NFPA 221 Standard for Fire Walls and Fire Barrier Walls 1994 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101

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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 221

Standard for

Fire Walls and Fire Barrier Walls

1994 Edition

This edition of NFPA 221, *Standard for Fire Walls and Fire Barrier Walls*, was prepared by the Technical Committee on Building Construction and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 16-18, 1994, in San Francisco, CA. It was issued by the Standards Council on July 14, 1994, with an effective date of August 5, 1994, and supersedes all previous editions.

The 1994 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 221

In 1991, the NFPA Technical Committee on Building Construction asked the Standards Council to consider approval of a new document on fire walls. This request was approved, and the committee developed NFPA 221, *Standard for Fire Walls and Fire Barrier Walls*.

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Committee Scope: This committee shall have responsibility for documents on the design, installation, and maintenance of building construction features not covered by other NFPA committees. (This Committee does not cover building code requirements, exits, protection at openings, vaults, air conditioning, blower systems, etc., that are handled by other committees.)

Contents

NFPA 221

Standard for

Fire Walls and Fire Barrier Walls

1994 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates explanatory material on that paragraph in Appendix A.

Information on referenced publications can be found in Chapter 8 and Appendix B.

Chapter 1 General

1-1 Scope. This standard specifies requirements for the design and construction of fire walls and fire barrier walls.

1-2 Purpose.

1-2.1 This standard prescribes minimum requirements for fire walls and fire barrier walls for use in providing safety to life and protection of property from fire. These requirements shall apply to walls that are required to separate buildings or subdivide a building to prevent the spread of fire.

1-2.2 Nothing in this standard is intended to prevent the use of alternate materials or devices, provided sufficient technical data is submitted to the authority having jurisdiction to demonstrate that the alternate method of construction or device provides equivalent strength and fire resistance.

1-3 Definitions.

Angle Walls. Exterior walls intersecting at angles of 135 degrees or less at the end of a fire wall.

Approved. Acceptable to the authority having jurisdiction.

NOTE: The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations that is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

End Walls. Exterior walls intersecting at angles of more than 135 degrees at the end of a fire wall.

Fire Barrier Wall. A wall, other than a fire wall, having a fire resistance rating.

Fire Damper. A device, installed in an air distribution system, designed to close automatically upon detection of heat to interrupt migratory airflow and to restrict the passage of flame.

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

Fire Wall. A wall separating buildings or subdividing a building to prevent the spread of fire and having a fire resistance rating and structural stability.

High Hazard Materials. Materials that are combustible or flammable liquids; flammable gases; and combustible dusts.

Listed. Equipment or materials included in a list published by an organization acceptable to the authority having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

Non-load-bearing Wall. A wall supporting only its own weight and no other vertical loads such as a floor or roof.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Chapter 2 Fire Walls

2-1 Types of Fire Walls. Fire walls shall meet the requirements of Chapters 2, 4, 5, 6, and 7 and shall be:

(a) Cantilevered/freestanding fire walls; or

(b) Tied fire walls; or

(c) Double fire walls.

2-2 Structural Stability and Strength.

2-2.1 Fire walls shall be designed and constructed to remain stable after the collapse due to fire of the structure on either side of the wall. Fire walls constructed in compliance with the requirements of Section 2-3, 2-4, or 2-5 shall be deemed to provide the required stability.

2-2.2* Design Loads. All fire walls and their supports shall be designed to withstand a minimum uniform load of 5 psf (0.24 kPa) from either direction applied perpendicular to the face of the wall. All fire walls shall be non-load-bearing. Structural framing within the plane of the wall shall be permitted to be load-bearing.

2-2.3* Where the fire wall or fire protective covering of a structural member is subject to impact damage from moving vehicles or the handling of merchandise or other activity, protection against impact damage shall be provided for an appropriate height but not less than 5 ft (1.5 mm) from the finished floor.

2-3* Cantilevered/Freestanding Fire Walls. Cantilevered or freestanding fire walls shall be entirely self-supported and non-load-bearing. There shall be no connections to the building(s) or contents on either side other than to the flashing. Such walls shall be erected where there is a complete break in the structural framework. The wall shall be secured to the foundation to resist overturning due to design loads.

