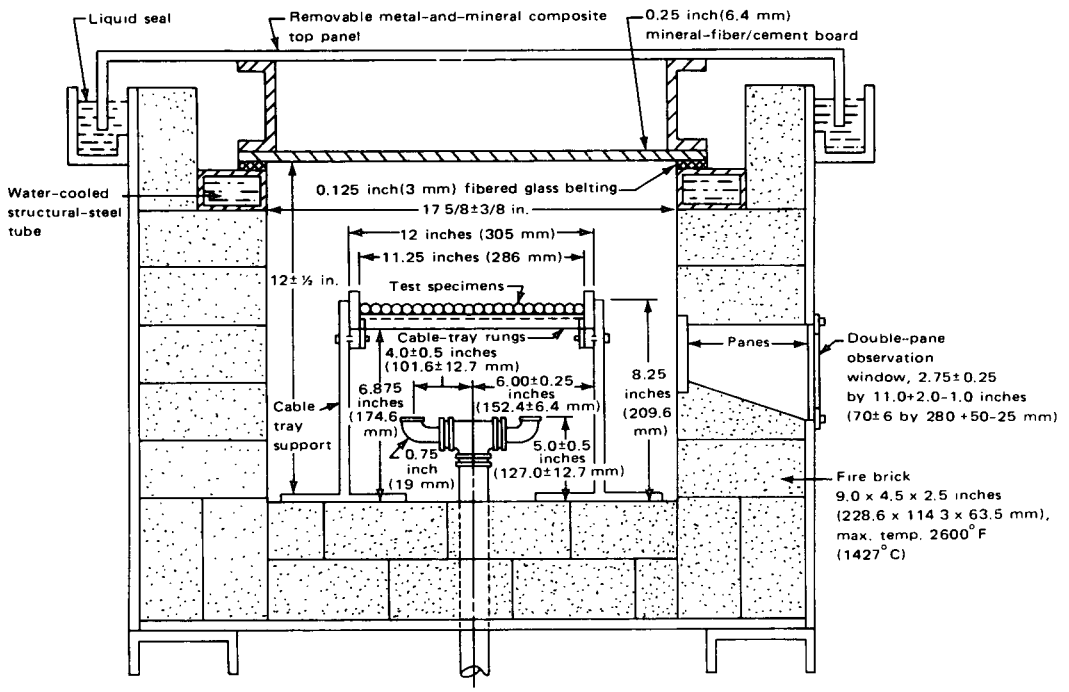

Figure 2-1.1(b) Section B-B.

