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NFPA 252 Fire Tests of Door Assemblies 1990 Edition

National Fire Protection Association 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101

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The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

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 252

Standard Methods of

Fire Tests of Door Assemblies

1990 Edition

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 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.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

Origin and Development of NFPA 252

The 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 from that committee were adopted in 1958, 1969, 1972, 1976, 1979, 1984, and 1990.

The test procedure covered by this standard was developed by Underwriters Laboratories Inc.

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NIST/Center for Fire Research

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Richard P. Thornberry, The Code Consortium

Alternates

Kathleen Almand, American Iron & Steel Inst.
(Alternate to D. F. Boring)
Robert M. Berhinig, Underwriters Laboratories Inc.
(Alternate to L. Przybyla)
Peter H. Billing, Nat'l Forest Products Assoc.
(Alternate to R. W. Glowinski)
J. P. Carroll, Society of the Plastics Industry
(Alternate to J. A. Blair)
Thomas G. Daly, Hilton Hotels Corp.
(Alternate to M. W. Janko)
John A. Davenport, Industrial Risk Insurers
(Alternate to E. E. Miller)
Richard G. Gewain, Hughes Assoc., Inc.
(Alternate to P. J. DiNenno)
Carl A. Hafer, Southwest Research Inst.
(Alternate to J. J. Beitel)
R. Joseph Pearson, Warnock Hersey Int'l Inc.
(Alternate to G. E. Meyer)
Hardy Poole, American Textile Manufacturing Inst.
(Alternate to J. W. Michener)
John Roberts, Underwriters Laboratories of Canada
(Alternate to P. Higginson)

(Nonvoting)

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Herman H. Spaeth, Novato, CA
(Member Emeritus)

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NFPA 252

Standard Methods of

Fire Tests of Door Assemblies

1990 Edition

Chapter 1 General

1-1 Purpose. This standard outlines methods of fire test for door assemblies.

1-2 Scope.

1-2.1 These methods of fire test are applicable to door assemblies of various materials and types of construction used in wall openings to retard the passage of fire.

1-2.2 Tests made in conformity with these test methods will register performance of door assemblies during the test exposure; but such tests shall not be construed as determining their suitability for use after exposure to fire.

1-2.3 It is the intent that tests made in conformity with these test methods will develop data that enables regulatory bodies to determine the suitability of door assemblies for use in locations where fire resistance of a specified duration is required.

1-3 Significance.

1-3.1 These test methods are intended to evaluate the ability of a door assembly to remain in an opening during a predetermined test exposure.

1-3.2 The tests expose a specimen to a standard fire exposure that is controlled to achieve specified temperatures throughout a specified time period, followed by the application of a specified standard fire hose stream. The exposure, however, may not be representative of all fire conditions, which may vary with changes in the amount, nature, and distribution of fire loading, ventilation, compartment size and configuration, and heat sink characteristics of the compartment. It does, however, provide a relative measure of the fire performance of door assemblies under these specified fire exposure conditions.

1-3.3 Any variation in the construction or conditions that are tested may substantially change the performance characteristics of the assembly.

1-3.4 The test methods do not provide the following:

1-3.4.1 Full information on the performance of all door assemblies in walls constructed of materials other than those tested.

1-3.4.2 Evaluation of the degree to which the door assembly contributes to the fire hazard through generation of smoke, toxic gases, or other products of combustion.

1-3.4.3 A measurement that determines a limit on the number of openings allowed in glazed areas or the number and size of lateral openings between the door and frame.

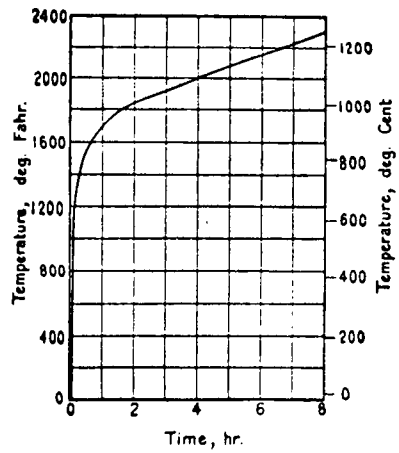
1-3.4.4 A measurement of the degree of control or limitation of the passage of smoke or products of combustion through the door assembly.

1-3.4.5 A measurement that determines a temperature limit on the unexposed side of the door assembly.