2-4* Tied Fire Walls. Tied fire walls shall be centered on a single column line or constructed between a double column line. Structural framing on either side of the wall shall line up horizontally and vertically and shall support the roof. The framework on each side of the fire wall shall be continuous or tied together through the wall. The framework on each side shall be designed so that it can resist the maximum lateral pull that can be developed due to framework collapse in a fire on the opposite side. Tied fire walls shall be laterally supported by the building framework with flexible anchors. Where centered on a single column line, structural framing (columns and beams or trusses) at the column line shall have a fire resistance rating of not less than the required fire resistance rating of the fire wall. Where the wall is installed between double column lines, framing along the first column line immediately on each side of the fire wall shall have a fire resistance rating of not less than the required fire resistance rating of the fire wall.

2-5* Double Fire Walls. A double fire wall [*see Figure 2-5(a)*] consists of two back-to-back walls. There shall be no connections, other than to the flashing, between the walls. [*See Figures 2-5(b) and (c).*]

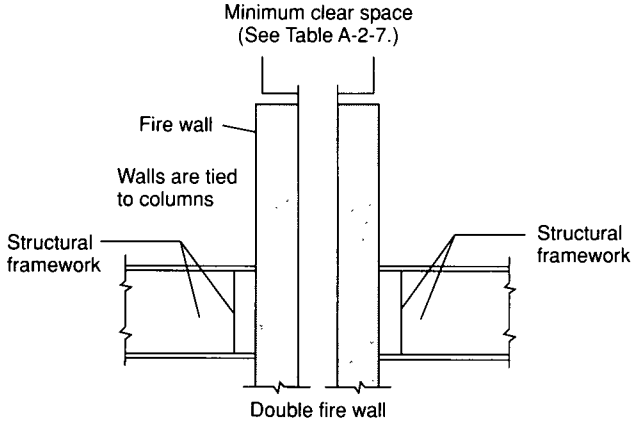

Figure 2-5(a) Double fire wall.

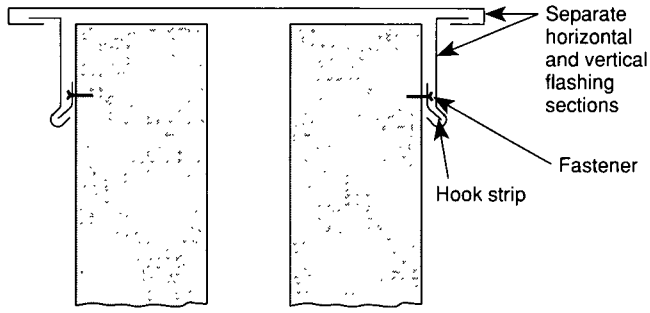

Figure 2-5(b) Double fire wall.

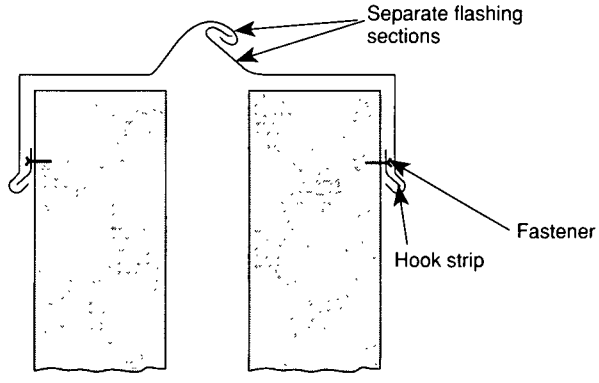

Figure 2-5(c) Double fire wall.

Each fire wall shall be laterally supported by the building frame on its respective side and shall be independent of the fire wall and framing on the opposite side.

2-6 Fire Walls at Elevation Differences. Where the roofs on opposite sides of a fire wall are not of the same elevation, the fire wall assembly shall be arranged in either of two ways:

(a) The two buildings shall be separated by a double fire wall; or

(b)* A cantilevered fire wall shall be constructed from the foundation to the top of the parapet for the lower roof. The upper wall section shall be permitted to have an exterior fire resistance rating of one hour less than the required fire resistance rating of the lower cantilevered portion but not less than a 2-hr rating. The upper wall shall be connected to the framework of the higher building and shall be structurally independent of the cantilevered wall.

2-7* Clearance. Clearance to allow for expansion of unprotected structural framework shall be provided. This space shall be provided between cantilevered walls and structural framework on each side and between double walls.