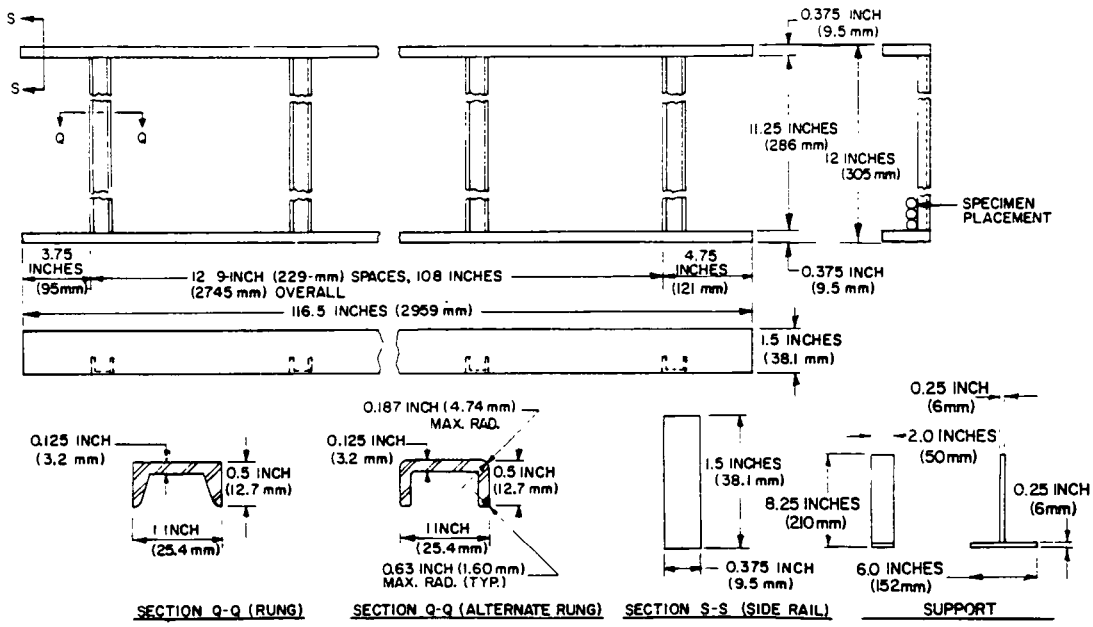

Figure 2-1.1(c) Details of steel cable tray and supports.

The entire top-panel unit is to be protected with flat sections of high-density (nominally 110 lb/ft^3 or 1760 kg/m^3) 0.25-in. (6-mm) mineral-fiber/cement board maintained in an unwarped and uncracked condition through continued replacement. While in place, the top panel is to be completely sealed against the leakage of air into the fire-test chamber during the test.

2-1.5 The ladder-type cable tray used to support the test specimens is shown in Figures 2-1.1(b) and (c). The tray is fabricated from cold-rolled steel, 50,000 psi minimum (350 MPa) tensile strength. The solid-bar-stock siderails are as shown in Section S-S in Figure 2-1.1(c). The C-shaped channel rungs are as shown in Section Q-Q in Figure 2-1.1(c). Each rung is 11.25 in. (286 mm) long. The rungs are welded to the side rails 9.0 in. (229 mm) on centers along the tray length. The tray, which may consist of several sections, shall have a total assembled length of 23.9 ft (7.29 m) and be supported with 16 supports equally spaced along the length of the tray. The supports [*see Figure 2-1.1(c)*] are fabricated from bar steel.

2-1.6 One end of the test chamber, designated as the fire end in Figure 2-1.1(a), is provided with two gas burners delivering flames upward that engulf the cross section of the test specimens midway between two rungs of the cable tray. As shown in Figure 2-1.1(b), the burners are positioned transversely to each side of the center line of the furnace so that the flame is evenly distributed over the width of the specimens.

2-1.7 The controls used to maintain a constant flow of gas to the burners are to consist of a pressure regulator, a gas meter calibrated to read in increments of not more than 0.1 ft^3 (2.8 dm^3), a gage to indicate gas pressure in inches of water (Pa), a quick-acting gas shutoff valve, a gas-metering valve, and an orifice plate in combination with a 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 is to be provided at the fire end. The shutter is to be positioned to provide an air-inlet port as shown in Figure 2-1.1(a). A draft gage manometer to indicate static pressure is to be connected approximately midway in the section between the air intake and the burners, as shown in Figure 2-1.1(a).

2-1.8 The other end of the test chamber, designated as the vent end in Figure 2-1.1(a), is to be fitted with a rectangular-to-round transition piece, which is in turn to be fitted to a round flue pipe. The movement of air is to be by induced draft. The draft-inducing system is to have a total draft capacity of at least 0.15 in. of water (37 Pa) with the specimens in place, with the shutter at the fire end open to its normal position, and with the damper [*see Section C-C in Figure 2-1.1(a)*] in the wide open position.

2-1.9 The damper is to be installed in the vent pipe downstream of the smoke-indicating attachment described in 2-2.1.

2-1.10 An automatic draft-regulator controller may be mounted in the vent pipe downstream of the manual damper. Other manual, automatic, or special draft-regulation devices may be incorporated to maintain airflow control throughout each test run.

2-1.11 The room in which the test chamber is located is to have provision for a free inflow of air to maintain the room at atmospheric pressure throughout each test run.

2-2 Smoke Measurement.

2-2.1 A light source[5] is to be mounted on a horizontal section of the vent pipe (*see Figure 2-2.1*) at a point at which (1) it is preceded by a straight run of round pipe at least 12 diameters or 16 ft (4.88 m) from the vent end of the rectangular-to-round transition section, and (2) it is not affected by flame from the test chamber. The light beam is to be directed upward along the vertical axis of the vent pipe. The vent pipe is to be insulated with high-temperature mineral-composition material from the vent end of the chamber to the photometer location. A photoelectric cell[6] having an output directly proportional to the amount of light received is to be mounted over the light source with an overall light-to-cell path length of 36.0 ± 2.0 in. (914 ± 51 mm). The light source and photocell are to be located such that they are open to the environment of the test room. 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 duct, with the resultant light beam centered on the photocell. The cell is to be connected to recording devices for indicating changes in the attenuation of incident light by passing smoke, by particulate matter, and by other effluents.

