NFPA No.
255
File: 200 Series
Building Construction

Method of Test of

Surface Burning Characteristics of

BUILDING MATERIALS

May
1958

Thirty-five cents*

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NATIONAL FIRE PROTECTION ASSOCIATION
International
60 Batterymarch St., Boston 10, Mass.

2M-6-58 WP-PP *Discount for Quantities Printed in U. S. A.

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 two hundred national and regional societies and associations (list on outside back cover) and seventeen 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.

Method of Test of Surface Burning Characteristics of Building Materials

NFPA No. 255 — May 1958

This standard was adopted by the National Fire Protection Association on May 22, 1958 on recommendation of the Committee on Fire Tests to supersede the standard adopted in 1955. This 1958 edition is a complete revision of the 1955 standard including a change in the title of the standard.

Previous editions of this standard have been published by Underwriters' Laboratories, Inc. as UL 723.

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History

The test procedure covered by this standard was originally developed by Underwriters' Laboratories, Inc. and a descriptive article thereon was published in the NFPA Quarterly for July, 1943. Subsequently the test method was considered by Committee E-5 of the American Society for Testing Materials and adopted by the ASTM as a tentative standard in 1950. Subsequent to NFPA action on this standard on recommendation of the Committee on Building Construction in 1953, a new NFPA Committee on Fire Tests was created to provide the machinery for NFPA action on fire test standards in cooperation with the American Society for Testing Materials. The NFPA Committee on Fire Tests has interlocking membership with the ASTM committee. At the 1955 Annual Meeting the Committee on Fire Tests by a divided vote recommended continuing tentative status but in view of the recommendation of the NFPA Committee on Building Construction and also of the NFPA Committee on Safety to Life which needed this standard for use in connection with interior finish requirements (see NFPA No. 101), the Standard was officially adopted in 1955 and a revised edition in 1958.

METHOD OF TEST OF SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS*

NFPA No. 255 — May 1958

1. Scope

(a) This method of test of surface burning characteristics of building material is applicable to any type of building material that by its own structural qualities, or by the manner in which it is applied, is capable of supporting itself in position. The purpose is to determine the comparative burning characteristics of the material under test by evaluating the flame spread over its surface, fuel contributed by its combustion, and the density of smoke developed when exposed to a test fire.

(b) It is the intent of this method of test to register performance during the period of exposure, and not to determine suitability for use after the test exposure.

(c) This method does not establish ratings or standards of performance for specific uses, as these depend upon service requirements.

NOTE: Reference may be made to the Standard Methods of Fire Tests of Building Construction and Materials, (NFPA No. 251) for procedures for determining the performance under fire exposure conditions, of building constructions and materials when incorporated into a test structure and subjected to a standard exposing fire of controlled extent and severity.

2. Fire Test Chamber

(a) The fire test chamber shall consist of a horizontal duct having an inside width of 17½ ± ½ inch, a depth of 12 ± ½ inch measured from the bottom of the test chamber to the top of the inner walls, and a length of 25 feet. The sides and base of the duct shall be lined with an insulating masonry material. One side shall be provided with draft-tight observation windows so that the entire length of the test sample may be observed from outside the fire test chamber. Each end of the fire test chamber shall be constructed to provide a free flow of air without turbulence.

*Formerly known as Fire Tests for Fire Hazard Classification of Building Materials.

The top shall consist of a removable, insulated and noncombustible structure of a size necessary to cover completely the fire test chamber and to accommodate the test samples. The top shall be designed so that it can be sealed against the leakage of air into the fire test chamber during test and to permit the attachment of test samples.

(b) One end of the test chamber, designated as the "fire end," shall be provided with gas burners delivering flames upward against the surface of the test sample. The burners shall be spaced 6 to 12 inches from the fire end of the sample and $7\frac{1}{2} \pm \frac{1}{2}$ inch below the under surface of the test sample. The burners shall be so located that the flame is evenly distributed over the cross section of the furnace. The quality of fuel shall be uniform during any series of tests and shall be the same as used in the calibration tests for that series. Suitable controls shall be installed to assure a constant flow of fuel to the burners during periods of use. An adjustable air intake extending the entire width of the test chamber shall be provided at the fire end.

(c) The other end of the test chamber, designated as the "vent end," shall be provided with a vent pipe fitted with a damper for regulating the velocity of the air flow in the chamber. The movement of air shall be by induced draft and shall be sufficient to provide draft in excess of that required for test.

NOTE: It has been found satisfactory to have about twice as much draft available as usually used in a test.

A draft gage to indicate static pressure in the vent pipe shall be installed upstream of the damper and at a point of minimum air turbulence. A light source shall be mounted on a horizontal section of the vent pipe, at a point where it will not be affected by flame in the tunnel, and a beam of light directed downward along the vertical axis of the vent pipe. A photoelectric cell of which the output is directly proportional to the amount of light received shall be mounted under the light source and connected to a meter suitable for indicating changes in smoke density.

