NFPA 203

Guide on Roof Coverings and Roof Deck Constructions

2000 Edition

NFPA, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 203

Guide on

Roof Coverings and Roof Deck Constructions

2000 Edition

This edition of NFPA 203, *Guide on Roof Coverings and Roof Deck Constructions,* was prepared by the Technical Committee on Building Construction and acted on by the National Fire Protection Association, Inc., at its World Fire Safety Congress and Exposition™ held May 14–17, 2000, in Denver, CO. It was issued by the Standards Council on July 20, 2000, with an effective date of August 18, 2000, and supersedes all previous editions.

This edition of NFPA 203 was approved as an American National Standard on August 18, 2000.

Origin and Development of NFPA 203

In 1909, the former NFPA Committee on Devices and Materials presented a report on the Classification of Roofing Materials, which was revised and officially adopted in 1910. This report included standards on testing and certain other details that have since become obsolete. When the committee was suspended in 1911, the responsibility for the classification of roofing materials was assumed by Underwriters Laboratories Inc., and the UL classification system was adopted and published by NFPA in 1960 in NFPA 203, together with the 1910 Classification of Roofing Materials and a suggested roofing ordinance.

The 1970 edition was issued as a manual that provided general information on roof coverings and their fire characteristics. Since the 1970 edition, four other updates were made (1980, 1987, 1992, and 1995) that primarily involved editorial changes.

The 2000 edition includes the latest information on the current test standards for evaluating roof covering materials and assemblies.

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Roof Coverings and Roof Deck Constructions

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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. Where one or more complete paragraph(s) has been deleted, the deletion is indicated by a bullet between the paragraphs that remain.

Chapter 1 Introduction

1.1 General.

1.1.1 The term *roof covering* refers to the material or the combination of materials applied on top of the roof deck for weatherproofing and can include insulation.

1.1.2 Since most roof coverings are combustible to some degree, they could be vulnerable to external fire exposure. Some roof coverings propagate a rapidly spreading fire over the surface or allow the fire to penetrate the roof covering and to communicate to the interior of the building and need to be avoided.

1.1.3 Roof coverings over metal and some other decks also should be considered for their possible contribution to fire spread originating on the interior of the building. The heat of the interior fire rises to the ceiling and can cause the liberation of combustible gases and flaming droplets through the joints, overlaps, and distortions of the deck. This can contribute significantly to the fire by means of flame spread beneath the roof and ignition of combustible contents by means of burning droplets of flowing materials.

1.1.4 A wide variety of roof coverings and roof deck constructions have been fire tested and listed by testing laboratories with respect to their characteristic behavior when subjected to both external and internal fire exposure.

1.1.5 Precautions should be taken during the installation of roof decks or coverings and above-deck components to prevent fire. *(For further information, see NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.)*

Chapter 2 General Types of Roof Coverings

2.1 Composition Built-up. As the term implies, these coverings consist of alternate layers of felt and bitumen built up into a weatherproof membrane. The felts are supplied in rolls and could be composed of organic, glass, polyester, or other fibers saturated with bituminous material. Bitumen is used to bond the felts to each other and, in some cases, to insulation or to the deck. It could consist of hot or cold applied asphalt or hot applied coal tar pitch. The finished surface could be a smooth flood coat of bitumen, or it could have gravel or slag imbedded in it. The gravel or slag surfacing acts to reflect heat, to prevent flow and cracking of the bitumen, and to improve the fire performance of the coverings. Another finish could be a granular-surfaced capsheet. These coverings normally are applied to low slope roofs.

2.2 Prepared Coverings. These coverings are factory produced and ready for attachment to the deck, providing the complete weatherproofing. They include tile, slate, metal, shingle, and sheet goods. The shingle and sheet materials are of organic, glass felt, or other felt base coated with asphalt and surfaced with granules. Prepared coverings need sufficient slope for drainage.

2.3 Wood Shingles and Shakes. These usually are made from red cedar, redwood, or cypress wood. The shingles are sawed with a taper and applied with nails exposing one-third of the thick end. Shakes are split pieces resulting in a rough and uneven surface. They are applied like shingles. A sufficient slope for drainage is needed.