2-2.2 The output of the photoelectric cell is to be connected to a recording device having an accuracy within ± 1 percent full scale, to process the signal into a continuous record of smoke obscuration.

2-2.3 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 ± 3 percent of the calibrated value for each filter.

2-3 Temperature Measurement.

2-3.1 A No. 18 AWG thermocouple (nominal wire cross section of 1620 CM or 0.823 mm^2) with 0.375 ± 0.125 in. (10 ± 3 mm) of the junction exposed in the fire-chamber air is to be inserted through the floor of the test chamber so that the tip is 1.000 ± 0.031 in. (25 ± 1 mm) below the top surface of the gasketing tape and within 1.0 ft (300 mm) of the vent end of the test chamber at the center of the width of the chamber.

2-3.2 A No. 18 AWG thermocouple (nominal wire cross section of 1620 CM or 0.823 mm^2) embedded 0.125 in. (3mm) below the floor surface of the test chamber is to be mounted in refractory or portland cement (carefully dried to keep it from cracking) at distances of 13.5 and 24.0 ft (4.11 and 7.32 m) from the fire end of the test chamber.

[5] A General Electric Model 4405 12-V sealed-beam clear auto spot lamp is acceptable for this purpose.

[6] A meter acceptable for this purpose is a Weston Instruments No. 856BB photronic cell with an overall light-to-cell path length of 36.0 ± 2.0 in. (914 ± 51 mm).

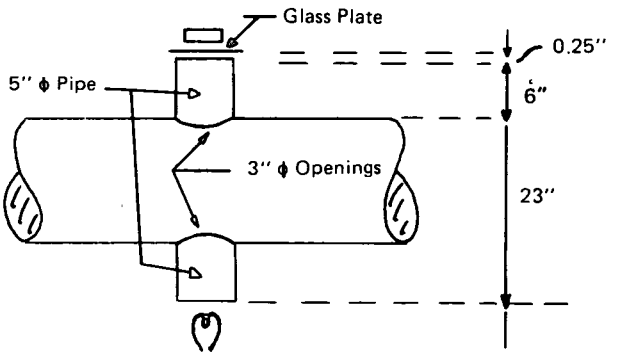

Figure 2-2.1.

Chapter 3 Test Specimens

3-1 Cable specimens in 24.0-ft (7.32-m) lengths are to be installed in a single layer across the bottom of the cable tray as shown in Figure 2-1.1(b). The specimens are laid in the tray in parallel straight rows without any space between adjacent specimens other than that needed for the cable fasteners described in Section 3-2. The number of cable specimens is to equal the measured inside width of the rack divided by the cable diameter with the result of the division rounded off to the nearest lower whole number of specimens that fit considering the presence of cable fasteners.

3-2 Bare copper or soft steel tie wires not larger than No. 18 AWG (nominal wire cross section of 1620 CM or 0.823 mm^2) may be used to fasten the cable specimens to the rungs of the cable tray wherever a tie is necessary to keep the cable in contact with the rung straight and parallel with all of the other cable specimens and to minimize movement during the test. A tie is not to be used in any manner that alters the ability of the cable to transmit gases and/or vapors longitudinally through the core of the cable.

3-3 Properties applicable to identification of the cable specimens are to be determined and recorded.

Chapter 4 Calibration of Test Equipment

4-1 One 0.25-in. (6-mm) mineral-fiber/cement board is to be placed on the ledge of the furnace chamber as shown in Figure 2-1.1(b). The removable top of the test chamber is to be placed in position.

4-2 With the board in position and with the removable top in place, the draft is to be established to produce a 0.15-inch water column reading (37 Pa) on the draft manometer with the fire-end shutter open 3 ± 1/16 in. (76 ± 2 mm) and with the manual damper in the wide open position. Then, the fire-end shutter is to be closed and sealed. The manometer reading is to increase to at least a 0.375-in. water column (93 Pa), indicating that no excessive air leakage exists.