(d) A 16 or 18 gage unprotected thermocouple shall be inserted through the floor of the test chamber so that the tip shall be 1 inch from the exposed surface of the test sample and within 1 foot of the vent end of the test sample at approximately the center of its width.

3. Test Samples

(a) The test sample shall be at least 2 inches wider than the interior width of the tunnel and the full length of the tunnel. It shall be truly representative of the material for which classification is desired. Properties adequate for identification of the materials or ingredients or both of which the test sample is made shall be determined and recorded.

(b) The test sample shall be conditioned to a constant weight at a temperature of 70 ± 5°F. and at a relative humidity of 35 to 40 per cent.

(c) The test sample shall be attached to the underside of the removable top or placed on the test chamber in a manner truly representative of intended use.

4. Test Procedure

(a) The removable top of the test chamber, with the sample attached to its lower face or set in place, shall be placed in position and all joints sealed against the infiltration of air.

(b) The draft regulating damper shall be adjusted to establish the standard air velocity ± 5 feet per minute, determined as follows: The average air velocity through the tunnel shall be measured at seven symmetrically placed points at the vent end on a line 6 inches above the bottom. The air flow shall be adjusted to give an average velocity thus obtained of 240 ± 5 feet per minute. The velocity observed at the center point under this condition shall be the standard air velocity. The corresponding reading on the draft gauge shall be noted, and this reading shall be maintained throughout the test by regulation of the damper. The air supply shall be maintained at 70 ± 5°F., and relative humidity at between 35 and 40 per cent.

(c) Prior to the start of any test or series of consecutive tests, the test chamber shall be preheated for a minimum of 10 minutes with the removable top in place and with the fuel supply equivalent to that used in tests. This preheating is for the purpose of approximating the conditions that will exist following successive tests. The photoelectric cell output shall be observed immediately prior to each test.

(d) The igniting flame shall be lighted and adjusted as follows: The flame shall be such that under the controlled conditions described above, a test sample of select grade red oak flooring will spread flame 19½ feet from the end of the igniting fire in 5½ ± ½ minute. The test shall be continued for a 10 minute period unless the sample is completely consumed in the fire area before that time, in which case the test shall be ended after complete combustion occurs.

NOTE: When setting up new test apparatus, it is suggested that the fuel supply be initially adjusted at approximately 4800 Btu per minute.

(e) When the test is ended, the gas supply shall be shut off, smoldering and other conditions within the test duct observed, and the sample removed for further examination.

5. Calibration of Test Equipment

(a) With the test equipment adjusted as above described, a test or series of tests shall be made, using select grade red oak flooring as the sample. Observations shall be made continually and the time recorded when flame reaches the end point, that is 19½ feet from the end of the ignition fire. The temperature measured by the thermocouple near the vent end shall be recorded at least every minute and the photoelectric cell output at least every 15 seconds.

(b) The temperature and photoelectric cell readings shall be separately plotted on suitable coordinate paper. The average of the results of three calibration tests of select grade red oak flooring in which the flame spreads 19½ feet from the end of the igniting flame in 5½ minutes shall be considered as representing a classification of 100.

(c) Following the calibration tests for red oak, a similar test or tests shall be conducted on samples of asbestos cement board, and the corresponding results plotted. These results shall be considered as representing a classification of 0.

6. Classification

(a) The flame spread classification shall be determined as follows:

(1.) For materials on which flame spreads 19½ feet in 5½ minutes or less, the classification shall be 100 times

5½ minutes divided by the time in minutes in which flame spreads 19½ feet.

(2.) For materials on which flame spreads 19½ feet in more than 5½ minutes but not more than 10 minutes, the classification shall be 100 times 5½ minutes divided by the time in minutes in which flame spreads 19½ feet, plus one half the difference between this result and 100.

(3.) For materials on which flame spreads only part way then ceases to continue or recedes, the classification shall be 100 times the distance in feet from the igniting flame to the extreme flame travel on the sample divided by 19½ feet.

(b) The test results for fuel contributed and smoke shall be plotted, using the same coordinates, and comparison of the areas under the respective curves will establish a numerical classification by which the performance of the material may be compared with that of asbestos cement board and select grade red oak flooring which have been arbitrarily established as zero and 100, respectively.

NOTE: Allowance should be made for accumulation of soot and dust on the photoelectric cell during the test.

Materials of 0 flame spread classification having highly insulating properties may show an apparent contribution of fuel due to the lessened heat loss through the sample.

7. Analysis of Products of Combustion

Although not required as a part of this procedure, products of combustion may be drawn from the test duct during the progress of the test for chemical analysis to determine degree of toxicity or other characteristics that might be of concern considering the intended use of the material undergoing test.

POCKET EDITIONS OF NFPA STANDARDS

Standards published in 4¾ x 7¼ in. size, revised as of June 2, 1958. For complete list of publications write National Fire Protection Assn., 60 Batterymarch St., Boston 10, Mass.

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