NFPA 252
Standard Methods of Tests of Door Assemblies

1999 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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Fire Tests of Door Assemblies

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This edition of NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, was prepared by the Technical Committee on Fire Tests and acted on by the National Fire Protection Association, Inc., at its May Meeting held May 17–20, 1999, in Baltimore, MD. It was issued by the Standards Council on July 22, 1999, with an effective date of August 13, 1999, and supersedes all previous editions.

This edition of NFPA 252 was approved as an American National Standard on August 13, 1999.

Origin and Development of NFPA 252

Standard Methods of Fire Tests of Door Assemblies was adopted as a tentative standard by the ASTM in 1940 and was formally adopted in 1941. In 1942, this standard was adopted by the NFPA and approved by the American Standards Association. It was reaffirmed by the Committee on Fire Tests of Building Construction and Materials and adopted in 1950. In 1953, a new NFPA Committee on Fire Tests was formed by action of the board of directors, and recommendations for revision of the standard made by that committee were adopted in 1958, 1969, 1972, 1976, 1979, 1984, and 1990.

The basic procedure covered by this standard was developed by Underwriters Laboratories Inc. and has not undergone any significant revisions to the original concept of procedures. The 1995 edition introduced a new provision addressing the neutral plane of the furnace. This provision permits the testing agency to establish the neutral plane of the test furnace to the specification of the particular need, for example, positive pressure at a 40-in. level, top of the opening, or test at atmospheric pressure.

The 1999 edition of NFPA 252 contains further editorial refinements to harmonize the procedures and terminology as found in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials;* NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies;* and NFPA 80, *Standard for Fire Doors and Fire Windows*. This edition also provides greater clarification for the hose stream application and procedure and the application and reporting of positive pressure testing for door assemblies.

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Committee Scope: This Committee shall have primary responsibility for documents on fire testing procedures, for reviewing existing fire test standards and recommending appropriate action to NFPA, for recommending the application of and advising on the interpretation of acceptable test standards for fire problems of concern to NFPA technical committees and members, and for acting in a liaison capacity between NFPA and the committees of other organizations writing fire test standards. This Committee does not cover fire tests that are used to evaluate extinguishing agents, devices, or systems.

Contents

NFPA 252

Standard Methods of

Fire Tests of Door Assemblies

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Chapter 7, Section B-15, and Appendix C.

Chapter 1 General

1-1 Scope. This standard prescribes standardized fire and hose stream test procedures that apply to fire door assemblies intended to be used to retard the spread of fire through door openings in fire-resistive walls.

1-2 Purpose. The purpose of this standard is to prescribe specific fire and hose stream test procedures for fire door assemblies in order to standardize a method for determining the degree of fire protection provided by such assemblies in retarding the spread of fire (flame, heat, and hot gases) through door openings in fire-resistive walls. The degree of fire protection measured in units of time is not an absolute value because all possible actual fire scenarios are not represented by the standard fire exposure described herein. This standard allows different fire door assemblies to be compared with each other in order to evaluate their relative performance as measured against a standard fire exposure.

1-3 Significance.

1-3.1 This standard is intended to evaluate the ability of a door assembly to remain in a wall opening during a prescribed fire test exposure, which is then followed by the application of a prescribed hose stream.

1-3.2 Tests conducted as described in these standard test methods measure the performance of fire door assemblies during the test exposure and develop data that enable regulatory bodies to require fire door assemblies for use in wall openings where fire protection is required.

1-3.3 The tests described in these standard test methods expose a specimen to a standard fire exposure that is controlled to achieve specified temperatures throughout a specified time period, which is then followed by the application of a specified standard hose stream. The fire exposure, however, is not representative of all fire conditions, which vary with changes in the amount, nature, and distribution of fire loading, ventilation, compartment size and configuration, and heat sink characteristics of the compartment. The fire exposure does, however, provide a relative measure of the performance of fire door assemblies under these specified fire exposure conditions. Similarly, the hose stream exposure is not representative of all applications of actual hose streams used by a fire department during fire suppression efforts.

1-3.4 Any variation from, or change to, the construction or conditions of the door assembly as tested can change the performance characteristics of the fire door assembly.

1-3.5 These tests are not to be construed as determining the suitability of fire door assemblies for continued use after exposure to real fires.

1-3.6 This standard does not provide the following:

(1) Full information regarding the performance of specific fire door assemblies where installed in walls constructed of materials other than those tested

(2) Evaluation of the degree by which the fire door assembly contributes to the fire hazard by generation of smoke, toxic gases, or other products of combustion

(3) Measurement that determines a limit on the number and size of vision panels permitted or the number and size of lateral openings permitted between the door and frame

(4) Measurement of the fire door assembly's ability to control or limit the passage of smoke or similar products of combustion through the assembly

(5) Measurement that determines a specific temperature limit on the unexposed surface of the fire door assembly

1-4 Definitions. The following definitions shall apply.

Door Assembly. Any combination of a door, frame, hardware, and other accessories that is placed in an opening in a wall that is intended primarily for access or for human entrance or exit.

Fire Door Assembly. A door assembly for which a fire protection rating is determined and that is intended for installation in door openings in fire-resistive walls.