2.4 Elastomer Coverings. Elastomer is a term given to coverings of essentially one layer that are applied in a thin membrane having elastic properties. Some of the advantages include light weight, reflectivity, color, resistance to corrosive atmospheres, and capability of application on steep or complex-shaped roofs. The materials generally are synthetic rubber or plastic products supplied in sheet form that is cemented to the deck or in liquid form for brush, spray, or roller application. The sheets usually are 35 mil (0.035 in, 0.89 mm) to 60 mil (0.060 in, 1.52 mm) thick, and the dry film of the liquid form is approximately 20 mil (0.020 in, 0.51 mm) to 30 mil (0.030 in, 0.76 mm) thick. A solid deck with grouted or taped joints and cracks is necessary for use of elastomer coverings. The manufacturer's specifications should be followed carefully for proper application.

Chapter 3 Fire Performance Classification

3.1 Exterior Exposure.

3.1.1 One test method that should be used for the evaluation of roof coverings from exterior fire exposure has gained national recognition. In fact, no other method of evaluation is recognized as acceptable by any approval authorities. A detailed description of the test procedure, apparatus, and criteria for classification can be obtained by reference to Underwriters Laboratories Inc. The same basic test methods also are provided in NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*.

3.1.2 The tests consist of exposing the top surface of specimen roof decks to both gas flames and burning wood brands to determine if the coverings allow any of the following:

(1) Exposure of the deck below
(2) Excessive flame propagation of the covering itself
(3) Release of flaming or glowing material from the covering or the deck

3.1.3 The tests are arranged to provide three levels of severity by adjusting the temperature and duration of the gas flame and the sizes of the burning wood brands. Successful coverings are rated Class A, Class B, or Class C, with Class A withstanding the most severe exposure, Class B withstanding intermediate exposure, and Class C withstanding the least severe exposure. A photograph of the test apparatus is shown in Figure 3.1.3(a), and an illustration of the wood brands is shown in Figure 3.1.3(b).

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FIGURE 3.1.3(a) Test apparatus.

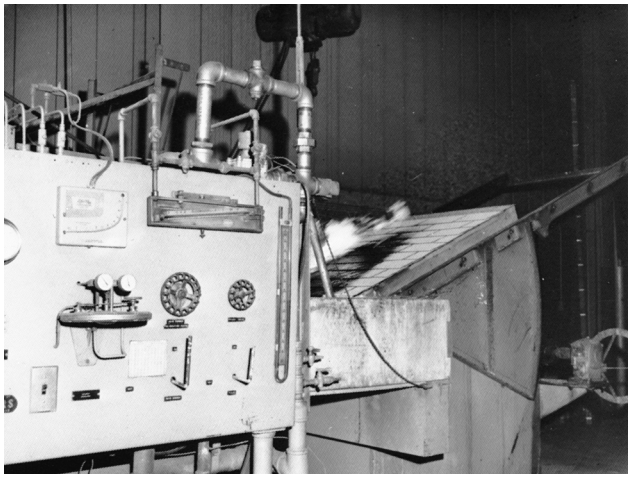
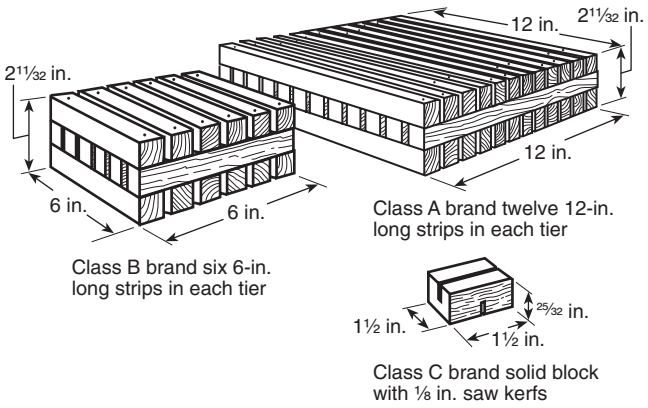


FIGURE 3.1.3(b) Class A, Class B, and Class C brands.