Chapter 2 Control of Fire Tests

2-1 Time-Temperature Curve.

2-1.1 The fire exposure of door assemblies shall be controlled to conform to the applicable portion of the standard time-temperature curve shown in Figure 2-1.1. The points on the curve that determine its character are:



1000°F (538°C).....at 5 minutes
1300°F (704°C).....at 10 minutes
1550°F (843°C).....at 30 minutes
1638°F (892°C).....at 45 minutes
1700°F (927°C).....at 1 hour
1792°F (978°C).....at 1½ hours
1925°F (1052°C).....at 3 hours

Figure 2-1.1.

2-1.2 For a closer definition of the time-temperature curve, see Figure 2-1.2.

2-2 Furnace Temperatures.

2-2.1 Test exposure temperatures shall be determined by using the average temperature obtained from the readings of not less than nine thermocouples symmetrically disposed and distributed to show the temperature near all parts of the test assembly. The thermocouples shall be protected by sealed

Time	Temperature,	Area Above 68 F. Base		Temperature	Area Above 20 C. Base	
hr. min.	deg. Fahr.	deg. Fahr.-min.	deg. Fahr.-hr.	deg. Cent.	deg. Cent.-min.	deg. Cent.-hr.
0:00	68	00	0	20	00	0
0:05	1 000	2 330	39	538	1 290	22
0:10	1 300	7 740	129	704	4 300	72
0:15	1 399	14 150	236	760	7 860	131
0:20	1 462	20 970	350	795	11 650	194
0:25	1 510	28 050	468	821	15 590	260
0:30	1 550	35 360	589	843	19 650	328
0:35	1 584	42 860	714	862	23 810	397
0:40	1 618	50 510	842	878	28 060	468
0:45	1 638	58 300	971	892	32 390	540
0:50	1 661	66 200	1 103	905	36 780	613
0:55	1 681	74 220	1 237	916	41 230	687
1:00	1 700	82 330	1 372	927	45 740	762
1:05	1 718	90 540	1 509	937	50 300	838
1:10	1 735	98 830	1 647	946	54 910	915
1:15	1 750	107 200	1 787	955	59 560	993
1:20	1 765	115 650	1 928	963	64 250	1 071
1:25	1 779	124 180	2 070	971	68 990	1 150
1:30	1 792	132 760	2 213	978	73 760	1 229
1:35	1 804	141 420	2 357	985	78 560	1 309
1:40	1 815	150 120	2 502	991	83 400	1 390
1:45	1 826	158 890	2 648	996	88 280	1 471
1:50	1 835	167 700	2 795	1 001	93 170	1 553
1:55	1 843	176 550	2 942	1 006	98 080	1 635
2:00	1 850	185 440	3 091	1 010	103 020	1 717
2:10	1 862	203 330	3 389	1 017	112 960	1 882
2:20	1 875	221 330	3 689	1 024	122 960	2 049
2:30	1 888	239 470	3 991	1 031	133 040	2 217
2:40	1 900	257 720	4 295	1 038	143 180	2 386
2:50	1 912	276 110	4 602	1 045	153 390	2 556
3:00	1 925	294 610	4 910	1 052	163 670	2 728
3:10	1 938	313 250	5 221	1 059	174 030	2 900
3:20	1 950	332 000	5 533	1 066	184 450	3 074
3:30	1 962	350 890	5 848	1 072	194 940	3 249
3:40	1 975	369 890	6 165	1 079	205 500	3 425
3:50	1 988	389 030	6 484	1 086	216 130	3 602
4:00	2 000	408 280	6 805	1 093	226 820	3 780
4:10	2 012	427 670	7 128	1 100	237 590	3 960
4:20	2 025	447 180	7 453	1 107	248 430	4 140
4:30	2 038	466 810	7 780	1 114	259 340	4 322
4:40	2 050	486 560	8 110	1 121	270 310	4 505
4:50	2 062	506 450	8 441	1 128	281 360	4 689
5:00	2 075	526 450	8 774	1 135	292 470	4 874
5:10	2 088	546 580	9 110	1 142	303 660	5 061
5:20	2 100	566 840	9 447	1 149	314 910	5 248
5:30	2 112	587 220	9 787	1 156	326 240	5 437
5:40	2 125	607 730	10 129	1 163	337 630	5 627
5:50	2 138	628 360	10 473	1 170	349 090	5 818
6:00	2 150	649 120	10 819	1 177	360 620	6 010
6:10	2 162	670 000	11 167	1 184	372 230	6 204
6:20	2 175	691 010	11 517	1 191	383 900	6 398
6:30	2 188	712 140	11 869	1 198	395 640	6 594
6:40	2 200	733 400	12 223	1 204	407 450	6 791
6:50	2 212	754 780	12 580	1 211	419 330	6 989
7:00	2 225	776 290	12 938	1 218	431 270	7 188
7:10	2 238	797 920	13 299	1 225	443 290	7 388
7:20	2 250	819 680	13 661	1 232	455 380	7 590
7:30	2 262	841 560	14 026	1 239	467 540	7 792
7:40	2 275	863 570	14 393	1 246	479 760	7 996
7:50	2 288	885 700	14 762	1 253	492 060	8 201
8:00	2 300	907 960	15 133	1 260	504 420	8 407