2-8 Expansion, Seismic, and Control Joints. Joints shall be provided to prevent cracking due to drying, shrinkage, or normal building temperature change. The integrity of the fire resistance rating of the wall shall be maintained by the protection of these joints. Protection for expansion and seismic joints shall be installed in accordance with tested design specifications.

Chapter 3 Fire Barrier Walls

3-1 Design Requirements. A fire barrier wall shall meet the requirements of Chapter 3, Chapter 4, 5-1.1, and 6-2.1.

3-2 Termination Points. A fire barrier wall shall extend from the foundation or floor below to the underside of the roof or floor deck above.

Exception: The fire barrier wall shall be permitted to terminate at the underside of an individually protected structural member in the same plane. The structural member shall have a fire resistance rating of not less than that required for the fire barrier wall and shall prevent the passage of flame and hot gases.*

3-2.1 Design Loads. All fire barrier walls and their supports shall be designed to withstand a minimum uniform load of 5 psf (0.24 kPa) from either direction applied perpendicular to the face of the wall.

3-3 Expansion, Seismic, and Control Joints. Joints shall be provided to prevent cracking due to drying, shrinkage or normal building temperature change. The integrity of the fire resistance rating of the wall shall be maintained by the protection of these joints. Protection for expansion and seismic joints shall be installed in accordance with tested design specifications.

Chapter 4 Fire Resistance

4-1* Wall Materials. The fire resistance rating of the wall assembly shall be as required by the applicable code or standard. Assemblies shall be tested and rated in accordance with NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials.*

Exception: Assemblies calculated to have equivalent fire resistance shall be permitted, provided that the calculations are based on the conditions of acceptance and the fire exposure specified in NFPA 251, Standard Methods of Fire Tests of Building Construction and Materials.

4-2 Penetration Seals. All through-penetration protection systems shall be tested and rated in accordance with ASTM E814, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops.* The positive pressure difference between the exposed and unexposed surfaces of the test assembly shall not be less than 0.01 in. water gauge (2.5 Pa). A through-penetration protection system shall have an F rating (as defined by ASTM E814) not less than the required fire resistance rating of the fire wall or fire barrier wall.

Exception: Concrete, mortar, or grout shall be permitted with maximum 6-in. (153-mm) nominal diameter steel or copper pipe, or steel conduit. Concrete, mortar, or grout shall be the thickness required to maintain the required fire resistance rating of the wall being penetrated. The maximum opening size shall be 144 in.^{2} (0.094 m^2).

4-3 Double Wall Assemblies. Double wall assemblies shall be considered to have a combined assembly fire rating as specified in Table 4-3.

Table 4-3 Fire Resistance Ratings for Double Wall Assemblies

Fire Resistance Rating of Each Wall of	Equivalent to Single Wall of
3 hr	4 hr
2 hr	3 hr
1 hr	2 hr

Chapter 5 Protection of Openings

5-1 General.

5-1.1 All openings in fire walls and fire barrier walls shall be protected in accordance with NFPA 80, *Standard for Fire Doors and Fire Windows.* The aggregate width of openings in each floor level shall not exceed 25 percent of the wall length.

5-1.2 Fire walls having a required fire resistance rating of 4 hr shall have each opening protected with two fire door assemblies, each having a minimum 3-hr fire resistance rating.

5-2* Double Fire Walls. Openings in double fire walls shall be protected using one fire door in each separate wall or two fire doors in a freestanding, fire-resistive vestibule.

Chapter 6 Penetrations

6-1* Pipes, Conduit, and Cables. Pipes, conduit, and cable trays (regardless of size) penetrating fire walls having a required 3-hr or greater fire resistance rating shall be positioned to pass through the wall no more than 3 ft (1.0 m) above the finished floor level. A steel sleeve of adequate size to allow an approximate 1-in. (25-mm) clearance between the sleeve and the pipe or conduit shall be provided for each pipe or conduit. The space between the sleeve and penetrating item (annular space) shall be filled as required in Section 4-2. Joint reinforcement shall be provided in the horizontal mortar joints immediately above and below sleeves in concrete masonry walls, and all hollow spaces of concrete masonry walls immediately adjacent to the sleeve shall be filled with concrete, mortar, or grout.

The center-to-center spacing between adjacent pipes or conduit shall be not less than three times the larger pipe or conduit outside diameter.