For SI units, 1 in. = 25.4 mm.

3.1.4 Supplementary rain and weathering tests are conducted on wood shingles and shakes to ensure a high level of permanence for the treating materials.

3.1.5 In addition to roof coverings that have been classified in accordance with NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*, concrete, slate, concrete masonry, brick, metal, and tile generally are considered acceptable where Class A roof coverings are required by building codes.

Chapter 4 Fire Classification — Interior Exposure

4.1 Insulated Metal Deck.

4.1.1 General. In the case of interior fires, the entire assembly comprised of the metal deck, vapor retarder, adhesives, insulation, and roof covering should be considered. A rapidly spreading under-the-deck fire is possible in such an assembly. Since the insulation frequently is considered part of the covering, an examination of insulated metal deck is appropriate.

4.1.2 Fire experience has demonstrated that the nature and quantity of combustible adhesives, the vapor retarder, the insulation, the roof covering, or a combination thereof above a metal roof deck can contribute significantly to the development of an interior fire. The heat from the fire is readily transmitted to the combustibles directly above the metal deck, where destructive distillation liberates combustible gases. These hot gases build up pressure and, since they are unable to vent to atmosphere because of the watertight roof covering, they are forced downward through the joints in the metal deck where they are ignited.

4.1.3 If these gases are liberated in sufficient quantity, they could progressively vaporize, surrounding the insulation, vapor retarder, and adhesive in a cyclic manner. Therefore, the fire beneath the roof can propagate rapidly and independently of the fire in the contents. Adhesive could drip through the roof deck joints, rain down on combustible contents, and ignite them.

4.1.4 The Factory Mutual Research Corporation and Underwriters Laboratories Inc. conducted comprehensive large-scale fire tests to determine the fire characteristics of insulated metal deck roof constructions. In a 20 ft × 100 ft (6.1 m × 30.5 m) fire test building with a severe fire source at one end, fire propagation beneath the roof deck was demonstrated and droplets of adhesive ahead of the fire source were evident. Continued studies established that a roof assembly consisting of a metal deck, a 1-in. (25.4-mm) thick vegetable fiberboard mechanically fastened to the deck, and a built-up roof covering would not propagate a rapidly spreading fire. The performance of this assembly established the criteria for judging other assemblies. Views of the test building are shown in Figures 4.1.4(a), (b), and (c).

FIGURE 4.1.4(a) Overall view of 20 ft × 100 ft (6.1 m × 30.5 m) fire test building from exhaust end.



4.1.5 Small-scale tests for the classification of roof decks have been developed by both the Factory Mutual Research Corporation and Underwriters Laboratories Inc. based upon performance in the large building tests of acceptable constructions.

4.2 Factory Mutual Classification. Assemblies are placed in the construction materials calorimeter, which yields results in terms of rate of heat release. Those assemblies that release heat at a sufficiently low rate are designated as being in Class 1. Metal roof deck assemblies that fail to meet the fire requirements are designated as being in Class 2. Details of the test setup and pass/fail criteria are contained in FMRC Approval Standards 4450, *Class 1 Insulated Steel Deck Roofs*, and 4470, *Roof Covers*.

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FIGURE 4.1.4(b) View of firing mechanism of fire test building.

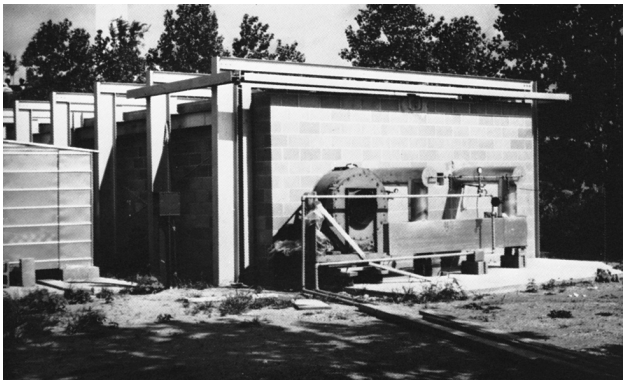
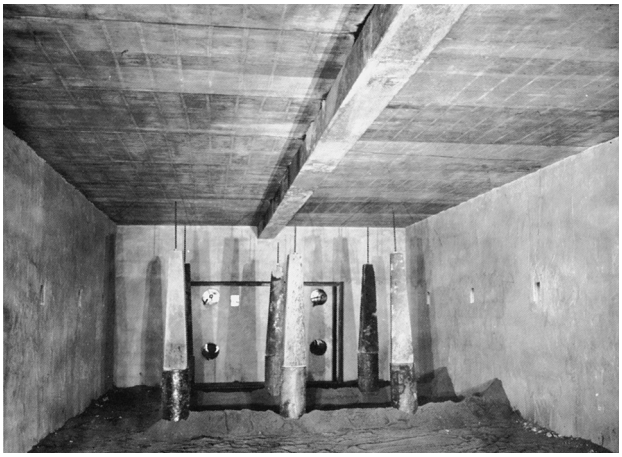