4-3 In addition, a supplemental leakage test is to be conducted periodically by activating a smoke bomb in the fire chamber while the fire shutter and exhaust duct beyond the differential manometer tube are sealed. The bomb is to be ignited and the chamber is to be pressurized to a 0.375 ± 0.150-inch water column (93 ± 37 Pa). All points of leakage observed in the form of escaping smoke particles are to be sealed.

4-4 A draft reading is to be established within the range of a 0.055- to 0.085-inch water column (13-21 Pa). The required draft-gage reading is to be maintained by regulating the manual damper. The air velocity at each of seven points, each located 1.0 ft (300 mm) from the vent end, is to be recorded. These points are to be determined by dividing the width of the tunnel into seven equal sections and recording the velocity at the geometric center of each section. The average velocity shall be 240 ± 5 ft per min (73.2 ± 1.5 meters per min).

4-5 The air supply is to be maintained at 70.0 ± 5.0°F (21.0 ± 2.8°C) and the relative humidity is to be kept at 50 ± 5 percent.

4-6 The test fire that produces approximately 300,000 Btu (thermochemical) per hr (87.9 kW) is to be fueled with bottled methane gas of uniform quality and with a heating value of approximately 1000 Btu (thermochemical) per cu ft (37.3 MJ/m^3). The gas supply is to be initially adjusted to approximately 5000 Btu (thermochemical) per min (87.9 kW). The gas pressure, the pressure differential across the orifice plate, and the volume of gas used are to be recorded in each test. A length of coiled copper tubing is to be inserted into the gas line between the supply and the metering connection to compensate for possible errors in the indicated flow because of reductions in the gas temperature associated with the pressure drop and expansion across the regulator. Other applicable means of correction may be used. With the draft and the gas supplies adjusted as indicated in Section 4-4 and in this section, the test flame is to extend downstream to a distance of 4.5 ft (1.4 m) over the specimens, with negligible upstream coverage.

4-7 The test chamber is to be preheated with the mineral fiber/cement board and the removable top in place and with the fuel supply adjusted to the required flow. The preheating is to be continued until the temperature indicated by the floor thermocouple at 24.0 ft (7.32 m) reaches 150 ± 5°F (66 ± 3°C). During the preheat test the temperatures indicated by the thermocouple at the vent end of the test chamber are to be recorded at 15-second intervals and are to be compared to the preheat temperatures taken at the same intervals from the representative curve of temperature as a function of time shown in Figure 4-7. The preheating is for the purpose of establishing the conditions that exist following successive tests and to indicate the control of the heat input into the test chamber. If appreciable variation from the temperatures shown in the representative preheat curve occurs because of variations in the characteristics of the gas used, adjustments in the fuel supply are to be made before proceeding with the red oak calibration tests.

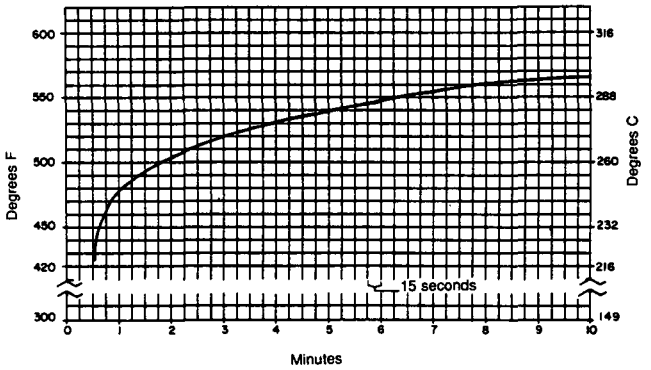

Figure 4-7 Representative preheat curve.

4-8 The furnace is to cool after each test. As soon as the floor thermocouple at 14 ft (4.2 m) shows a temperature of 105 ± 5°F (41 ± 3°C), the next set of specimens is to be placed in position for test.