Opening. A through-hole in the fire door assembly that can be seen from the unexposed side while looking through the plane of the assembly from a perpendicular position.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

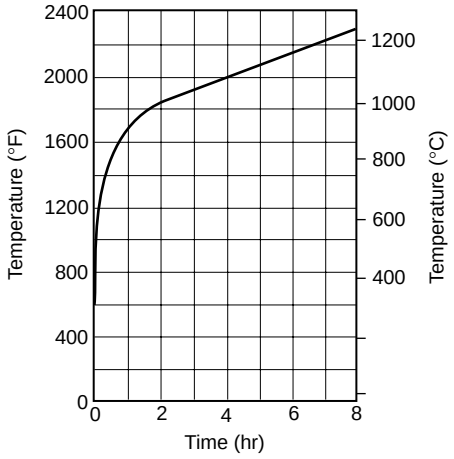
Vision Panel. A glazing material installed in a fire door assembly to allow for viewing through the fire door assembly.

Chapter 2 Control of Fire Test

2-1 Temperature–Time Curve.

2-1.1* The temperature inside the furnace to which the fire door assembly is exposed during the fire test shall be controlled to conform to the standard temperature–time curve shown in Figure 2-1.1 for the duration of the fire test.

Figure 2-1.1 Temperature–time curve.



Note: The following are the points that determine the curve.

1000°F (538°C).....at 5 minutes
1300°F (704°C).....at 10 minutes
1550°F (843°C).....at 30 minutes
1700°F (927°C).....at 1 hour
1850°F (1010°C).....at 2 hours
2000°F (1093°C).....at 4 hours
2300°F (1260°C).....at 8 hours or over

2-1.2 At the start of the fire test, the temperature inside the furnace shall be ambient.

2-2 Furnace Temperatures.

2-2.1 The temperature of the furnace shall be determined by the average temperature obtained from the readings of not less than nine thermocouples symmetrically disposed and distributed within the furnace to measure the temperature near all parts of the fire door assembly.

The thermocouples shall be protected in one of the following ways:

(1) By sealed porcelain tubes having a $^{3}/_{4}$-in. (19-mm) outside diameter and a $^{1}/_{8}$-in. (3-mm) wall thickness
(2) By sealed $^{1}/_{2}$-in. (13-mm) nominal diameter wrought-steel or wrought-iron pipe of standard weight where base-metal thermocouples are used
(3) By enclosure in protective tubes of such materials and dimensions that the time constant of the protected thermocouple assembly lies within a range of 5.0 minutes to 7.2 minutes

The exposed length of the thermocouple protection tube in the furnace chamber shall be not less than 12 in. (304.8 mm). The junction of the thermocouples shall be 6 in. (152 mm) from the exposed face of the fire door assembly, or from the test wall in which the assembly is installed.

2-2.2 The furnace temperature shall be measured and recorded at intervals not exceeding 1 minute during the fire test.

2-2.3 The furnace temperature shall be controlled so that the area under the temperature–time curve, obtained by averaging the results from the furnace temperature readings, is within the following percentages of the corresponding area under the standard temperature–time curve shown in Figure 2-1.1:

(1) 10 percent for fire tests of 1 hour or less
(2) 7.5 percent for fire tests longer than 1 hour and not longer than 2 hours
(3) 5 percent for fire tests longer than 2 hours

2-3 Unexposed Surface Temperatures. Temperatures of the unexposed surface of the fire door shall be recorded during the first 30 minutes of the fire test and shall be determined in accordance with 2-3.1 through 2-3.3.

Exception: Single-layer metal doors shall not be required to comply with Section 2-3.

2-3.1 Unexposed surface temperatures shall be measured at not fewer than three points on the door surface, with at least one thermocouple for each 16 ft^2 (1.5 m^2) of the door. Thermocouples shall not be located over reinforcements extending through the door, over vision panels, or within 12 in. (305 mm) of the edge of the door.

2-3.2* Unexposed surface temperatures shall be measured with thermocouples placed under thermocouple pads that meet the requirements specified in 2-3.4. The pads shall be held against the surface of the door. The thermocouple leads shall be positioned under the pad for a length of not less than $3^{1}/_{2}$ in. (89 mm), with the hot junction under the center of the pad. The thermocouple leads under the pads shall not be heavier than No. 18 AWG (0.82 mm^2) and shall be electrically insulated with heat-resistant and moisture-resistant coatings.

2-3.3 Unexposed surface temperatures shall be measured at intervals not exceeding 1 minute.

2-3.4 Thermocouple pads shall meet the following requirements or otherwise shall be demonstrated to be equivalent by comparative tests in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials:*

(1) Length and width, 6 in. ± $^{1}/_{8}$ in. (152 mm ± 3.2 mm)
(2) Thickness, 0.04 in. ± 0.05 in. (10.2 mm ± 1.3 mm)
(3) Thermal conductivity [at 150°F (65°C)], 0.38 ± 0.027 Btu·in./hr·ft^2·°F (0.55 ± 0.0039 W/m·K)

Chapter 3 Fire Door Assembly

3-1 Construction and Size.

3-1.1 The design, construction, materials, workmanship, hardware, and size of the fire door assembly, which can consist of single doors, doors in pairs, special-purpose doors (e.g., Dutch doors, double-egress doors), or multisection doors, shall represent those for which a fire protection rating is desired. A record of the materials and construction details to be used for the purpose shall be kept.