FIGURE 4.1.4(c) Interior view of firing end of fire test building.



4.3 Underwriters Laboratories Inc. Classification. Where a basic roof deck design has demonstrated its performance in the 100-ft (30.5-m) building test, variations of that design can be tested in the Steiner Tunnel furnace and compared to the performance of the appropriate acceptable roof assembly. If equivalent, the assembly is listed and given a construction number. Equivalency is judged on the basis of flame spread and extent of damage. Details of the test set up and pass/fail criteria are contained in UL 1256, *Fire Test of Roof Deck Construction.*

Chapter 5 Selection of Roof Coverings from a Fire Standpoint

5.1 General. The selection of roof coverings and roof deck constructions to resist fire propagation should be based on the proximity and severity of the external fire exposure and on the threat of internal fire from the contents and operation within the building. Those roof coverings with the greatest resistance to severe fire (Class A) are preferable. Both built-up and prepared roof coverings can be specified with a Class A rating, while treated wood shingles generally qualify for Class B or Class C ratings. The manufacturer's specifications should be followed carefully, and no variation from the materials or methods of construction for classified systems should be permitted.

5.2 Built-up Coverings. Gravel or slag could be needed on the roofing surface for its fire resistance qualities. (Gravel or slag is also desirable for resistance to hailstones.) Many built-up roofs are limited in maximum slope.

5.3 Prepared Roofs. As with built-up roofs, roof slope is a design consideration.

5.4 Wood Shingles and Shakes. Untreated wood shingle roofs have been looked at with disfavor by the NFPA for many years. NFPA statistics indicate that wood shingles have been a contributing factor in more conflagrations than any other of 27 factors from 1901 to 1967. This was particularly true in the first half of this period, before the full impact of modern building codes, which restricted the construction of wood shingled roofs. If wood shingles or shakes are to be used, they should be fire-retardant treated by impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPA C1, *All Timber Products — Preservative Treatment by Pressure Processes,* and classified in accordance with NFPA 256, *Standard Methods of Fire Tests of Roof Coverings.* Untreated shingles or shakes should not be used.

5.5 Elastomer Coverings. Some of the liquids used in applying these coverings are flammable, and no open flames should be permitted near the areas of application.

Chapter 6 Referenced Publications

6.1 The following documents or portions thereof are referenced within this guide and should be considered as part of its recommendations. The edition indicated for each referenced document is the current edition as of the date of the NFPA issuance of this guide.

6.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, 2000 edition.

NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*, 1998 edition.

6.1.2 Other Publications.

6.1.2.1 AWPA Publication. American Wood-Preservers' Association, P.O. Box 5690, Granbury, TX 76049.

AWPA C1, *All Timber Products — Preservative Treatment by Pressure Processes,* 1999.

6.1.2.2 FMRC Publications. Factory Mutual Research Corporation, P.O. Box 9102, 1151 Boston-Providence Turnpike, Norwood, MA 02062-9102.

FMRC 4450, *Approval Standard for Class 1 Insulated Steel Deck Roofs.*

FMRC 4470, *Approval Standard for Roof Covers*, April 1986.

6.1.2.3 UL Publication. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 1256, *Fire Test of Roof Deck Construction,* March 1998.

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