4-9 With the test equipment adjusted and conditioned as described in Sections 4-2, 4-4, 4-5, and 4-7, a test or series of tests is to be made using nominally $^{25}/_{32}$-inch (18.3-mm) select-grade red oak flooring in place of the mineral-fiber/cement board specified in Section 4-1. Prior to the testing, the wood is to be conditioned to a moisture content of 6-8 percent as determined by the 221°F (105°C) oven method (Method A) described in ASTM D2016. Observations are to be made continually and the time is to be recorded when the flame reaches the end of the specimen — that is, 19.5 ft (5.94 m) from the end of the ignition fire. The end of the ignition fire is to be considered as being 4.5 ft (1.37 m) from the burners. The flame is to reach the end point in 5.5 minutes ± 15 seconds. The flame is to be judged to have reached the end point when the vent end thermocouple registers a temperature of 980°F (527°C). The temperature measured by the thermocouple near the vent end is to be recorded at least every 30 seconds. The photoelectric cell output is to be recorded immediately before the test and at least every 15 seconds during the test.

4-10 Calibration tests shall be conducted for 10 minutes.

4-11 The temperature and changes in photoelectric cell readings are to be recorded electronically or plotted separately on coordinate paper. Figures 4-11(a), (b), and (c) are representative curves for red oak for the flame spread, the thermocouple temperature at the 24-ft (7.3-m) location, and the optical density.

4-12 Following the calibration test(s) for red oak, a similar test or tests are to be conducted on specimens of 0.25-in. (6-mm) mineral-fiber/cement board. The temperature readings are to be plotted separately on coordinate paper. Figure 4-12 is a representative curve for mineral-fiber/cement board for the temperature recorded by the thermocouple at the 24-ft (7.3-m) location.

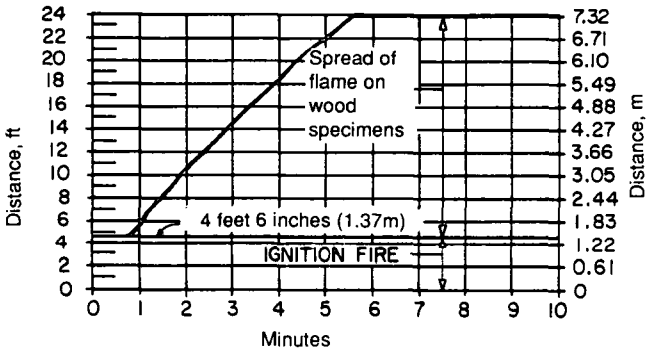

Figure 4-11(a) Representative curve of flame spread on red oak.

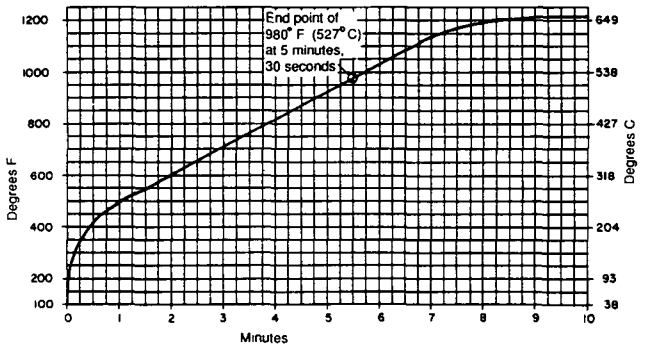

Figure 4-11(b) Representative curve of temperature at 24-ft (7.3-m) location for red oak specimen.

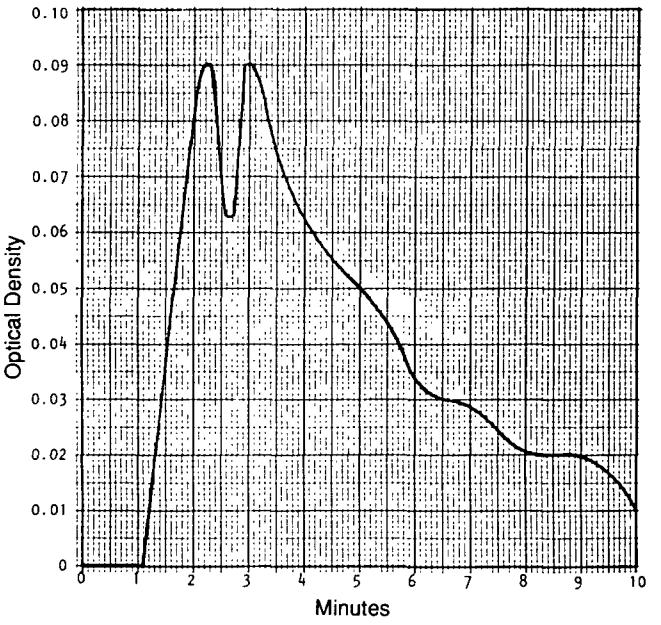

Figure 4-11(c) Representative curve of optical density from red oak.