Exception: The limitation on the height of penetrations above the floor and other requirements of Section 6-1 shall not apply where the structural framework of the building has a fire resistance rating equal to or greater than the required fire resistance rating of the fire wall; only compliance with Section 4-2 shall be required.

6-2 Heating, Ventilating, and Air Conditioning Systems.

6-2.1 Fire dampers shall be installed and maintained in accordance with NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems.*

6-2.2 Fire walls having a required fire resistance rating of 4 hr shall be protected with two minimum 3-hr rated fire damper assemblies.

6-2.2.1 One fire damper shall be provided in each wall assembly with a fire rating suitable for the respective wall of a double fire wall, and a slip joint connecting the sleeves between the walls shall be provided. The minimum fire resistance rating of each damper shall be 1½ hr.

6-3* Piping or Ductwork for High Hazard Materials.

6-3.1 Piping or ductwork used to convey high hazard materials shall not penetrate fire walls that have a required fire resistance rating of 4 hr.

6-3.2 Piping or ductwork that penetrates fire walls with a required fire resistance rating of less than 4 hr used to convey high hazard materials shall be protected with approved devices or systems designed to terminate the flow or movement of the materials through the fire wall upon fire detection.

Chapter 7 Exterior Protection

7-1* Parapets. Fire walls shall be provided with parapets at least 30 in. (0.76 m) high. The parapet height shall be measured from the top surface of the roof being protected. Roofs sloped greater than $\frac{1}{4}$ in. per ft (6 mm per 305 mm) downward toward the wall shall be provided with a minimum 36-in. (0.9-m) parapet.

7-2* Roof Surface Protection.

7-2.1 Built-up roofs shall be surfaced for at least 25 ft (7.6 m) on both sides of the fire wall with gravel or slag. The application rate shall be at least 4 lb/ft^2 (19 kg/m^2).

7-2.2 All single-ply membrane roof coverings shall be protected by noncombustible paver blocks or ASTM D448, *Standard Classification for Sizes of Aggregate for Road and Bridge Construction,* No. 3 [nominal 1-in. to 2-in. (2.54-cm to 5.08-cm) diameter] gravel ballast. Complete membrane coverage shall be provided at a rate not less than 10 lb/ft^2 (48.8 kg/m^2) for at least 25 ft (7.6 m) on both sides of the fire wall.

7-3* Roof-mounted Structures. Combustible structures or equipment such as monitors, penthouses, or cooling towers not more than 20 ft (6.1 m) in height above roofs shall be located at least 50 ft (15.2 m) from fire walls required to have a fire resistance rating exceeding 2 hr. Roof-mounted structures over 20 ft (6.1 m) high shall be provided with a greater separation distance acceptable to the authority having jurisdiction.

7-4 Roof Penetrations. Heat and smoke vents, skylights, and unprotected roof penetrations for air-handling equipment or smoke control systems shall be located at least 25 ft (7.6 m) from fire walls requiring a fire resistance rating of more than 2 hr and at least 4 ft (1.3 m) from fire walls requiring a fire resistance rating of 2 hr or less.

7-5* End Walls. The length and arrangement of end walls shall be in accordance with Table 7-5 and Figure 7-5(a) or (b). The fire resistance rating of the end walls shall be from the outside and shall be a minimum of 1 hr but shall be not more than two hours less than that of the fire wall.

Table 7-5 Length of End Wall Protection*

Height of Exposing Area [ft (m)]	Length of End Wall Protection* [ft (m)]
Up to 40 (12.2)	6 (1.8)
41 to 70 (21.3)	10 (3.1)
71 (21.6) and over	14 (4.3)

* Protection shall consist of blank, fire-rated construction.

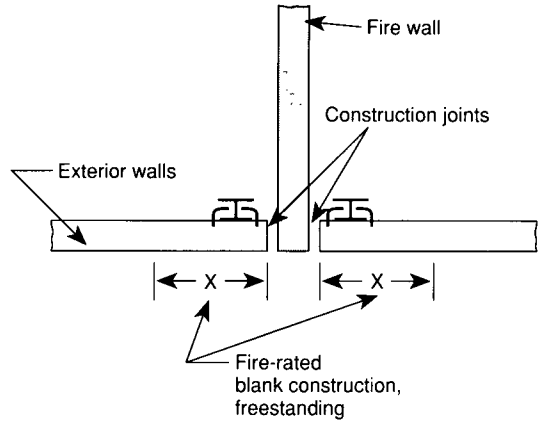

Figure 7-5(a) End wall exposure protection — end walls tied to structural framing.