Figure 2-1.2 Standard Time-Temperature Curve for Control of Fire Tests.

porcelain tubes having $\frac{3}{4}$-in. (19-mm) outside diameter and $\frac{1}{8}$-in. (3-mm) wall thickness, or, as an alternate, in the case of base metal thermocouples, protected by $\frac{1}{2}$-in. (13-mm) wrought steel or wrought iron pipe of standard weight. The junction of the thermocouples shall be located 6 in. (152 mm) from the exposed face of the test assembly, or from the masonry in which the assembly is installed, during the entire test exposure.

2-2.2 The temperatures shall be read at intervals not exceeding 5 minutes during the first 2 hours, and thereafter the intervals may be increased to not more than 10 minutes.

2-2.3 The accuracy of the furnace control shall be such that the area under the time-temperature curve, obtained by averaging the results from the thermocouple readings, is within 10 percent of the corresponding area under the standard time-temperature curve for fire tests of 1 hour or less duration, within 7.5 percent for those over 1 hour and not more than 2 hours, and within 5 percent for tests exceeding 2 hours in duration.

2-3 Unexposed Surface Temperatures.

2-3.1 Unexposed surface temperatures shall be recorded and shall be determined in the following manner:

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

(b) Unexposed surface temperatures shall be measured by thermocouples placed under flexible, oven-dried, felted asbestos pads 6 ± 1/8 in. sq (152 ± 3 mm sq), 0.40 ± 0.05 in. (10 ± 1 mm) in thickness, and weighing not less than 1.0 lb/ft^2 nor more than 1.4 lb/ft^2 (5 kg/m^2 nor more than 6.8 kg/m^2). The pads shall be held firmly against the surface of the door and shall fit closely about the thermocouples. The thermocouple leads shall be positioned under the pad for a distance 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 be not heavier than No. 18 AWG (0.82 mm^2) and shall be electrically insulated with heat-resistant and moisture-resistant coatings.

(c) Unexposed surface temperatures shall be read at intervals not exceeding 5 minutes for the first 30 minutes of the test.

Exception: Single-layer metal doors need not comply with 2-3.1 (a) through (c).

Chapter 3 Test Assemblies

3-1 Construction and Size.

3-1.1 The construction and size of a test door assembly, which can include single doors, doors in pairs, special-purpose doors (such as Dutch doors, double-egress doors, etc.), or multisection doors, shall be representative of that type of assembly for which classification or rating is desired.

3-1.2 A floor structure shall be provided as part of the opening to be protected, except where such floor interferes with the operation of the door. The floor segment shall be of noncombustible material and shall project into the furnace for a distance that is approximately twice the thickness of the test door, or to the limit of the frame, whichever is greater.

3-2 Mounting.

3-2.1 Swinging doors shall be mounted so as to open into the furnace chamber.

3-2.2 Sliding and rolling doors, except horizontal slide-type elevator doors, shall be mounted on the exposed side of the opening in the wall closing the furnace chamber.

3-2.3 Horizontal slide-type elevator doors shall be mounted on the unexposed side of the opening in the wall closing the furnace chamber.

3-2.4 Access-type doors and their frame assemblies and chute-type doors and their frame assemblies shall be mounted so as to have one assembly open into the furnace chamber and another assembly open away from the furnace chamber.