3-1.2 A floor structure shall be provided as part of the opening in the test wall. The floor structure shall be of noncombustible material and shall project into the furnace for a distance that is not less than twice the thickness of the fire door or to the limit of the frame, whichever is greater.

Exception: A floor structure shall not be required to be part of the opening in the test wall where the floor structure interferes with the operation of the door.

3-2 Mounting.

3-2.1 Swinging doors shall be mounted to swing into the furnace chamber.

3-2.2 Sliding and rolling doors shall be mounted on the exposed side of the opening in the test wall that encloses the furnace chamber.

Exception: Slide-type elevator doors shall be permitted to be mounted on the unexposed side of the opening in the test wall that encloses the furnace chamber.

3-2.3 Access-type door assemblies and chute-type door assemblies shall be mounted with one door arranged to swing into the furnace chamber and another door arranged to swing away from the furnace chamber.

3-2.4 Dumbwaiter doors and service-counter doors shall be mounted on the exposed side of the opening in the test wall that encloses the furnace chamber.

3-2.5 Door frames shall be evaluated when mounted to verify that the doors open either away from or into the furnace chamber, at the discretion of the testing authority, to obtain representative information on the performance of the construction under test.

3-2.6 Surface-mounted hardware (fire-exit devices) for use on fire doors shall be evaluated under conditions where it is installed on one door arranged to swing into the furnace chamber and on another door arranged to swing away from the furnace chamber.

3-2.7 The fire door assembly shall be installed in the test wall opening in the manner in which it is intended to be used. Such mounting shall not prevent unrestricted operation of the fire door. Clearances shall be provided in accordance with Section 3-3.

3-3 Clearances.

3-3.1 Clearances for swinging doors installed in the test wall opening shall be permitted to have a tolerance up to $-1/16$-in. (−1.6-mm) tolerance:

(1) $1/8$ in. (3 mm) along the top

(2) $1/8$ in. (3 mm) along the hinge and latch jambs

(3) $1/8$ in. (3 mm) along the meeting edges of doors in pairs

(4) $3/8$ in. (10 mm) at the bottom edge of a single swinging door

(5) $1/4$ in. (6 mm) at the bottom edge of a pair of doors

3-3.2 Clearances for horizontal sliding doors installed in the test wall opening and not mounted within guides shall be as follows with a $-1/8$-in. (−3-mm) tolerance:

(1) $1/2$ in. (3 mm) between the door and the test wall surfaces

(2) $3/8$ in. (10 mm) between the door and the floor structure

(3) $1/4$ in. (6 mm) between the meeting edges of center-parting doors

A maximum overlap of 4 in. (102 mm) of the door over the test wall opening at the sides and top shall be provided.

3-3.3 Clearances for vertical sliding doors installed in the test wall opening and mounted within guides shall be as follows with a $-1/8$-in. (−3-mm) tolerance:

(1) $1/2$ in. (3 mm) between the door and the test wall surfaces along the top or bottom door edges, or both, with guides mounted directly to the wall surface

(2) $3/16$ in. (5 mm) between the meeting edges of bi-parting doors

(3) $3/16$ in. (5 mm) between the door and the floor structure

3-3.4 Clearances for horizontal slide-type elevator doors installed in the test wall opening shall be as follows with a $-1/8$-in. (−3-mm) tolerance:

(1) $3/8$ in. (10 mm) between the door and the test wall surfaces

(2) $3/8$ in. (10 mm) between multisection door panels

(3) $3/8$ in. (10 mm) at the bottom edge of a panel

Multisection door panels shall overlap $3/4$ in. (19 mm). Door panels shall overlap the test wall opening $3/4$ in. (19 mm) at sides and top.

3-4 Test Wall. The test wall in which the fire door assembly is mounted and tested shall have the strength and fire resistance to retain the assembly throughout the fire and hose stream tests. The test wall shall be constructed of materials representative of the wall construction in which the fire door assembly is intended to be installed. When used, wall anchors shall be compatible with the test wall in which the fire door assembly is installed.

Chapter 4 Conduct of Tests

4-1 Fire Test.

4-1.1 Duration. The fire test shall be conducted until the desired fire protection rating period is reached or until failure to meet any of the performance criteria specified in Chapter 5 occur.

4-1.2 Furnace Pressure. The vertical pressure distribution within the furnace shall be measured and controlled in accordance with 4-1.2.1 through 4-1.2.6.

4-1.2.1 The vertical pressure distribution within the furnace shall be measured by at least two pressure-sensing probes separated by a minimum vertical distance of 6 ft (1.8 m) inside the furnace. A calculation of the neutral pressure plane (zero differential pressure) location shall be made, based on the vertical separation and pressure differences between the pressure-sensing probes.

4-1.2.2 The pressure-sensing probes shall be as shown in either Figure 4-1.2.2(a) or Figure 4-1.2.2(b).

Figure 4-1.2.2(a) Static pressure-sensing probe dimensions.