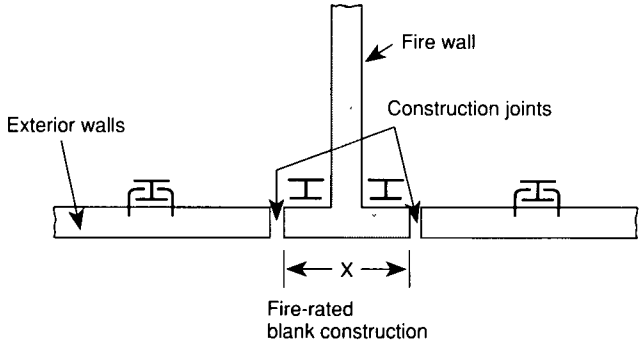

Figure 7-5(b) End wall exposure protection — end walls not tied to structural framing.

7-6 Angle Walls. The length of fire-resistive angle walls, Y, [*see Figure 7-6(a)*] shall be 20 ft to 35 ft (6.1 m to 10.7 m), depending on the severity of exposure (*see Table 7-6*). The fire resistance rating of the angle walls shall be from the outside and shall be not more than one hour less than that of the fire wall. In addition, construction of each wall and eave shall be noncombustible beyond the fire-resistive construction for the minimum distances outlined in Table 7-6.

Elevation differences perpendicular to fire walls shall be protected as angle walls. [*See Figure 7-6(a).*]

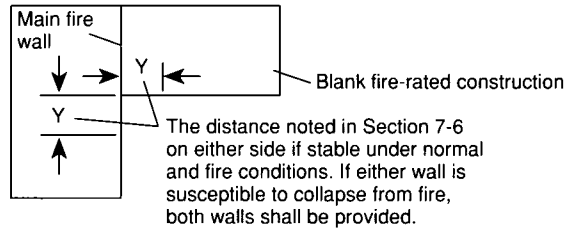

Figure 7-6(a) Angular wall exposure protection.

7-7 Railroad Sidings and Truck Docks. Railroad sidings parallel to end walls and truck dock openings shall not be located within 20 ft (6.1 m) on either side of a fire wall.

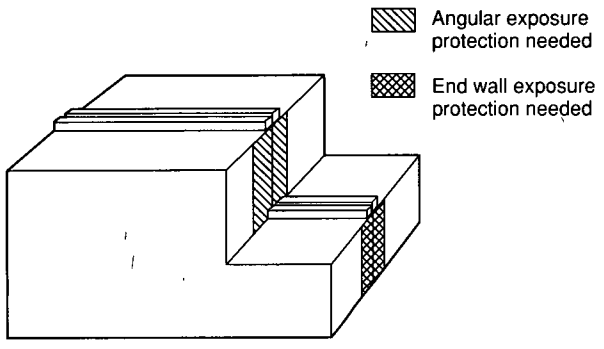

Figure 7-6(b) Exterior wall protection.

Table 7-6 Angle Wall Protection

Occupancy Hazard*	Length of Fire-resistive Angle Walls [ft (m)]	Length of Noncombustible Construction Beyond Fire-resistive Construction [ft (m)]
Light	20 (6.1)	60 (18.3)
Ordinary Group 1	30 (9.1)	75 (22.9)
Ordinary Group 2	35 (10.7)	100 (30.5)
Extra Group 1 and 2		

* As defined in NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Chapter 8 Referenced Publications

8-1 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 the current edition as of the date of the NFPA issuance of this document.

8-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1994 edition.

NFPA 80, *Standard for Fire Doors and Fire Windows*, 1992 edition.

NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*, 1993 edition.

NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*, 1990 edition.

8-1.2 Other Publications.

8-1.2.1 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D448, *Standard Classification for Sizes of Aggregate for Road and Bridge Construction*, 1986.

ASTM E814, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops*, 1988.