3-2.5 Dumbwaiter doors and frame assemblies and service-counter doors and frame assemblies shall be mounted on the exposed side of the opening in the wall.

3-2.6 Door frames shall be evaluated when mounted so as to have 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.

3-2.7 Surface-mounted hardware (fire-exit devices) for use on fire doors shall be evaluated under conditions where it is installed in one door assembly that swings into the furnace chamber and another door assembly that swings away from the furnace chamber.

3-2.8 The mountings of all doors shall be such that they fit snugly within the frame, against wall surfaces, or in guides, but such mounting shall not prevent free and easy operation of the test door.

3-3 Clearances.

3-3.1 Clearances for swinging doors shall be as follows:

With a minus 1/16-in. (1.6-mm) tolerance: 1/8 in. (3 mm) along the top, 1/8 in. (3 mm) along the hinge and latch jambs, 1/8 in. (3 mm) along the meeting edge of doors in pairs, 3/8 in. (10 mm) at the bottom edge of a single swinging door, and 1/4 in. (6 mm) at the bottom of a pair of doors.

3-3.2 Clearances for horizontal sliding doors not mounted within guides shall be as follows:

With a minus 1/8-in. (3-mm) tolerance: 1/2 in. (12.7 mm) between door and wall surfaces, 3/8 in. (10 mm) between door and floor structure, and 1/4 in. (6 mm) between the meeting edges of center-parting doors. A maximum lap of 4 in. (102 mm) of the door over the wall opening at sides and top shall be provided.

3-3.3 Clearances for vertical sliding doors moving within guides shall be as follows:

With a minus 1/8-in. (3-mm) tolerance: 1/2 in. (12.7 mm) between the door and wall surfaces along top and/or bottom door edges, with guides mounted directly to the wall surface, and 3/16 in. (5 mm) between meeting edges of bi-parting doors or 3/16 in. (5 mm) between door and floor structure or sill.

3-3.4 Clearances for horizontal slide-type elevator doors shall be as follows:

With a minus 1/8-in. (3-mm) tolerance: 3/8 in. (10 mm) between the door and wall surface, 3/8 in. (10 mm) between multisection door panels, and 3/8 in. (10 mm) from the bottom of a panel to the sill. Multisection door panels shall overlap 3/4 in. (19 mm). Door panels shall lap the wall opening 3/4 in. (19 mm) at sides and top.

Chapter 4 Conduct of Tests

4-1 Test Assembly.

4-1.1 The wall or partition in which the door assembly is tested shall be adequate to retain the assembly throughout the fire and hose stream test; it shall be constructed of masonry or other materials representative of wall or partition construction.

4-1.2 Door frame wall anchors, where used, shall be suitable for the wall or partition construction.

4-2 Fire Endurance Test.

4-2.1 Furnace Pressure.

(a) The furnace pressure shall be measured at the top of the door assembly. The pressure measuring probe tip shall be as shown in Figure 4-2.1, manufactured from stainless steel or other suitable metal.

(b) Measure the pressure at intervals not exceeding 5 minutes throughout the test by means of a manometer or equivalent transducer. The device shall be capable of reading in increments of 0.01 in. H_2O (2.5 Pa) with a measurement precision of 0.005 in. H_2O (1.2 Pa).

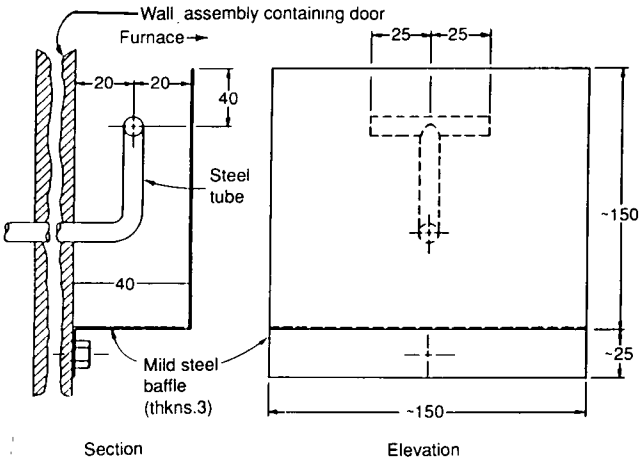


Figure 4-2.1 Static Pressure-Measuring Device Dimensions (in Millimeters).

4-2.2 Maintain the pressure in the furnace chamber as nearly equal to the atmospheric pressure as possible.