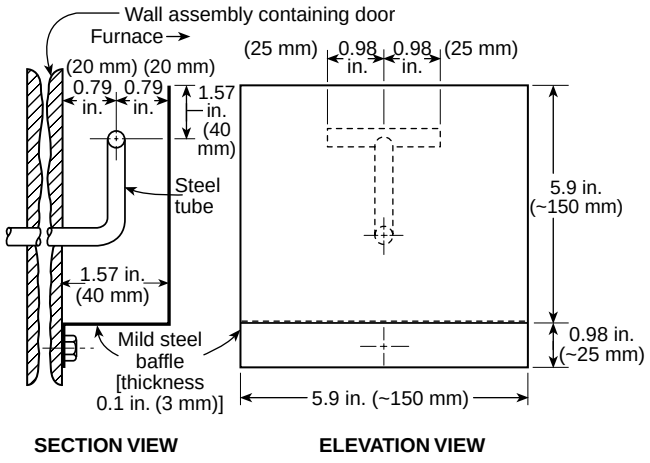
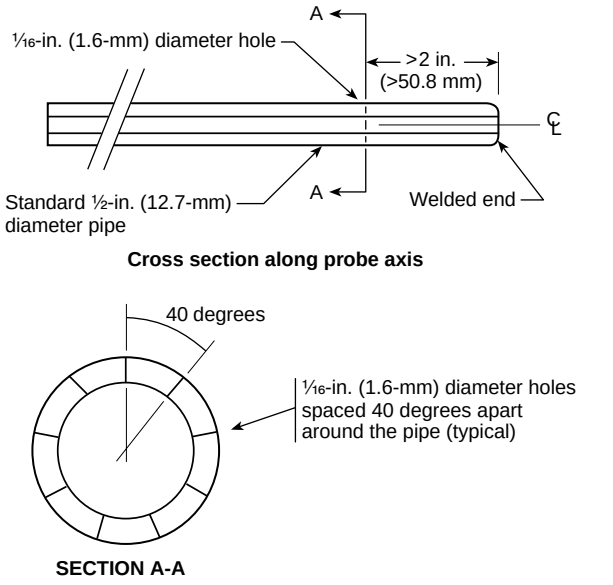


Figure 4-1.2.2(b) Pressure-sensing probe.



4-1.2.3 The pressure-sensing probes shall be located within 6 in. (152 mm) of the vertical centerline of the furnace opening.

4-1.2.4 The pressure at each location shall be measured using a differential pressure instrument capable of reading in graduated increments no larger than 0.01 in. wg (2.5 Pa) with a precision of not more than +0.005 in. wg (+1.25 Pa). The differential pressure measurement instrument shall be located to minimize stack effects caused by vertical runs of pressure tubing between the pressure-sensing probes and the differential pressure measurement instrument locations.

4-1.2.5 Control of the furnace pressure shall be established beginning no later than 5 minutes after the start of the test and shall be maintained throughout the remainder of the fire test period.

4-1.2.5.1 When the fire test is to be conducted under positive pressure, the neutral pressure plane in the furnace shall be established at 40 in. (1016 mm) or less above the bottom of the door.

4-1.2.5.2 When the fire test is to be conducted so that the furnace pressure is as close to neutral as possible, the neutral pressure plane shall be established at the top of the door ±1 in. (±25 mm).

4-1.2.6 The furnace pressure shall be measured and recorded throughout the fire test at intervals not exceeding 1 minute.

4-2 Hose Stream Test.

4-2.1* Within the 2 minutes immediately following the fire test, the fire-exposed side of the fire door assembly shall be subjected to the impact, erosion, and cooling effects of a standard hose stream.

*Exception:** *For 20-minute fire protection–rated fire door assemblies, at the option of the test sponsor, the hose stream test shall not be required to be performed.*

4-2.2 The standard hose stream shall be delivered through a $2^1/_2$-in. (64-mm) hose discharging through a national standard play pipe in accordance with ANSI/UL 385, *Standard for Safety Play Pipes for Water Supply Testing in Fire-Protection Service*. The play pipe shall have an overall length of 30 in. (762 mm) and shall be equipped with a $1^1/_8$-in. (28.5-mm) discharge tip of the standard-taper, smooth-bore pattern without shoulder at the orifice. The play pipe shall be fitted with a $2^1/_2$-in. (64-mm) inside diameter by 6-in. (153-mm) long nipple mounted between the hose and the base of the play pipe. The pressure tap for measuring the water pressure at the base of the play pipe shall be normal to the surface of the nipple and centered on its length and shall not protrude into the water stream. The water pressure shall be measured with a pressure gauge having a minimum range of 0 to 50 psi (0 to 344.8 kPa) graduated in increments not greater than 2 psi (13.8 kPa).

4-2.3 The tip of the play pipe shall be located 20 ft (6 m) from the fire door assembly. The lengthwise centerline of the play pipe shall be aligned perpendicular to the plane of the fire door assembly. The lengthwise centerline of the play pipe shall be permitted to deviate not more than 30 degrees from the line perpendicular to the center of the fire door assembly. Where the play pipe so deviates from this perpendicular line, the required distance from the tip of the play pipe to the center of the fire door assembly shall be reduced by 1 ft (0.31 m) for each 10 degrees of deviation from the perpendicular line.

4-2.4 The hose stream shall be directed around the periphery of the fire door assembly, starting upward from either bottom corner. When the hose stream has traversed the periphery of the fire door assembly and is approximately 1 ft (0.31 m) from reaching the starting point, the hose stream shall be applied in vertical paths approximately 1 ft (0.31 m) apart until the entire width has been covered, and then in horizontal paths approximately 1 ft (0.31 m) apart until the entire height has been covered. If the required duration of the hose stream test has not been reached after this procedure has been performed, the procedure shall then be reversed and followed until the required duration has been met. Reversals in the direction of the hose stream shall be made within 1 ft (0.31 m) outside of the perimeter edge of the fire door assembly.

