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Standard Methods of
Fire Tests of
DOOR ASSEMBLIES

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NATIONAL FIRE PROTECTION ASSOCIATION
International

60 Batterymarch St., Boston 10, Mass.

National Fire Protection Association

INTERNATIONAL

Executive Office: 60 Batterymarch St., Boston 10, Mass.

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes nearly two hundred national and regional societies and associations (list on outside back cover) and more than sixteen thousand individuals, corporations and organizations. Anyone interested may become a member; membership information is available on request.

This pamphlet is one of a large number of publications on fire safety issued by the Association including periodicals, books, posters and other publications; a complete list is available without charge on request. All NFPA standards adopted by the Association are published in six volumes of the **National Fire Codes** which are re-issued annually and which are available on an annual subscription basis. The standards, prepared by the technical committees of the National Fire Protection Association and adopted in the annual meetings of the Association, are intended to prescribe reasonable measures for minimizing losses of life and property by fire. All interests concerned have opportunity through the Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

NFPA standards are purely advisory as far as the Association is concerned, but are widely used by law enforcing authorities in addition to their general use as guides to fire safety.

Definitions

The official NFPA definitions of shall, should and approved are:

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations, or that which is advised but not required.

APPROVED refers to approval by the authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The standards are prepared, as far as practicable, in terms of required performance, avoiding specifications of materials, devices or methods so phrased as to preclude obtaining the desired results by other means. The suitability of devices and materials for installation under these standards is indicated by the listings of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada and the Factory Mutual Laboratories test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

Fire Tests of Door Assemblies.

NFPA No. 252—1950

The Standard for Fire Tests of Door Assemblies was adopted as a tentative standard by the ASTM in 1940 and was finally 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 (page 251-1) and adopted in 1950, and is available in pamphlet form from the ASTM office.

STANDARD METHODS OF FIRE TESTS OF DOOR ASSEMBLIES.

Scope.

1. (a) These methods of fire test are applicable to door assemblies, of various materials and of various types of construction, for installation as wall opening protectives, to serve against the passage of fire, heat, fumes, or smoke.*

(b) It is the intent that classifications shall register performance during the period of exposure and shall not be construed as having determined suitability for use after exposure to either fire, or fire and hose stream.

(c) These methods do not establish ratings, or standards of performance for different uses, as these depend upon service requirements and are under the control of various regulatory bodies.

CONTROL OF FIRE TESTS

Time-Temperature Curve.

2. The conduct of fire tests of materials and construction shall be controlled by the standard time-temperature curve shown in Fig. 1. The points on the curve which determine its character are:

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

Furnace Temperatures.

3. (a) The temperature fixed by the curve shall be deemed to be the average temperature obtained from the readings of not less than five thermocouples symmetrically disposed and distributed to show the temperature near all parts of the test assembly, the thermocouples being enclosed in sealed porcelain tubes $\frac{3}{4}$ in. in outside diameter and $\frac{1}{8}$ in. in wall thickness, or, in the case of base metal thermocouples, enclosed in sealed, standard-weight

*The committee is giving consideration to the subject of smoke generation and the creation and spread of dangerous fumes; which upon completion will result in subsequent revision of these methods.

$\frac{1}{2}$ -in. wrought steel pipe. The exposed length of the pyrometer tube and couple in the furnace chamber shall be not less than 12 in. Other types of protecting tubes or pyrometers may be used that, under test conditions, give the same indications as the above standard within the limit of accuracy that applies for furnace-temperature measurements. The junction of the thermocouples shall be placed 4 to 6 in. away from the exposed face of the test assembly at the beginning of the test, and during the test shall not touch the assembly as a result of its deflection.

(b) The temperatures shall be read at intervals not exceeding 5 min. during the first hour, and thereafter at intervals not exceeding 15 min.