4-2.3 Continue the test until the exposure period of the desired classification or rating is reached unless the conditions of acceptance set forth in Chapter 5 are exceeded in a shorter period.

4-3 Hose Stream Test.

4-3.1 Immediately following the fire endurance test, subject the test assembly to the impact, erosion, and cooling effects of a hose stream directed first at the middle and then at all parts of the exposed surface, making changes in direction slowly.

4-3.2 The stream shall be delivered through a 2½-in. (64-mm) hose discharging through a national standard play pipe as described in ANSI/UL 385. The play pipe shall have an overall length of 30 in. (762 mm) and be equipped with a 1⅛-in. (28.5-mm) discharge type of the standard-taper, smooth-bore pattern without shoulder at the orifice. The play pipe shall be fitted with a 2½-in. (64-mm) I.D. 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 nozzle shall be normal to the surface of the nipple, centered in its length, and shall not protrude into the water stream. The water pressure shall be measured with a suitable pressure gauge (as a minimum 0-50 psi) graduated in no more than 2 psi increments. The water pressure and duration of application shall be as prescribed in Table 4-3.2.

Table 4-3.2 Water Pressure at Base of Nozzle and Duration of Application.

Desired Rating	Water Pressure at Base of Nozzle lb per sq in.	Duration of Application Seconds per sq ft of Exposed Area
3 hour and over	45 (310 kPa)	3.0 (32 seconds/m^2)
1½ hour and over, if less than 3 hour	30 (207 kPa)	1.5 (16 seconds/m^2)
1 hour and over, if less than 1½ hour	30 (207 kPa)	0.9 (10 seconds/m^2)
Less than 1 hour	30 (207 kPa)	0.6 (6 seconds/m^2)

NOTE: The exposed area may 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 will have to be considered as the exposed area since the hose stream must traverse this area during its application.

4-3.3 The tip of the nozzle shall be located 20 ft (6 m) from and on a line normal to the center of the test door. If impossible to be so located, the nozzle may be on a line deviating not more than 30° from the line normal to the center of the test door. Where so located, the distance from the center shall be under 20 ft (6 m) by a length equal to 1 ft (0.3 m) for each 10° of deviation from the normal.

Chapter 5 Report

5-1 Results.

5-1.1 Results shall be reported in accordance with performance in the tests prescribed in these test methods. The report shall include:

(a) The performance under the desired exposure period chosen from the following: 20 minutes, 30 minutes, ¾ hour, 1 hour, 1½ hours, or 3 hours and over (in hourly increments).

(b) The temperature measurements of the furnace.

(c) The temperature measurements of the unexposed side.

(d) All observations having a bearing on the performance of the test assembly.

(e) Flaming, if any, on the unexposed surface of the door leaf.

(f) The amount of movement of any portion of the edges of the door adjacent to the door frame from the original position (*see Chapter 6*).

(g) The materials and the construction of the door, frame, and wall or partition and the details of the installation, hardware, door frame, and wall anchors, hangers, guides, trim, finish and clearance or lap shall be recorded or appropriately referenced to ensure positive identification or duplication in all respects.

(h) Pressure measurements made in the furnace and location of such measurements relative to the elevation of the top of the door.

Chapter 6 Conditions of Acceptance

6-1 General.

6-1.1 A door assembly shall be considered as meeting the requirements for acceptable performance when it remains in the opening during the fire endurance test and hose stream test within the following limitations:

6-1.1.1 The test assembly shall have withstood the fire endurance test and the hose stream test without developing any openings through the assembly.

NOTE: Openings, for purposes of this provision, are defined as through-holes in the assembly that can be seen from the unexposed side when looking at the location of the suspected opening from a position perpendicular to the plane of the assembly.

Exception No. 1: Dislodging of small portions of glass light during the hose stream.

Exception No. 2: Permissible separation between meeting edges of pairs of doors as stated in 6-2.4, 6-3.4, and 6-3.10.

Exception No. 3: Permissible openings between the bottom edges of doors and sills as stated in 3-3.1 through 3-3.4 and in 6-3.3.

6-1.1.2 No flaming shall occur on the unexposed surface of a door assembly during the first 30 minutes of the classification period.

6-1.1.3 After 30 minutes, some intermittent light flames [approximately 6 in. (152 mm) long], for periods not exceeding 5-minute intervals, may occur along the edges of doors.