4-2.5* The minimum water pressure measured at the base of the play pipe shall be as specified in Table 4-2.5.

Table 4-2.5 Water Pressure at Base of Play Pipe and Duration of Application for Hose Stream

	Duration of Water Pressure at Base of Play Pipe		Application for Exposed Area	
Desired Rating	**psi**	**kPa**	**sec/ft²**	**sec/m²**
3 hr and over	45	310	3.0	32
1 1/2 hr and over and less than 3 hr	30	207	1.5	16
1 hr and over and less than 1 1/2 hr	30	207	0.9	10
Less than 1 hr	30	207	0.6	6

4-2.6 The hose stream shall be applied over the exposed area of the fire door assembly in accordance with the criteria specified in Table 4-2.5. The exposed area shall be calculated using the outside dimensions of the fire door assembly including the door frames.

Chapter 5 Performance Criteria

5-1 General.

5-1.1 The fire door assembly shall meet the performance criteria specified in this chapter during both the fire test and the hose stream test unless otherwise indicated.

5-1.2 The fire door assembly shall remain in the test wall opening.

5-1.3 The fire door assembly shall not develop any openings in the door assembly.

Exception No. 1: Openings created by glazing material breakage in the central area of each individual glazed light in any vision panel shall not exceed 5 percent of the area of the glazed light during the hose stream test.

Exception No. 2: Separation shall be permitted between meeting edges of pairs of doors in accordance with 5-2.4, 5-3.4, and 5-3.10.

Exception No. 3: Clearances shall be permitted at the bottom edges of doors in accordance with 3-3.1 through 3-3.4 and 5-3.3.

5-1.4 No flaming shall occur on the unexposed surface of the door assembly during the first 30 minutes of the fire test.

Exception: Intermittent flames not greater than 6 in. (152 mm) in length shall be permitted to occur for periods not to exceed 10 seconds.

5-1.5 After 30 minutes of the fire test, some intermittent flames not greater than 6 in. (152 mm) in length shall be permitted to occur along the edges of doors for periods not to exceed 5 minutes.

5-1.6 For doors having a fire test duration of 45 minutes or greater, flames not greater than 6 in. (152 mm) in length shall be permitted to occur on the unexposed surface area of the door during the last 15 minutes of the fire test, provided that the flames are contained within a distance of 1 1/2 in. (38 mm) from a vertical door edge, within 3 in. (76 mm) from the top edge of the door, and within 3 in. (76 mm) from the top edge of the frame of a vision panel.

5-1.7 Where hardware is evaluated for use on fire doors, it shall keep the door in the closed position for a fire test duration of not less than 3 hours, and the latch bolt shall remain projected and intact. The hardware shall not be required to be operable following the tests.

5-2 Swinging Doors.

5-2.1 For swinging doors, any portion of the edges adjacent to the door frame shall not move from its original position in a direction perpendicular to the plane of the doors for a distance greater than the door thickness during the fire test or greater than 1 1/2 times the door thickness during the hose stream test.

5-2.2 For swinging doors mounted in pairs, any portion of the meeting edges of each of the doors shall not move from its original position in a direction perpendicular to the plane of the doors for a distance greater than the door thickness away from the adjacent door edge.

5-2.3 Swinging doors mounted in pairs, incorporating an astragal, shall not separate in a direction parallel to the plane of the doors by more than 3/4 in. (19 mm) along the meeting edges or a distance equal to the throw of the latch bolt at the latch location.

5-2.4 Swinging doors mounted in pairs, without an overlapping astragal, for a fire test duration of 1 1/2 hours or less, shall not separate along the meeting edges by more than 3/8 in. (10 mm).

5-2.5 A single swinging door shall not separate from the door frame by more than 1/2 in. (13 mm) at the latch location.

5-2.6 Door frames to be evaluated with doors shall remain fastened to the test wall on all sides and shall not develop openings between the frame and the doors or between the frame and the adjacent test wall.

5-3 Sliding Doors.

5-3.1 Sliding doors mounted on the face of the test wall shall not move away from the wall more than 2 7/8 in. (73 mm).

5-3.2 Sliding doors mounted in guides shall not release from the guides, and the guides shall not loosen from the fastenings.

5-3.3 The bottom bar of rolling steel doors shall not separate from the floor structure by more than 3/4 in. (19 mm).

5-3.4 The meeting edges of center-parting horizontal sliding doors and biparting vertical sliding doors shall not separate from each other by a distance greater than the door thickness measured in a direction perpendicular to the plane of the doors.

5-3.5 The meeting edges of center-parting horizontal sliding doors and bi-parting vertical sliding doors, without an overlapping astragal, for a fire test duration of 1 1/2 hours or less, shall not separate from each other in a direction parallel to the plane of the doors by more than 3/8 in. (10 mm).

5-3.6 The meeting edges of center-parting horizontal sliding doors, incorporating an astragal, shall not separate from each other in a direction parallel to the plane of the doors by more than 3/4 in. (19 mm) or a distance equal to the throw of the latch bolt at the latch location.

5-3.7 The bottom edge of service-counter doors or single-slide dumbwaiter doors shall not separate from the sill by more than $^3/_8$ in. (10 mm).