(c) The accuracy of the furnace control shall be such that the area under the time-temperature curve, obtained by averaging the results from the pyrometer readings, is within 10 per cent of the corresponding area under the standard time-temperature curve shown in Fig. 1 for fire tests of 1 hr. or less duration, within 7.5 per cent for those over 1 hr. and not more than 2 hr., and within 5 per cent for tests exceeding 2 hr. in duration.

Temperature of Unexposed Surfaces of Doors.

4. (a) Temperatures at unexposed surfaces shall be measured with thermocouples or thermometers placed under flexible, oven-dry, felted asbestos pads 6 in. square, 0.4 in. in thickness, and weighing not less than 1.0 nor more than 1.4 lb. per sq. ft. The pads shall be sufficiently soft that, without breaking, they may be shaped to contact over the whole surface against which they are placed. The wire leads of the thermocouple or the stem of the thermometer shall have an immersion under the pad and be in contact with the unexposed surface for not less than $3\frac{1}{2}$ in. The hot junction of the thermocouple or the bulb of the thermometer shall be placed approximately under the center of the pad. The outside diameter of protecting or insulating tubes, and of thermometer stems, shall be not more than $\frac{1}{8}$ in. The pad shall be held firmly against the surface, and shall fit closely about the thermocouples or thermometer stems. Thermometers shall be of the partial-immersion type, with a length of stem, between the end of the bulb and the immersion mark, of 3 in. The wires of the thermocouple in the length covered by the pad shall be not heavier than No. 18 B. & S. gage (0.04 in.) and shall be electrically insulated with heat-resistant and moisture-resistant coatings.

(b) Temperature readings shall be taken at not less than three points, one located at the middle of the unexposed surface of the test assembly and one each at the mid-points of the upper and lower halves of the assembly. If the construction is not uniform, or if, in the opinion of the testing authority, temperature measurements at other locations are necessary to give a true indication of performance, the thermocouples shall be symmetrically disposed to give results representative of the different constructions, and preferably with no location nearer than 12 in. to the edges of the test assembly.

(c) Temperature readings on the unexposed surfaces shall be taken at the same intervals as specified for furnace temperatures.

(d) If a temperature end point of the rating period is specified, it shall be determined by the average of the measurements taken at individual points representing the least resistant construction; except that if a temperature rise 30 per cent in excess of the limit established by the regulatory body for whom the test is made occurs at any one of these points, the remainder shall be ignored and the fire endurance period judged as ended.

NOTE. At the discretion of the testing authority, additional temperature measurements may be taken on, or near the unexposed surface.

TEST STRUCTURES

Test Structures.

5. (a) The test structure may be located at any place where all the necessary facilities for properly conducting the test are provided.

(b) Entire freedom is left to each testing authority in the design and location of the test structure and the nature and use of fuel, provided the test requirements are met.

TEST ASSEMBLIES

Test Assemblies.

6. (a) The test assembly shall be truly representative as to material, details (installation, hardware trim, and finish), and workmanship of the construction for which classification is desired. A record of materials and construction details, adequate for identification, shall be made.

(b) The test assembly shall consist of the door or doors, together with the necessary framing and appurtenances, installed in a single opening on one or both sides of a common wall.

Size of Test Assembly.

7. The classification or rating derived from the test assembly shall be considered to apply to doors of similar design and construction, smaller in dimension and in area, or whose area does not exceed that of the test assembly by more than 25 per cent.

Mounting of Test Assembly.

8. (a) Swinging doors shall be mounted so as to open into the furnace chamber. Sliding and rolling doors, unless of the flush-mounted type, shall be mounted on the fire side of the wall. Clearances of swinging doors of hollow metal or kalamein types shall conform to good practice,* but shall not be less than 3/32 in. between the door and hinge and lock jambs, 1/16 in. at the top, and 3/16 in. at the bottom.

(b) Minimum clearances for swinging wood doors shall be 1/8 in. at the sides and top, and 3/16 in. at the bottom.