6-1.1.4 Light flaming may occur during the last 15 minutes of the classification period on the unexposed surface area of the door, provided it is contained within a distance of 1 1/2 in. (38 mm) from a vertical door edge and 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.

6-1.1.5 When hardware is to be evaluated for use on fire doors, it shall secure the door closed in accordance with the conditions of acceptance for an exposure period of 3 hours and, in addition, the latch bolt shall remain projected and shall be intact after the test. The hardware need not be operable after test.

6-2 Swinging Doors.

6-2.1 The movement of swinging doors shall not result in any portion of the edges adjacent to the door frame moving from its original position in a direction that is perpendicular to the plane of the door more than the thickness of the door during the first half of the classification period, or greater than 1 1/2 times the door thickness during the entire classification period, or moving as a result of the hose stream test.

6-2.2 The movement of swinging doors mounted in pairs shall not result in any portion of the meeting edges moving a distance greater than the thickness of the door away from the adjacent door edge in a direction that is perpendicular to the plane of the doors during the entire classification period, or as a result of the hose stream test.

6-2.3 An assembly consisting of a pair of swinging doors incorporating an astragal shall not separate 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.

6-2.4 An assembly consisting of a pair of swinging doors, without an overlapping astragal, for a fire and hose stream exposure of 1 1/2 hours or less, shall not separate along the meeting edges by more than 3/8 in. (10 mm), including the initial clearance between doors.

6-2.5 An assembly consisting of a single swinging door shall not separate by more than 1/2 in. (13 mm) at the latch location.

6-2.6 Door frames to be evaluated with doors shall remain securely fastened to the wall on all sides and shall not permit through-openings between frame and doors or between frame and adjacent wall.

6-3 Sliding Doors.

6-3.1 Doors mounted on the face of the wall shall not move from the wall sufficiently to develop a separation of more than 2 7/8 in. (73 mm) during the entire classification period or as a result of the hose stream test.

6-3.2 Doors mounted in guides shall not release from the guides, and the guides shall not loosen from fastenings.

6-3.3 The bottom bar of rolling steel doors shall not separate from the floor structure by more than 3/4 in. (19 mm) during the entire classification period or as a result of the hose stream test.

6-3.4 The meeting edge of center-parting horizontal sliding doors and bi-parting vertical sliding doors shall not separate by a distance greater than the door thickness measured in a direction perpendicular to the plane of the doors.

6-3.5 The meeting edges of center-parting horizontal sliding doors and bi-parting vertical sliding doors without an overlapping astragal, for a fire and hose stream exposure of 1 1/2 hours or less, shall not separate in a direction parallel to the plane of the doors by more than 3/8 in. (10 mm) along the meeting edges, including the initial clearance between doors.

6-3.6 The meeting edges of center-parting horizontal sliding doors incorporating an astragal shall not separate 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 along the meeting edges.

6-3.7 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).

6-3.8 A resilient astragal, if provided, shall not deteriorate sufficiently to result in through-openings during the fire endurance test, but small portions may be dislodged during the hose stream test.

6-3.9 The lap edges of horizontal slide-type elevator doors, including the lap edges of multisection doors, shall not move from the wall or adjacent panel surfaces sufficiently to develop a separation of more than 2 7/8 in. (73 mm) during the entire classification period or immediately following the hose stream test.

6-3.10 The meeting edges of center-parting horizontal slide-type elevator door assemblies, for a fire and hose stream exposure of 1 1/2 hours or less, shall not move apart more than 1 1/4 in. (32 mm) as measured in any horizontal plane during the entire classification period or immediately following the hose stream test.

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.

7-1.1 UL Publications. Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062

ANSI/UL 385-1988, *Play Pipes for Water Supply Testing in Fire-Protection Service.*

Appendix A Commentary

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

The numbers in parentheses refer to the list of references at the end of this Appendix.

A-1 Introduction. This commentary has been prepared to provide the user of NFPA 252, *Standard Methods of Fire Tests of Door Assemblies* 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 peruse 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.

A-2 Application.

A-2.1 Compartmentation of buildings by fire-resistive walls has been recognized for many years as an efficient method of restricting fires to the area of origin (1, 2, 5, 6, 7, 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 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 occurs, and these standards and codes specify the fire rating of the assembly required to protect the openings.