5-3.8 A resilient astragal, where provided, shall not develop openings during the fire test. Not more than 5 percent of the area of the astragal shall be permitted to develop openings during the hose stream test.

5-3.9 The lap edges of horizontal slide-type elevator doors, including the lap edges of multisection doors, shall not move from the test wall or adjacent door surfaces so as to develop a separation of more than $2^7/_8$ in. (73 mm).

5-3.10 The meeting edges of center-parting horizontal slide-type elevator door assemblies, for a fire test duration of $1^1/_2$ hours or less, shall not separate from each other by more than $1^1/_4$ in. (32 mm) as measured in any horizontal plane.

Chapter 6 Report

6-1 Results. Results shall be reported in accordance with the performance of the fire door assembly subjected to the tests as prescribed in these test methods. The report shall include, but shall not be limited to, the following information:

(a) A description of the construction details and materials used to construct the test wall in which the fire door assembly is mounted for testing.

(b) The temperature measurements of the fire test furnace plotted on a comparative graph showing the standard temperature–time curve.

(c) The temperature measurements of the unexposed surface of the fire door assembly.

(d) The pressure differential measurements made between the furnace and the unexposed side of the fire door assembly and the calculation that determines the position of the neutral pressure plane with respect to the bottom of the fire door assembly during the fire test.

(e) All observations of the reactions of the fire door assembly that have an influence on its performance during both the fire and hose stream tests.

(f) Flaming on the unexposed surface of the door or passing through the fire door assembly.

(g) The magnitude and direction of the movement of any portion of the edges of the door from the original position.

(h) A description of the fire door assembly, including fasteners and attachments and other hardware, as they appear after the fire test and the hose stream test.

(i) The materials and construction of the fire door assembly, details of installation including hardware, door frame, and wall anchors, hangers, guides, trim, finish, and clearance or lap, in order to ensure positive identification and duplication of the fire door assembly in all respects.

(j) The actual duration of the fire test. The fire protection rating of the fire door assembly that successfully meets the performance criteria specified in Chapter 5 shall also be reported. The fire protection rating shall be based on, and shall not be greater than, the duration of the fire test and shall be assigned in accordance with one of the following:

(1) 20 minutes
(2) 30 minutes
(3) $^3/_4$ hour
(4) 1 hour
(5) $1^1/_2$ hours
(6) 3 hours
(7) Hourly increments for ratings over 3 hours

(k) Where the fire protection rating is 30 minutes or longer, a correction shall be applied for variation of the furnace exposure time from that prescribed in 2-2.3 in those cases where it affects the fire protection rating. This shall be done by multiplying the indicated duration by $^2/_3$ of the difference in area between the curve of the average furnace temperature and the standard temperature–time curve for the first $^3/_4$ of the test duration and then dividing the product by the difference in area between the standard temperature–time curve and a baseline of 68°F (20°C) for the same portion of the test, increasing the latter area by 54°F/hr (30°C/hr) [3240°F/min (1800°C/min)] to compensate for the thermal lag of the furnace thermocouples during the first part of the test. For fire exposures in the test higher than the standard temperature–time curve, the indicated fire protection rating shall be increased by the amount of the correction and shall be decreased similarly for fire exposure below the standard temperature–time curve.

The correction shall be expressed by the following formula:

$$C = \frac{2I(A - A_s)}{3(A_s + L)}$$

where:

C = correction in the same unit as I
I = indicated fire protection rating
A = area under the curve of the indicated average furnace temperature for the first $^3/_4$ of the indicated rating period
A_s = area under the standard temperature–time curve for the same part of the indicated fire protection rating
L = lag correction in the same units as A and A_s [54°F/hr (30°C/hr)] [3240°F/min (1800°C/min)]

(l) The results of the hose stream test.

Chapter 7 Referenced Publications

7-1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix C.

7-1.1 NFPA Publication. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials,* 1999 edition.

7-1.2 ANSI/UL Publication. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

ANSI/UL 385, *Standard for Safety Play Pipes for Water Supply Testing in Fire-Protection Service,* 1994.

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A-2-1.1 See Table A-2-1.1.

