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# NFPA 220 Types of Building Construction 1985

National Fire Protection Association Batterymarch Park, Quincy, MA 02269

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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 220**

**Standard on**

# Types of Building Construction

**1985 Edition**

This edition of NFPA 220, *Standard on Types of Building Construction*, was prepared by the Technical Committee on Building Construction, released by the Correlating Committee on Building Construction, and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 13-17, 1985 in Chicago, Illinois. It was issued by the Standards Council on June 6, 1985, with an effective date of June 26, 1985, and supersedes all previous editions.

The 1985 edition of this standard 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 220

In 1952 the Committee on Building Construction secured tentative adoption of Standard Types of Building Construction at the NFPA Annual Meeting. At the 1954 NFPA Annual Meeting, revisions of the 1952 tentative text were adopted by the Association, and in 1955 minor revisions were also acted upon favorably. A new definition of "noncombustibility" and editorial changes in the description of the fire resistance rating of structural members (under the definition of fire-resistive construction) were adopted at the 1956 NFPA Annual Meeting on recommendation of the Committee on Building Construction.

In 1958 with the use of plastics in building construction, recommendations on the types of standard fire tests to be used in evaluating the firesafety of these materials were adopted and inserted in the Appendix.

In 1961 an Appendix was adopted to furnish a guide to NFPA Committees, regulatory officials, and others relative to the classification of air-supported structures.

In 1975 a more fundamental definition for noncombustible was added including the introduction of "limited-combustible" based on potential heat value limitations and more generalized definitions for types of building construction.

In 1979 the standard was extensively rewritten to introduce the nomenclature related to construction types "Type I" through "Type V" which include parenthetically placed hourly fire resistance designations of the structural components.

This 1985 edition includes the addition of a new Chapter 4 which lists referenced publications whose use is mandated within this standard.

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## Contents

# NFPA 220

## Standard on

# Types of Building Construction

## 1985 Edition

Information on referenced publications can be found in Chapter 4 and Appendix A.

## Chapter 1 General

**1-1 Purpose.** This standard outlines basic definitions for standard types of building construction for reference by committees operating under the procedures of the National Fire Protection Association.

**1-2 Scope.** This standard considers only those factors necessary to define building types. The requirements for partitions, fire separation partitions, shaft enclosures and fire walls, other than bearing walls and partitions, are not related to the construction types and need to be specified in other standards and codes, where appropriate. It is also necessary for the user to consider the influence of location, occupancy, exterior exposure, possibility of mechanical damage to fire protection material, and other features which may impose additional requirements for safeguarding life and property, as commonly covered in building codes.

**1-3 Guide to Classification of Types of Construction.** The types of construction include five basic types designated by Roman numerals as Type I, Type II, Type III, Type IV, and Type V. This system of designating types of construction also includes a specific breakdown of construction type through the use of Arabic numbers. These numbers follow the Roman numeral notation when naming a type of construction, e.g., Type I-443, Type II-111, Type III-200, etc.

The Arabic numbers following each basic type (Type I, Type II, etc.) designate the fire resistance rating requirements for certain structural elements as follows:

*First Arabic Number* — Exterior bearing walls.

*Second Arabic Number* — Structural frame or columns and girders, supporting loads for more than one floor.

*Third Arabic Number* — Floor Construction.

## Chapter 2 Definitions[1]

**2-1 Fire Resistance Rating.** The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as established in accordance with the test procedures of NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials.*[2]

**2-2 Flame Spread Rating.** Numbers or classifications obtained according to NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials.*

**2-3 Limited-Combustible.** As applied to a building construction material, a material, *not complying with the definition of noncombustible material,* which, in the form in which it is used, has a potential heat value not exceeding 3500 Btu per lb (8141 Kj/Kg),[3] *and* complies with one of the following paragraphs (a) or (b). Materials subject to increase in combustibility or flame spread rating beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible.

(a) Materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of ⅛ in. (3.2 mm) which has a flame spread rating not greater than 50.