A-2.2 These fire protection standards and building codes permit labeled wire glass panels and other penetrations, such as labeled ventilation louvers, in some rated doors. The reader is referred to the model building codes, NFPA 80, *Standard for Fire Doors and Windows*, and the specific fire door manufacturer's label service for information on the types and sizes of these openings.

A-2.3 Fire doors must also be properly installed to maintain their fire rating. Again, NFPA 80, *Standard for Fire Doors and Windows*, and the specific fire door manufacturer's label service should be consulted for details on the installation of fire door assemblies and for limitations on the application of specific labeled fire doors.

A-3 Historical Aspects. The first effort to test fire doors is 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 their own standards. ASTM adopted Method E-152 on fire door assembly tests in 1941.

A-4 Scope and Significance.

A-4.1 NFPA 252 is intended to provide methods for measuring the relative performance of fire door assemblies when exposed to predetermined standard fire conditions. The standard provides for testing of several classifications, 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 must 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 and hardware.

A-4.2 Fire protection ratings are assigned to indicate that the assembly has continued to perform as required for periods of 1/3, 1/2, 3/4, 1, 1 1/2, 3, or more hours. Labels on assemblies also carry the letter designations of A, B, C, D, or E. These letter designations are not a part of the NFPA 252 standard classification system but are used to designate the class of opening for which the door is designed as determined by other standards (8, 9).

A-4.3 The 1/3-hour or 20-minute fire-rated door is relatively new. Concern about the uniform adequacy of the 1 3/4-in. (44.5-mm) solid bonded wood core 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 document using the

same acceptance criteria specified for door assemblies traditionally tested for a longer period of time, with the exception that the hose stream test is required by the test method but may not be required by regulatory codes.

A-4.4 It is usual for a fire door to have a fire protection rating lower than the wall in which it is installed; for example, a 1½-hour fire door 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 lessened since there will be a clear space on both sides of the opening for traffic purposes. Wall assemblies are put together on site, and their uniformity is not as likely as a complete factory produced door assembly (e.g., undesigned penetrations tend to "creep" into wall assemblies). For this reason, any "factor of safety" that may be tacitly called for in a wall assembly requirement should exceed that of a door assembly. If the opening is not used, combustibles may be piled against the door, and the assumed enclosure protection will not be maintained. In these instances, the openings should be made equal to the rating of the wall or precautions taken to prevent storage of combustibles against the doors (2, 8).

A-5 Limitations.

A-5.1 Methods intend that the door be tested until the conditions of acceptance are met for the desired exposure period unless the conditions of acceptance are exceeded in a shorter period. It is not intended that a fire door subjected to a building fire will be satisfactory for reuse after the fire.

A-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 side, when recorded, are stopped after 30 minutes.

A-6 Furnace.

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

A-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 to 18 in. (203 to 457 mm) has been considered desirable by most laboratories. The reader is urged to consult reference documents for a more comprehensive review of furnace design and performance (12, 13).

A-7 Temperature — Time Curve.

A-7.1 A specific temperature - time relationship for the test fire is defined in the standard and in Figure 2-1.2. 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.

A-7.2 The standard temperature - time (T - t) curve used in NFPA 252 is considered to represent a severe building fire (5). The curve was adopted in 1918 as a result of several conferences by eleven technical organizations, including testing laboratories, insurance underwriters, fire protection associations, and technical societies (14, 15, 16). It should be recognized that the T - t relationship of these test methods represents only one real fire situation (14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27).

A-8 Furnace Control. The standard contains specific instruction for measuring temperatures in the furnace and for selection of the required thermocouples. Thermocouples of the design specified are sufficiently rugged to retain accuracy throughout anticipated test periods. However, their massive construction results in a significant time delay in response to temperature change and results in temperatures exceeding the indicated temperatures during the early stages of the test period when the temperature rises rapidly. The iron or porcelain tubes surrounding the junction and leads of the thermocouple provide a shield against degradation of the junction and increase the thermal inertia. It is customary for laboratories to replace furnace thermocouples after three or four accumulated hours of use.

A-9 Unexposed Surface Temperature.

