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*File: 200 Series
Building Construction*

Fire Tests for
Fire Hazard Classification of
BUILDING MATERIALS

May
1955



Twenty-five cents*

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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 over a hundred and ninety national and regional societies and associations (list on outside back cover) and more than fifteen 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 Hazard Tests of Building Materials.

NFPA No. 255—1955

This standard was adopted by the National Fire Protection Association on May 19, 1955 to supersede the tentative standard adopted in 1954 on recommendation of the NFPA Committee on Building Construction. The text is the same as that of the 1954 edition except for a change in title.

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 1954, 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 the same chairman as the ASTM committee and interlocking membership. 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. 101C), the Standard was officially adopted on May 19, 1955.

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FIRE TESTS FOR FIRE HAZARD CLASSIFICATION OF BUILDING MATERIALS

NFPA No. 255—1955; ASTM Designation: E 84-50T

1. Scope.

(a) This method of fire hazard classification 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 fire hazard classification of the material under test by evaluating the rate of flame spread over its surface, rate of combustion and heat generated, and the smoke density developed when attacked by an exposing fire.

(b) It is the intent that classification shall register performance during the period of exposure, and shall not be construed as having determined 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.

2. Test Equipment.

The test equipment may be located at any place where all the necessary facilities for properly conducting the test are provided.

NOTE: Reference may be made to the Underwriters' Laboratories, Inc. Bulletin of Research No. 32, September, 1944, for photographs and diagrams of equipment and fire hazard classifications of various representative materials.

3. Fire Test Chamber.

(a) The fire test chamber shall consist of a duct having an inside width of 17 inches and a length of 25 feet. The sides and base of the duct shall be insulated and of noncombustible material, one side being provided with numerous observation ports. The removable top or roof shall consist of an insulated structural framework 25 feet long and 20 inches wide formed into a flat non-combustible surface, which shall be fitted to the top of the duct in such a manner as to preclude air leakage into the test structure around its edges. The material to be tested shall be applied to the lower face of this framework in the same manner as it will be applied in actual use.

(b) One end of the chamber, designated as the "fire end," shall be provided with gas burners delivering flames vertically upward against the surface of the test sample. An adjustable opening and a tube for attaching a draft gage shall be provided at this end to permit the passage and recording of the desired amount of air.

(c) The other end of the chamber, designated as the "vent end," shall be provided with a vent pipe fitted with a manually controlled damper for regulating the velocity of air travel. Movement of air may be produced by induced draft or by a variable-speed suction fan. A light source shall be mounted on the vent pipe so as to direct a beam of light along the vertical diameter of the pipe. The beam of light shall be received on a photoelectric cell, which in turn shall be connected to a suitable microammeter. The cell shall be of a type whose current output is directly proportional to the light intensity.

(d) A thermocouple shall be inserted through the floor of the duct, the tip being located 1 inch from the exposed surface of the sample and 24 feet distant from the fire end of the sample.

4. Test Samples.

(a) The test sample shall be truly representative of the materials for which classification is desired, and assembled under conditions representative of actual practice applied in building construction and operation. The physical properties of the materials or ingredients, or both, used in the test sample shall be determined and recorded.

(b) The test sample shall be conditioned before test until constant conditions have been reached at a temperature of $70 \pm 5^\circ$ F., and at a relative humidity of 35 to 40 per cent.

(c) The test sample shall be attached to the removable top of the test structure in the same manner and using the same materials for attachment as are recommended in the manufacturer's instructions for application and use.

5. Test Procedure.

(a) The removable top of the test chamber, with the sample attached to its lower face, shall be placed in position and all joints sealed against the infiltration of air. The draft regulating damper shall be adjusted to establish an air velocity of 200 ± 5 fpm., measured in the full cross-section of the duct at the vent end. The corresponding reading on the draft gage shall be

noted, and this reading shall be maintained throughout the test by regulation of the damper. The air supply shall be maintained at $70 \pm 5^\circ$ F., and relative humidity at between 35 and 40 per cent.

(b) The igniting flame shall be lighted and adjusted as follows: The flame shall be such that under the controlled conditions described in Paragraph (a), a test sample of select Grade A red oak¹ will become involved in flame throughout its entire length in 6 min. (Note). The test shall be continued for a 10-min. 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: This will require the equivalent of a test flame the full width of the duct, about $4\frac{1}{2}$ ft. long, and burning approximately 8 cu. ft. of 800-btu. gas per min.

(c) 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.

6. Calibration of Test Equipment.

(a) With the test equipment adjusted as above described, a series of tests shall be made, using asbestos-cement board as the sample. Observations shall be made each 15 seconds of the length of spread of flame (which will be that of the test flame only), of the temperatures recorded by the thermocouple at the 24-ft. location (which will record the temperatures developed by the test flame only), and of the microammeter readings (which will record the reduced clear beam reading caused by the products of combustion of the test flame only).

(b) The three sets of readings shall be separately plotted on suitable coordinate paper and shall be considered as representing a classification of *zero* because the sample contributes neither to spread of fire, to heat of combustion, nor generation of smoke.

(c) Following establishment of the zero classification, similar tests shall be conducted on samples of select Grade A red

¹Select red oak was chosen for the purpose because, among other reasons, the term denotes a fairly uniform material throughout the United States, whereas many other designations have a purely local significance.

oak, and the corresponding results plotted. These results shall be considered as representing a classification of 100.

7. Classification.

(a) The flame spread classification shall be determined by comparing the rate of time in which flame reaches the far end of the sample, if it does, with that established for red oak. If flame travels only part way of the sample, then ceases to continue or recedes, the comparison shall be made on the ratio of the distance traveled, measured from the end of the igniting flame to the extreme flame travel on the sample.

NOTE: If flame reaches the end of the sample in 3 minutes as compared to 6 minutes for red oak, the classification is 200. If flame extends one half the distance from the end of the test flame to the end of the sample, then ceases to advance or recedes, the classification is 50.

(b) The test results for heat 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 A red oak which have been arbitrarily established as zero and 100, respectively.

8. Analysis of Products of Combustion.

Although not 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, irritability, 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 4 $\frac{1}{4}$ x 7 $\frac{1}{4}$ in. size, revised as of May 21, 1955. For complete list of publications write National Fire Protection Assn., 60 Batterymarch St., Boston 10, Mass.

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