(b) Materials, in the form and thickness used, other than as described in (a), having neither a flame spread rating greater than 25 nor evidence of continued progressive combustion *and* of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread rating greater than 25 nor evidence of continued progressive combustion.

**2-4 Minimum Hourly Fire Resistance Rating.** That degree of fire resistance deemed necessary by the authority having jurisdiction.

**2-5 Potential Heat Value.** The average value, in Btu per pound, obtained by testing a building material in accordance with the *Tentative Method of Test for Potential Heat of Materials in Building Fires.*

**2-6 Noncombustible Material.** A material which, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors, when subjected to fire or heat. Materials which are reported as passing ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C,* shall be considered noncombustible materials.

## Chapter 3 Types of Construction

**3-1 Type I (443-332).**

**3-1.1** Type I construction is that type in which the structural members, including walls, columns, beams, floors, and roofs, are of approved noncombustible or

[1]These definitions apply to the materials used in the construction of buildings, but do not apply to furnishings or the contents of buildings, or to the fire hazard evaluation of materials.

[2]The fire resistance of building construction varies with the susceptibility to damage by fire of the building materials used and the degree of fire protection, if any, provided for the structural members.

[3]See NFPA 259, *Standard Test Method for Potential Heat of Building Materials.*

limited-combustible materials and have fire resistance ratings not less than those set forth in Table 3.

### 3-2 Type II (222-111-000).

**3-2.1** Type II construction is that type not qualifying as Type I construction in which the structural members including walls, columns, beams, floors, and roofs are of approved noncombustible or limited-combustible materials and have fire resistance ratings not less than those set forth in Table 3.

### 3-3 Type III (211-200).

**3-3.1** Type III construction is that type in which exterior walls and structural members which are portions of exterior walls are of approved noncombustible or limited-combustible materials, and interior structural members, including walls, columns, beams, floors, and roofs, are wholly or partly of wood of smaller dimensions than required for Type IV construction or of approved noncombustible, limited-combustible, or other approved combustible materials. In addition, structural members have fire resistance ratings not less than those set forth in Table 3.

### 3-4 Type IV[1] (2HH).

**3-4.1** Type IV construction is that type in which exterior and interior walls and structural members which are portions of such walls are of approved noncombustible or limited-combustible materials. Other interior structural members including columns, beams, arches, floors and roofs are of solid or laminated wood without concealed spaces and comply with the provisions of 3-4.2 through 3-4.6. In addition, structural members have fire resistance ratings not less than those set forth in Table 3.

*Exception No. 1: Interior columns, arches, beams, girders, and trusses of approved materials other than wood are permitted provided they are protected to provide a fire resistance rating of not less than 1 hour.*

*Exception No. 2: Certain concealed spaces are permitted by the Exception to 3-4.4.*

**3-4.2** Wood columns supporting floor loads shall be not less than 8 in. (203 mm) in any dimension; wood columns supporting roof loads only shall be not less than 6 in. (152 mm) in least dimension and not less than 8 in. (203 mm) in depth.

**3-4.3** Wood beams and girders supporting floor loads shall be not less than 6 in. (152 mm) in width and not less than 10 in. (254 mm) in depth; wood beams and girders and other roof framing, supporting roof loads only, shall be not less than 4 in. (102 mm) in width and not less than 6 in. (152 mm) in depth.

**3-4.4** Framed or glued laminated arches which spring from grade or the floor line and timber trusses which support floor loads shall be not less than 8 in. (203 mm) in width or depth. Framed or glued laminated arches for