A-9.1 Conditions of acceptance for fire-resistive walls specify that the temperature increase on the unexposed side of the wall not exceed an average of 250°F (121°C) above ambient, and that there be no passage of flames or gases hot enough to ignite combustibles. It is obvious that the necessity of maintaining some clearances for efficient operation of the door and the possibility of warping preclude completely any attempt to restrict escape of gases and minor flames on the periphery of doors.

A-9.2 The standard describes a standard procedure for measuring the unexposed surface temperatures. However, unexposed surface temperatures are not a condition of acceptance for NFPA 252. Building regulations do restrict temperature transmission for some wall-opening protectives (8, 9). For instance, it is usual for codes to limit the temperature rise on the unexposed side of fire doors protecting exit stairways to 450°F (232°C) during the first 30 minutes of test. This criterion assumes that a higher temperature would provide enough radiant heat to discourage if not prevent occupants from passing by the door during an emergency. It is present practice for testing laboratories to provide labels on fire doors indicating that the maximum transmitted temperature on the unexposed side is 250°F, 450°F, or 650°F (121°C, 232°C, or 343°C) above ambient. If not indicated on the label, the temperature rise during the first 30 minutes may or may not be in excess of 650°F (343°C). Temperature rise on the unexposed side of glass panels and louvers is not measured.

A-9.3 Information on the properties of pads used to cover the thermocouples on the unexposed surfaces may be found in Appendix C, Requirements for Thermocouple Pads, of NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*.

A-10 Test Assemblies.

A-10.1 NFPA 252 provides a relative measure of performance for door assemblies. In order to establish confidence that the tested doors will perform in a building as expected, the tested assembly and its installation in the test frame must be representative of actual use conditions. Therefore, NFPA 80, *Standard for Fire Doors and Windows*(8), or such other standards or specifications should be consulted before testing an assembly.

A-10.2 The standard provides additional minimum requirements including direction of door swing, location in relation to the exposed side of the wall, and specific clearance between the door and its frame or wall, or both. Regardless of other specifications, these instructions must be followed in order to make a comparative judgment on test results.

A-11 Conduct of Tests. The test frame or wall in which a door assembly is installed should be rugged enough to endure exposure to the fire during the time period, without affecting the door assembly. Traditionally, this wall has been of masonry construction. Today, fire doors are installed in other than masonry walls and have been tested in walls framed with metal and wood studs covered with a number of materials.

A-12 Furnace Pressures.

A-12.1 A fire in a building compartment will create both negative and positive pressures on door assemblies depending upon atmospheric conditions, height above ground, wind conditions, and ventilation of the compartment at the beginning and during the fire.

A-12.2 NFPA 252 specifies that the pressure in the furnace be maintained as nearly equal to atmospheric pressure as possible. Experience has shown this practice to be acceptable. The pressure in the furnace is required to be reported.

A-13 Hose Stream Test. Immediately following a fire test, the test frame is removed from the furnace and the door assembly is subjected to the impact, erosion, and cooling effects of a stream of water from a 2½-in. (63.5-mm) hose discharging through a standard play pipe equipped with a 1⅛-in. (28.5-mm) tip under specified pressures. The application of water produces stresses in the assembly and provides a measure of its structural capability. Weights were once used to provide a measure of the ability of the assembly to withstand impact. The hose stream is considered to be an improvement in uniformity and accuracy over the weights.

A-14 Conditions of Acceptance. The standard provides a specific set of conditions by which the performance of the door is measured, the most important being that it remain in place during both the fire test and the hose stream test. Instructions for conducting the hose stream test are detailed in the standard.

A-15 References.

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(5) Gordon, C., "Considerations of Life Safety and Bldg. Use," DBR Paper No. 699, Division of Building Research, National Research Council of Canada, Ottawa, January, 1977.

(6) Gross, D., "Field Burnout Tests of Apartment Dwelling Units," Bldg. Science Series 10, U.S. Dept. of Commerce, National Bureau of Standards, Sept. 29, 1967.

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(8) NFPA 80—1990, *Standard for Fire Doors and Windows*, National Fire Protection Assn.

(9) Model Building Codes: *Basic Building Code* - Building Officials & Code Administrators International Inc., *Uniform Building Code* - International Conference of Building Officials Inc., Standard Building Code - Southern Building Code Congress International.

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(12) Seigel, L. G., "Effects of Furnace Design on Fire Endurance Test Results," Fire Test Performance, ASTM STP 463, Am. Soc. Testing Mats., 1970, pp. 56-67.

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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.