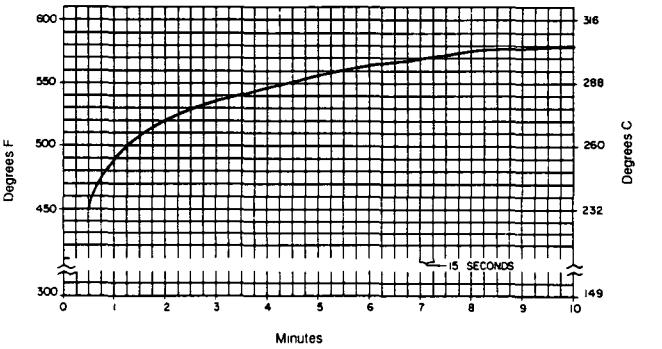

Figure 4-12 Representative curve of temperature at 24-ft (7.3-m) location for mineral-fiber/cement board.

Chapter 5 Test Procedure

5-1 The cable tray and supports are to be placed in the test chamber as shown in Figure 2-1.1(b) and described in 2-1.5 and 2-1.6 with the end 1.0 in. (25 mm) downstream from the center line of the burners.

5-2 The furnace is to be preheated as described in Section 4-7.

5-3 The furnace is to be cooled as described in Section 4-8.

5-4 The specimens are to be installed as described in Section 3-1.

5-5 The removable test chamber top is to be placed in position on top of the furnace side ledge.

5-6 The test equipment is to be adjusted and conditioned as described in Sections 4-2, 4-4, 4-5, and 4-7 (with the open-cable test specimens in place).

5-7 The test gas flame is to be ignited. The distance and time of maximum flame front are to be observed and recorded. The test is to be continued for 20 minute.

5-8 The photoelectric-cell output is to be recorded immediately prior to the test and continuously during the test.

5-9 The gas pressure, the pressure differential across the orifice plate, and the volume of gas used are to be recorded for the duration of the test.

5-10 After the gas supply to the ignition flame is shut off, smoldering and other conditions within the furnace are to be observed and recorded, and the specimens are then to be removed for examination.

Chapter 6 Report

6-1 The report shall include all of the following for each test:

(a) A detailed description of the open-cable specimens tested.

(b) The number of lengths used as specimens for the test.

(c) The graph of flame distance beyond 4½ ft (1.37 m) versus time for the duration of the test. Figure 6-1(a) is a representative flame spread curve. The graph shall also show the representative flame spread curve of red oak [*see Figure 4-11(a)*].

(d) The graph of the optical density of the smoke generated during the test versus time for the duration of the test

$$\text{Optical density} = \log_{10} T_0/T$$

where T_0 is the initial light transmission and T is the light transmission during the test, which varies with the amount of smoke. Figure 6-1(b) is a representative smoke curve. The graph shall also show the representative optical density curve of red oak [*see Figure 4-11(a)*].

(e) The peak and average optical density measured and calculated for the entire test period.

(f) Observations of the condition of the test specimens after completion of the test.

(g) The weight (mass) of nonmetallic components normalized to a figure based on 1000 ft (300 m) of tray length. For example, if the weight (mass) of a 1-ft (0.3-m) length of specimen cable, minus the metallic-component weight, is 0.016 lb (0.0073 kg) and there are 15 cables in the tray, the normalized value is 0.016 × 15 × 1000 = 240 lbs per 1000 ft of tray (32.85 kg per 300 m of tray).