**Table 3 Fire Resistance Requirements for Type I through Type V Construction**

| | Type I | | Type II | | | Type III | | Type IV | Type V | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 443 | 332 | 222 | 111 | 000 | 211 | 200 | 2HH | 111 | 000 |
| EXTERIOR BEARING WALLS — | | | | | | | | | | |
| Supporting more than one floor, columns or other bearing walls | 4 | 3 | 2 | 1 | 0[1] | 2 | 2 | 2 | 1 | 0[1] |
| Supporting one floor only | 4 | 3 | 2 | 1 | 0[1] | 2 | 2 | 2 | 1 | 0[1] |
| Supporting a roof only | 4 | 3 | 1 | 1 | 0[1] | 2 | 2 | 2 | 1 | 0[1] |
| INTERIOR BEARING WALLS — | | | | | | | | | | |
| Supporting more than one floor, columns or other bearing walls | 4 | 3 | 2 | 1 | 0 | 1 | 0 | 2 | 1 | 0 |
| Supporting one floor only | 3 | 2 | 2 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| Supporting a roof only | 3 | 2 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| COLUMNS — | | | | | | | | | | |
| Supporting more than one floor, bearing walls or other columns | 4 | 3 | 2 | 1 | 0 | 1 | 0 | H[2] | 1 | 0 |
| Supporting one floor only | 3 | 2 | 2 | 1 | 0 | 1 | 0 | H[2] | 1 | 0 |
| Supporting a roof only | 3 | 2 | 1 | 1 | 0 | 1 | 0 | H[2] | 1 | 0 |
| BEAMS, GIRDERS, TRUSSES & ARCHES — | | | | | | | | | | |
| Supporting more than one floor, bearing walls or columns | 4 | 3 | 2 | 1 | 0 | 1 | 0 | H[2] | 1 | 0 |
| Supporting one floor only | 3 | 2 | 2 | 1 | 0 | 1 | 0 | H[2] | 1 | 0 |
| Supporting a roof only | 3 | 2 | 1 | 1 | 0 | 1 | 0 | H[2] | 1 | 0 |
| FLOOR CONSTRUCTION | 3 | 2 | 2 | 1 | 0 | 1 | 0 | H[2] | 1 | 0 |
| ROOF CONSTRUCTION | 2 | 1½ | 1 | 1 | 0 | 1 | 0 | H[2] | 1 | 0 |
| EXTERIOR NONBEARING WALLS | 0[1] | 0[1] | 0[1] | 0[1] | 0[1] | 0[1] | 0[1] | 0[1] | 0[1] | 0[1] |

Those members listed that are permitted to be of approved combustible material.

[1] Requirements for fire resistance of exterior walls, the provision of spandrel wall sections, and the limitation or protection of wall openings are not related to construction type. They need to be specified in other standards and codes, where appropriate, and may be required in addition to the requirements of this Standard for the construction type.

[2] "H" indicates heavy timber members; see text for requirements.

[1]The dimensions used for sawn and glued laminated lumber in Section 3-4 are nominal dimensions.

roof construction which spring from grade or the floor line and do not support floor loads shall have members not less than 6 in. (152 mm) in width and not less than 8 in. (203 mm) in depth for the lower half of the height and not less than 6 in. (152 mm) in depth for the upper half. Framed or glued laminated arches for roof construction which spring from the top of walls or wall abutments and timber trusses which do not support floor loads shall have members not less than 4 in. (102 mm) in width and not less than 6 in. (152 mm) in depth.

*Exception: Spaced members may be composed of two or more pieces not less than 3 in. (76 mm) in thickness when blocked solidly throughout their intervening spaces or when such spaces are tightly closed by a continuous wood cover plate not less than 2 in. (51 mm) in thickness, secured to the underside of the members.*

Splice plates shall be not less than 3 in. (76 mm) in thickness.

**3-4.5** Floors shall be constructed of splined or tongued and grooved plank not less than 3 in. (76 mm) in thickness covered with 1-in. (25-mm) tongue and groove flooring, laid crosswise or diagonally to the plank, or with ½-in. (12.7-mm) plywood, or of laminated planks not less than 4 in. (102 mm) in width, set on edge close together, spiked at intervals of 18 in. (457 mm) and covered with 1-in. (25-mm) tongue and groove flooring laid crosswise or diagonally to the plank or with ½-in. (12.7-mm) plywood.

**3-4.6** Roof decks shall be of splined or tongued and grooved plank not less than 2 in. (51 mm) in thickness; or of laminated planks not less than 3 in. (76 mm) in width, set on edge close together, and laid as required for floors; or of 1⅛-in. (28.6-mm) thick interior plywood (exterior glue); or of approved noncombustible or limited-combustible materials of equal fire durability.