Appendix A Explanatory Material

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

A-1-3 Fire Resistance Rating. ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, and UL 263, *Fire Tests of Building Construction and Materials*, are similar to NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials.*

A-2-2.2 Other loads, such as seismic loads or interior pressure differences due to wind, can govern and should be considered in accordance with local code requirements. Parapets should be designed for wind loads, including appropriate pressure coefficients.

A-2-2.3 Where the potential exists for the collapse of building materials or contents or the impact of vehicles on a fire wall requiring a fire resistance rating of 4 hr, the fire wall should be constructed of materials that are of adequate strength.

A-2-3 Walls intended to be used as cantilever fire walls in the future and used as temporary exterior walls will be vulnerable to wind damage. Such walls should be designed to resist required wind loads. If the future cantilevered wall is temporarily fastened to the building frame until the additional building is built, care should be taken to ensure that all ties to the wall are fully cut when new construction is completed.

A-2-4 Tied fire walls [*see Figure A-2-4(a)*] are fastened to and usually encase members of the structural frame of the building. To remain stable, the pull of the collapsing structural members on the fire side of the wall must be resisted by the strength of the structure on the other side.

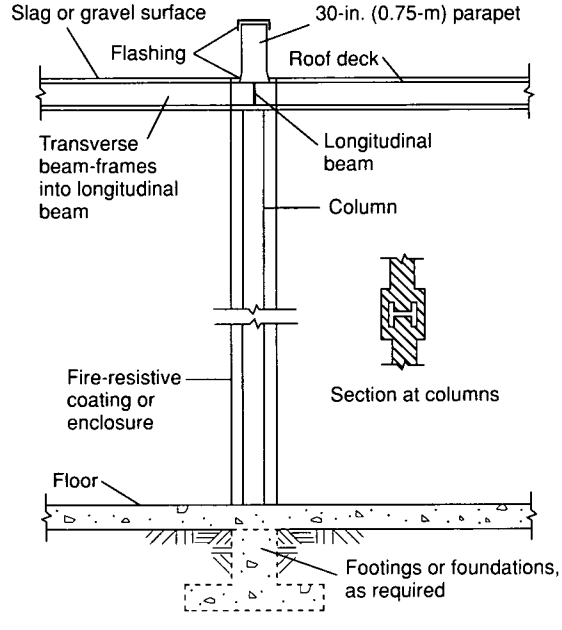

Figure A-2-4(a) Typical tied fire wall used with continuous building framework.

Since a fire can occur on either side of the wall, the wall preferably should be located at the center of strength of the building frame. The center of strength is the plane within the building frame in which the structural framing on either side has equal resistance. In small structures, the center of strength generally is in the middle of the building [*see Figure A-2-4(b)*]. In large buildings, the center of strength might lie midway between two double-column expansion joints [*see Figures A-2-4(c) and (d)*]. Single-column line expansion joints utilizing beams with slotted connections do not break the continuity of the building frame. [*See Figure A-2-4(e).*]

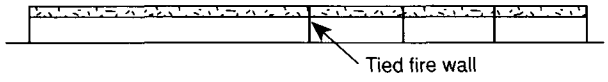

Figure A-2-4(b) A tied wall at the center of a continuous steel frame. The pull from collapsing steel on either side must be resisted by the lateral strength of steel on the other side.

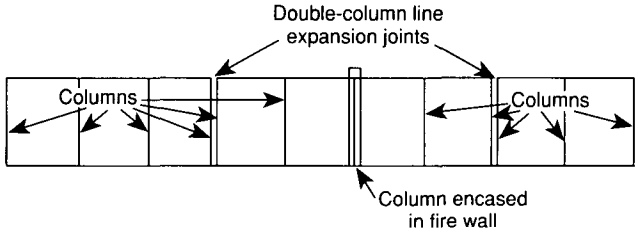

Figure A-2-4(c) Tied wall where framing is not continuous throughout the building.

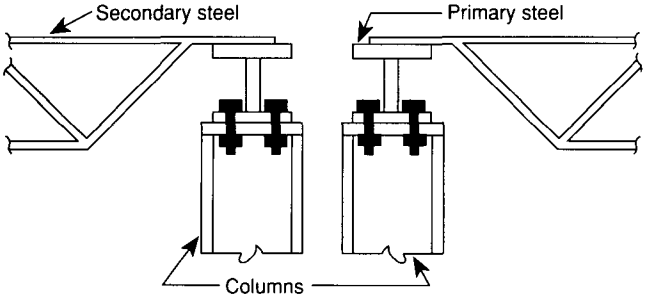

Figure A-2-4(d) Double-column line expansion joint.