(c) If special tightness against the passage of smoke is desired, or if other clearances are used for any reason, the actual clearances shall be reported in the classification of the test assembly.

(d) Sliding and rolling doors of any type shall fit well against wall surfaces or in guides, but retaining methods shall allow free and easy movement of the door from any position.

CONDUCT OF FIRE TESTS

Fire Test.

9. (a) During the fire test the pressure within the furnace shall be maintained as nearly equal to the outside atmospheric pressure as possible.

*Hollow Metal Single-Acting Swing Doors, Frames, and Trim, Dept. of Commerce Simplified Practice Recommendation R82-28, and Kalamein Single-Acting Swing Doors, Frames, and Trim, Dept. of Commerce Simplified Practice Recommendation R83-28.

(b) The fire test on the test assembly shall be continued until failure occurs, or the limit of resistance specified by the submitter has been met.

Hose Stream Test.

10. (a) Unless the optional program of the following Paragraph (c) is specified, a duplicate test assembly shall be subjected to a fire exposure test for a period equal to one half of the fire resistance period in the fire endurance test, but not for more than 1 hr., immediately after which the test assembly shall be subjected to the impact, erosion, and cooling effects of a hose stream directed first at the middle and then at all parts of the exposed face, changes in direction being made slowly.

(b) *Exemption.*—The hose stream test shall not be required in the case of the opening protective having a resistance period, indicated in the fire resistance test, of less than 1 hr.

(c) *Optional Program.*—When the test assembly is tested for a desired time limit of fire resistance, the submitter may elect, with the advice and consent of the testing authority, to have the hose stream test made on the assembly subjected to the fire resistance test and immediately following the expiration of the fire resistance test.

(d) *Stream Equipment and Details.*—The stream shall be delivered through 2½-in. hose discharging through a National Standard Playpipe of corresponding size equipped with a 1¼-in. discharge tip of the standard taper smooth-bore pattern without shoulder at the orifice. The water pressure and duration of application shall be as prescribed in Table I.

TABLE I.

Resistance Period	Water Pressure at Base of Nozzle, psi.	Duration of Application, min. per 100 sq. ft. exposed area*
4 hr. and over.....	45	5
2 hr. and over, if less than 4 hr.....	30	2½
1 hr. and over, if less than 2 hr.....	30	1½
Less than 1 hr. (if desired).....	30	1

*A 1-min. application of the hose stream shall be the minimum.

(e) *Nozzle Distance.*—The nozzle orifice shall be 20 ft. from the center of the exposed surface of the test assembly if the nozzle is so located that when directed at the center its axis is normal to the surface of the test assembly. If otherwise located, its distance from the center shall be less than 20 ft. by an amount equal to 1 ft. for each 10 deg. of deviation from the normal.

Time of Testing.

11. Masonry settings shall be allowed to dry for at least 3 days before tests are made.

CONDITIONS OF ACCEPTANCE

Heat Insulation.

12. The testing authority shall record and include in the test report, the temperature measurements taken within the furnace and on the unexposed side of the test assembly as specified in Sections 3 (a) and (b), and 4 (a) to (d). Observations of features of the test having a bearing upon the performance of the test assembly shall also be made a part of the report, including passage or production of fumes and smoke.

Fire Resistance.

13. The fire resistance test shall not be regarded as successful unless the following conditions are met:

(a) The test assembly shall have remained securely in the opening during the fire exposure period and, if required, during the hose stream test. When the test assembly comprises two doors located one on each face of a common wall, the test conditions are met when the door on the unexposed side remains securely in the opening, irrespective of the condition of the door on the fire side.

(b) The test assembly shall have withstood the fire endurance and hose stream test, except that small portions of glass dislodged by the hose stream shall not be considered a weakness, without developing openings anywhere through the assembly, or openings markedly in excess of the initial clearances at the outside or meeting edges.

(c) If a transmitted temperature end point is specified, it shall be considered as a condition of acceptance.