**3-5 Type V (111-000).**

**3-5.1** Type V construction is that type in which exterior walls, bearing walls, and floors and roofs and their supports are wholly or partly of wood or other approved combustible material smaller than required for Type IV construction. In addition, structural members have fire resistance ratings not less than those set forth in Table 3.

## Chapter 4 Referenced Publications

**4-1** 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 current as of the date of the NFPA issuance of this document. These references are listed separately to facilitate updating to the latest edition by the user.

**4-1.1 NFPA Publications.** National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 251-1985, *Standard Methods of Fire Tests of Building Construction and Materials*

NFPA 255-1984, *Standard Method of Test of Surface Burning Characteristics of Building Materials*

**4-1.2 ASTM Publications.** American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E136-1982, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*

ASTM *Special Technical Publication 464*, 1970, pp. 147-152.

## Appendix A Referenced Publications

**A-1** The following documents or portions thereof are referenced within this standard for informational purposes only and thus should not be considered part of the requirements of this document. The edition indicated for each reference is current as of the date of the NFPA issuance of this document. These references are listed separately to facilitate updating to the latest edition by the user.

**A-1.1 NFPA Publications.** National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 102-1978, *Standard for Assembly Seating, Tents, and Air-Supported Structures*

NFPA 251-1985, *Standard Methods of Fire Tests of Building Construction and Materials*

NFPA 255-1984, *Standard Method of Test of Surface Burning Characteristics of Building Materials*

NFPA 257-1982, *Standard for Fire Tests of Window Assemblies*

**A-1.2 ASTM Publication.** American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM *Proceedings*, Vol. 61, 1961, pp. 1336-1348.

## Appendix B Recommendations on Plastics in Building Codes and Standards

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

This Appendix is prepared to furnish guidance to NFPA Committees and for the drafting of provisions, applying to plastics, which may be used in building codes.

Small-scale fire tests may provide misleading results in evaluating plastics for building materials. It is not proper to exempt plastics from recommendations as to fire hazard characteristics which building codes and standards specify for other building materials.

The use of standard fire tests for all building materials, including plastics, is recommended, particularly those for fire resistance of structural assemblies (NFPA 251, *Standard Methods for Fire Tests of Building Construction and Materials*) and for surface flame spread and other features (NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*).

## Appendix C Classification of Air-Supported Structures[1]

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

This Appendix is prepared to furnish guidance to NFPA Committees, regulatory officials and others interested in the classification of air-supported structures.

Air-supported structures are enclosures which depend primarily on air pressure for their support. They are generally made of plastics and in most cases are directly supported by air pressure and in other cases the supports are air-inflated columns, pillars or pilasters. A third type has a limited amount of structural steel supports.

The use of air for structural support raises the question of the proper classification of such structures for application of codes and standards.

These structures should *not* be classified as buildings for a number of reasons, some of which follow. Present codes and standards contemplate that the supporting members of buildings are of material such as steel, concrete and wood, which are considered to provide more dependable structural support than air pressure. Further, there is no means for supporting sprinklers, where such might be needed to protect the structure or the occupancy, nor can fire resistance ratings be readily obtained for portions of the structure which should have such ratings under certain conditions if they were classified as buildings. These factors clearly indicate that such structures cannot be made to comply with provisions normally applicable to buildings.

It is recommended that these structures be classed as tents. as they more closely resemble tents from a fire protection standpoint and by classifying them as such, they can be made to comply with provisions applicable to tents, whether such provisions be in a building code, fire prevention code, or separate standards.