Table A-2-1.1 Standard Temperature–Time Curve for Control of Fire Tests

Time	Temperature	Area Above 68°F Base		Temperature	Area Above 20°C Base	
(hr:min)	°F	°F-min	°F-hr	°C	°C-min	°C-hr
0:00	68	0	0	20	0	0
0:05	1000	2,330	39	538	1,290	22
0:10	1300	7,740	129	704	4,300	72
0:15	1399	14,150	236	760	7,860	131
0:20	1462	20,970	350	795	11,650	194
0:25	1510	28,050	468	821	15,590	260
0:30	1550	35,360	589	843	19,650	328
0:35	1584	42,860	714	862	23,810	397
0:40	1613	50,510	842	878	28,060	468
0:45	1638	58,300	971	892	32,390	540
0:50	1661	66,200	1,103	905	36,780	613
0:55	1681	74,220	1,237	916	41,230	687
1:00	1700	82,330	1,372	927	45,740	762
1:05	1718	90,540	1,509	937	50,300	838
1:10	1735	98,830	1,647	946	54,910	915
1:15	1750	107,200	1,787	955	59,560	993
1:20	1765	115,650	1,928	963	64,250	1,071
1:25	1779	124,180	2,070	971	68,990	1,150
1:30	1792	132,760	2,213	978	73,760	1,229
1:35	1804	141,420	2,357	985	78,560	1,309
1:40	1815	150,120	2,502	991	83,400	1,390
1:45	1826	158,890	2,648	996	88,280	1,471
1:50	1835	167,700	2,795	1,001	93,170	1,553
1:55	1843	176,550	2,942	1,006	98,080	1,635
2:00	1850	185,440	3,091	1,010	103,020	1,717
2:10	1862	203,330	3,389	1,017	112,960	1,882
2:20	1875	221,330	3,689	1,024	122,960	2,049
2:30	1888	239,470	3,991	1,031	133,040	2,217
2:40	1900	257,720	4,295	1,038	143,180	2,386
2:50	1912	276,110	4,602	1,045	153,390	2,556
3:00	1925	294,610	4,910	1,052	163,670	2,728
3:10	1938	313,250	5,221	1,059	174,030	2,900
3:20	1950	332,000	5,533	1,066	184,450	3,074
3:30	1962	350,890	5,848	1,072	194,940	3,249
3:40	1975	369,890	6,165	1,079	205,500	3,425
3:50	1988	389,030	6,484	1,086	216,130	3,602
4:00	2000	408,280	6,805	1,093	226,820	3,780
4:10	2012	427,670	7,128	1,100	237,590	3,960
4:20	2025	447,180	7,453	1,107	248,430	4,140

Table A-2-1.1 Standard Temperature–Time Curve for Control of Fire Tests *(Continued)*

Time	Temperature	Area Above 68°F Base		Temperature	Area Above 20°C Base	
(hr:min)	°F	°F-min	°F-hr	°C	°C-min	°C-hr
4:30	2038	466,810	7,780	1,114	259,340	4,322
4:40	2050	486,560	8,110	1,121	270,310	4,505
4:50	2062	506,450	8,441	1,128	281,360	4,689
5:00	2075	526,450	8,774	1,135	292,470	4,874
5:10	2088	546,580	9,110	1,142	303,660	5,061
5:20	2100	566,840	9,447	1,149	314,910	5,248
5:30	2112	587,220	9,787	1,156	326,240	5,437
5:40	2125	607,730	10,129	1,163	337,630	5,627
5:50	2138	628,360	10,473	1,170	349,090	5,818
6:00	2150	649,120	10,819	1,177	360,620	6,010
6:10	2162	670,000	11,167	1,184	372,230	6,204
6:20	2175	691,010	11,517	1,191	383,900	6,398
6:30	2188	712,140	11,869	1,198	395,640	6,594
6:40	2200	733,400	12,223	1,204	407,450	6,791
6:50	2212	754,780	12,580	1,211	419,330	6,989
7:00	2225	776,290	12,938	1,218	431,270	7,188
7:10	2238	797,920	13,299	1,225	443,290	7,388
7:20	2250	819,680	13,661	1,232	455,380	7,590
7:30	2262	841,560	14,026	1,239	467,540	7,792
7:40	2275	863,570	14,393	1,246	479,760	7,996
7:50	2288	885,700	14,762	1,253	492,060	8,201
8:00	2300	907,960	15,133	1,260	504,420	8,407

A-2-3.2 Material that is currently in use as a thermocouple pad is Ceraform 126®. Ceraform 126® is a registered trade name of Manville Speciality Group, P.O. Box 5108, Denver, CO 80217.

Specific product information is being provided for informational purposes only and has not been independently verified, certified, or endorsed by NFPA or any of its Technical Committees.

A-4-2.1 Additional information on the hose stream application can be found in Section B-13.

A-4-2.1 Exception. The elimination of the hose stream test for some 20-minute-rated assemblies is based on their field application.

A-4-2.5 In Table 4-2.5, the exposed area is permitted to be calculated using the outside dimensions of the test specimen, including a frame, hangers, tracks, or other parts of the assembly, if provided, but normally not including the wall into which the specimen is mounted. Where multiple test specimens are mounted in the same wall, the rectangular or square wall area encompassing all of the specimens is considered the exposed area, since the hose stream has to traverse this area during its application.

Appendix B Commentary

This appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.

B-1 Introduction. This commentary has been prepared to provide the user of NFPA 252 with background information on the development of the standard and its application in the fire protection of buildings. It also provides guidance in the planning and performance of fire tests and in the reporting of results. No attempt has been made to incorporate all of the available information on fire testing in this commentary. The serious student of fire testing is strongly urged to examine the referenced documents for a better appreciation of the history of fire-resistant design and the intricate problems associated with testing and with interpretation of test results.

B-2 Application.

B-2.1 Compartmentation of buildings by fire-resistive walls has been recognized for many years as an effective method of restricting fires to their area of origin [1, 2, 5–8, 16] or limiting their spread. The functional use of buildings, however, demands a reasonable amount of communication between compartments, necessitating openings in these fire-resistive walls. Fire door assemblies are utilized to protect these openings and maintain the integrity of the fire barrier [11]. Openings in walls have been traditionally classified by fire

protection standards [8, 9, 15] and building codes in accordance with the location and purpose of the wall in which the opening exists. However, such classifications were deleted from these standards and codes in the early 1990s. Instead, these standards and codes specify the fire protection rating of the door assembly required to protect the openings.