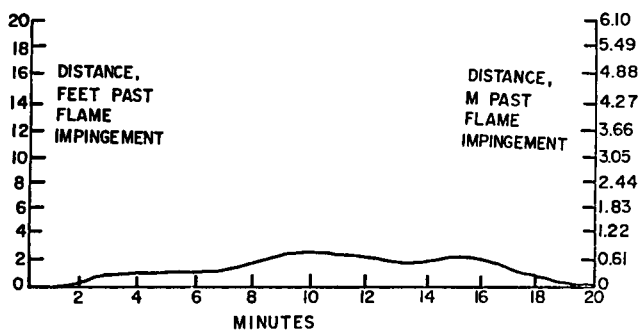

Figure 6-1(a) Representative flame spread curve of test specimen.

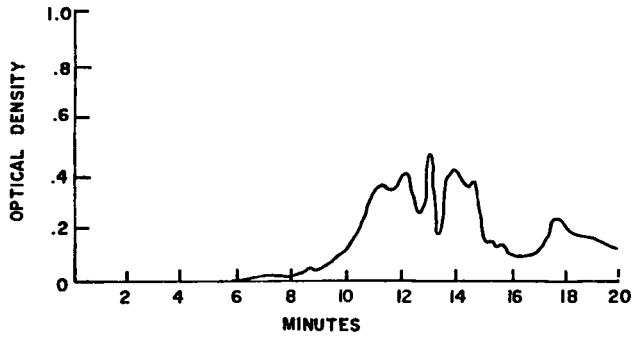

Figure 6-1(b) Representative optical density curve of test specimen.

Chapter 7 Referenced Publications

7-1 The following documents or portions thereof are referenced within this standard and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

7-2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 70-1990, *National Electrical Code*

7-3 ASTM Publication. American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103-1187.

ASTM D2016-1983, *Tests for Moisture Content of Wood*

Appendix A Referenced Publications

A-1 The following documents or portions thereof are referenced within this standard for informational purposes only and thus are not considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

A-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 251-1990, *Standard Methods of Fire Tests of Building Construction and Materials*

NFPA 255-1990, *Method of Test of Surface Burning Characteristics of Building Materials*

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SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Contact NFPA Standards Administration for final date for receipt of proposals on a specific document.

INSTRUCTIONS

Please use the forms which follow for submitting proposed amendments. Use a separate form for each proposal.

1. For each document on which you are proposing amendment indicate:
   (a) The number and title of the document
   (b) The specific section or paragraph.

2. Check the box indicating whether or not this proposal recommends new text, revised text, or to delete text.

3. In the space identified as "Proposal" include the wording you propose as new or revised text, or indicate if you wish to delete text.

4. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If a statement is more than 200 words in length, the technical committee is authorized to abstract it for the Technical Committee Report.

5. Check the box indicating whether or not this proposal is original material, and if it is not, indicate source.

6. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

7. Type or print legibly in black ink.

NOTE: The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include:

(a) identification of the submitter and his affiliation (Committee, organization, company) where appropriate, and

(b) identification of the document, paragraph of the document to which the proposal is directed, and

(c) a statement of the problem and substantiation for the proposal, and

(d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101

Note: All proposals must be received by 5:00 p.m. E.S.T./E.S.D.T. on the published proposal closing date.

Date 5/18/85 Name John B. Smith Tel. No. 617-555-1212

Address 9 Seattle St., Seattle, WA 02255

Representing (Please indicate organization, company or self) Fire Marshals Assn. of North America

1. a) Document Title: Protective Signaling Systems NFPA No. & Year NFPA 72D

   b) Section/Paragraph: 2-7.1 (Exception)

FOR OFFICE USE ONLY
Log #:
Date Rec'd:
Proposal #:

2. Proposal recommends: (Check one)
   - ☐ new text
   - ☐ revised text
   - ☒ deleted text.

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

   Delete exception.

4. Statement of Problem and Substantiation for Proposal:

   A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

5. ☒ This Proposal is original material.
   ☐ This Proposal is not original material; its source (if known) is as follows: _____

(Note. Original material is considered to be the submitter's own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

I agree to give NFPA all and full rights, including rights of copyright, in this Proposal and I understand that I acquire no rights in any publication of NFPA in which this Proposal in this or another similar or analogous form is used.

John B. Smith

Signature

PLEASE USE SEPARATE FORM FOR EACH PROPOSAL