[1]See also NFPA 102, *Standard for Assembly Seating, Tents, and Air-Supported Structures*

## Appendix D Potential Heat of Selected Building Materials[1]

| Material | Thickness in. | Density lb./ft.$^3$ | Potential Heat, Weight basis, BTU/lb. |
|---|---|---|---|
| **1. WOODS** | | | |
| a. Douglas fir, untreated | ¾ | 38.0 | 8,400 |
| b. Douglas fir (retardant treatment "A") | ¾ | 37.2 | 8,290 |
| c. Douglas fir (retardant treatment "B") | ¾ | 47.2 | 7,850 |
| d. Douglas fir (retardant treatment "C") | ¾ | 38.8 | 7,050 |
| e. Maple soft, untreated | 1 | 39.5 | 7,940 |
| f. Hardboard, untreated | ¼ | 59.8 | 8,530 |
| **2. PLASTICS** | | | |
| a. Polystyrene, wall tile | 0.075 | 65.4 | 17,420 |
| b. Rigid, polyvinyl chloride, retardant treated | .147 | 86.0 | 9,290 |
| c. Phenolic laminate | .063 | 76.4 | 7,740 |
| d. Polycarbonate resin | ¼ | 78.7 | 13,330 |
| **3. INSULATION** | | | |
| a. Glass fiber, semirigid, no vapor barrier | 1 | 3.0 | 3,040 |
| b. Rock wool batting, paper enclosure | 3 | 2.4 | 1,050 |
| c. Roof insulation board | 1 | 10.4 | 3,380 |
| d. Cork (reconstituted cork sheet) | ¼ | 14.8 | 11,110 |
| e. Cellulose mineral board | 2 | 47.8 | 2,250 |
| **4. CONCRETE** | | | |
| a. Cinder aggregate | | 93.0 | 3,080 |
| b. Slag aggregate | | 110.1 | 80 |
| c. Shale aggregate | | 80.5 | 10 |
| d. Calcareous gravel aggregate | | 133.1 | − 250 |
| e. Siliceous gravel aggregate | | 166.8 | − 40 |
| **5. CEMENT BOARD** | | | |
| a. Asbestos cement board | 3/16 | 117.0 | 80 |
| b. Asbestos cement board + 20 mil paint | 3/16 | 159.2 | 390 |
| **6. GYPSUM** | | | |
| a. $CaSO_4 \cdot H_2O$ hydrated neat gypsum | 0.41 | 137.9 | − 290 |
| b. Perlite aggregate plaster, 21 percent aggregate | 1 | 53.2 | 70 |
| c. Sand aggregate plaster, 68 percent aggregate | 1 | 101.8 | − 50 |
| d. Vermiculite aggregate plaster 15 percent aggregate | 1 | 51.2 | − 90 |
| e. Gypsum board "A" | 3/8 | 50.5 | 760 |
| f. Gypsum board "A" with paper removed | 3/8 | 46.6 | − 270 |
| g. Gypsum board "A" + alkyd gloss paint | 3/8 | 46.7 | 880 |
| h. Gypsum board "B" | ½ | 51.2 | 650 |
| **7. LATH** | | | |
| a. Gypsum A | 3/8 | 55.3 | 310 |
| b. Metal diamond mesh | .025 | 405 | 1,230 |
| c. Metal diamond mesh, paint removed | .019 | 401 | 660 |
| **8. METALS** | | | |
| a. Structural steel-unpainted | .060 | 489 | 230 |
| b. Magnesium | .128 | 122 | 10,800 |
| c. Aluminum | .004 | 165 | 30 |
| d. Brass | .004 | 534 | 100 |
| e. Copper | .024 | 556 | 60 |
| f. Lead | .036 | 710 | 280 |
| g. Zinc | | 415 | 760 |
| **9. MISCELLANEOUS** | | | |
| a. Paint "E" (dried paint film) | .05 | | 3,640 |
| b. Asphalt shingles (fire retardant) | ¼ | 70.7 | 8,320 |
| c. Building paper (asphalt impregnated) | .042 | 42.8 | 13,620 |
| d. Building paper (rosin sized) | .018 | 23.6 | 7,650 |
| e. Linoleum tile | 1/8 | 86.0 | 7,760 |
| f. Brick, red-face | 2¼ | 139.1 | 20 |
| g. Charcoal, coconut | — | — | 13,870 |

[1] *Proceedings of ASTM*, Vol. 61, 1961, pp. 1336–1348.

NOTE: All weight and percentages refer to original air-dry weight.