B-2.2 Fire protection standards and building codes permit labeled vision panels and other openings such as labeled ventilation louvers in some fire door assemblies. The model building codes, NFPA 80, *Standard for Fire Doors and Fire Windows* [8], and the specific fire door manufacturer's listing should be referenced for information on the types and sizes of these openings.

B-2.3 Fire door assemblies should be properly installed to maintain their fire protection rating. NFPA 80, *Standard for Fire Doors and Fire Windows* [8], and the specific fire door manufacturer's listing should be consulted for details on the installation of fire door assemblies and for limitations on the application of specific labeled fire doors.

B-3 Historical Aspects. The first effort to test fire doors was reported in a series of tests conducted in Germany in 1893 [3, 4, 10]. The British Fire Prevention Committee began testing in 1899 and produced a *Standard Table of Fire Resisting Elements*, including *Fire Resisting Doors* [1]. Underwriters Laboratories Inc. was involved in testing and listing fire doors shortly after 1900, using its own standards. In 1941, ASTM adopted ASTM E 152, *Standard Methods of Fire Tests of Door Assemblies*, on fire door assembly tests. NFPA 252 was first issued by the NFPA in 1942.

B-4 Scope and Significance.

B-4.1 NFPA 252 provides methods for measuring the relative performance of fire door assemblies where exposed to predetermined standard fire conditions. The standard provides for testing of several types and methods of door operation including swinging, sliding, rolling, and sectional doors [8]. Since the effectiveness of the opening protection is dependent upon the entire assembly, proper attention should be paid to the installation as a unit. Accordingly, fire door assemblies are required to be tested as an assembly of all necessary elements and equipment, including the door frame, hardware, and any glazing or other openings in the assembly.

B-4.2 Fire protection ratings are assigned to indicate that the fire door assembly has continued to perform as required for periods of $^1/_3$ hour, $^1/_2$ hour, $^3/_4$ hour, 1 hour, $1\,^1/_2$ hours, or 3 or more hours. Labels on assemblies used to carry the letter designations of A, B, C, D, or E. These letter designations were not a part of the NFPA 252 standard classification system but were used to designate the class of opening for which the door was intended to protect as determined by codes and other standards [8, 9].

B-4.3 The $^1/_3$-hour, or 20-minute, fire protection–rated door is relatively new. Concern about the uniform adequacy of the $1\,^3/_4$-in. (44.5-mm) solid bonded wood core door construction and the difficulty of determining the equivalency of other types of doors led to a voluntary consensus to test such doors for 20 minutes in the test furnace described in this standard using the same acceptance criteria specified for door assemblies traditionally tested for a longer periods of time, with the exception that the hose stream test required by this test method might not be required by regulatory codes.

B-4.4 It is common for a fire door to have a fire protection rating lower than the wall in which it is installed. For example, a $1\,^1/_2$-hour fire protection–rated door can be required in a wall having a fire resistance rating of 2 hours. This is justified in part by the fact that, under normal conditions of use, the potential fire exposure in the vicinity of a door opening is decreased since there will usually be a clear space on both sides of the opening for traffic purposes. Since wall assemblies are put together at the site, their uniformity is not as certain as a fire door assembly that is factory assembled (e.g., undesigned penetrations tend to show up in wall assemblies). For this reason, any factor of safety that is tacitly called for in a wall assembly requirement should exceed that of a door assembly. If the opening is not used, combustibles could be piled against the door, and the assumed enclosure protection might not be maintained. In these instances, ratings for the openings should be equivalent to the rating of the wall, or precautions should be taken to prevent storage of combustibles against the doors [2, 8].

B-5 Limitations.

B-5.1 The NFPA 252 test methods intend that the door be tested until the performance criteria are met for the desired exposure period or for a shorter period. The test methods do not intend that a fire door subjected to a building fire is satisfactory for use following the fire.

B-5.2 The variations in material performance preclude any prediction of an assembly's performance in walls other than those types used in the test. The standard also makes no provisions for measuring the generation of smoke and gases or other products of combustion from the unexposed side of the door. Temperature measurements on the unexposed surface of the door are stopped after 30 minutes.

B-6 Furnace.

B-6.1 The test methods provide details on the operation characteristics and temperature-measurement requirements of the test furnace. The walls of the furnace typically should be of furnace refractory materials and should be sufficiently rugged to maintain the overall integrity of the furnace during the fire exposure period.

B-6.2 The thermocouples in the furnace are located 6 in. (152 mm) from the face of the door or the wall in which the door is installed. Otherwise, no furnace depth is specified. A depth of 8 in. to 18 in. (203 mm to 457 mm) is considered desirable by most laboratories. Reference documents should be consulted for a more comprehensive review of furnace design and performance [12, 13].

B-7 Temperature–Time Curve.

B-7.1 A specific temperature–time relationship for the test fire is defined in the standard. The actual recorded temperature–time condition obtained in the furnace is required to be within specified percentages of those of the standard curve. The number and type of temperature-measuring devices are outlined in the standard. Specific standard practices for location and use of these temperature-measuring devices are also outlined in the standard.

B-7.2 The standard temperature–time (*T-t*) curve used in NFPA 252 represents a severe building fire [5]. The curve was adopted in 1918 as a result of several conferences by 11 technical organizations, including testing laboratories, insurance underwriters, fire protection associations, and technical soci-