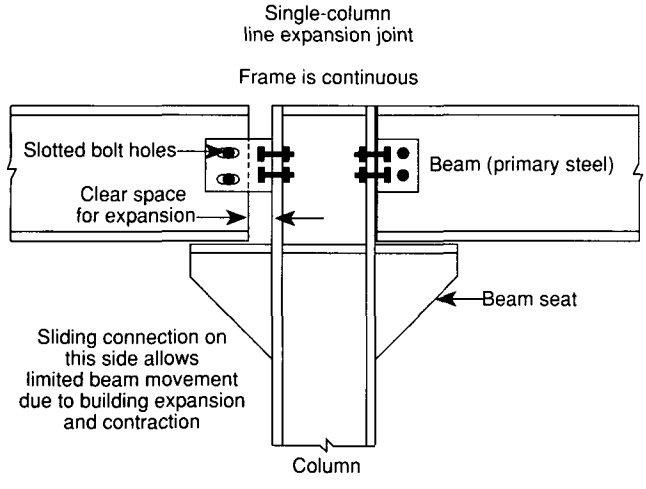

Figure A-2-4(e) Single-column line expansion joint frame is continuous.

Bolts with nuts and washers may be permitted to be used to tie framework across a double-column line. In order to prevent the defeat of the purpose of the expansion joint created by the double-column line, nuts should be backed off slightly about $\frac{3}{4}$ in. (19 mm). Where the primary roof framing is perpendicular to the fire wall, two bolts should tie the roof framing together over each column to provide concentric load distribution. Where the primary roof framing is parallel to the fire wall, single bolts may be permitted to be used; however, intermediate ties might be needed between column lines. A registered civil or structural engineer should be consulted to provide more exact details. [*See Figures A-2-4(f) and (g).*]

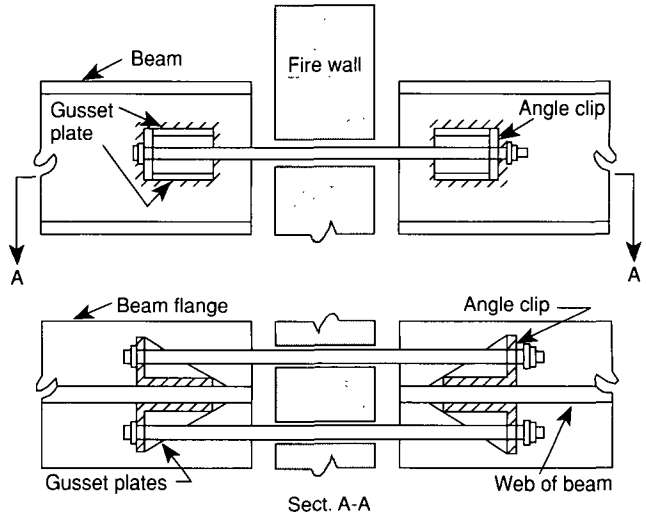

Figure A-2-4(f) Through-wall tie — primary roof framing perpendicular to wall.

NOTE: Columns are needed but not illustrated.

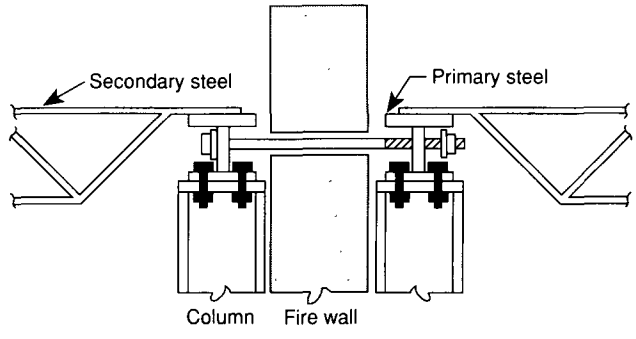

Figure A-2-4(g) Through-wall tie — primary steel parallel to fire wall.

If the wall is not located at the center of strength, the lateral resistance of the frame on either side of the wall should be sufficient to resist the maximum horizontal component of the force that could result from collapsing structural framework on the opposite side. The horizontal force at each tie should be computed by using the formula following Figure A-2-4(h).

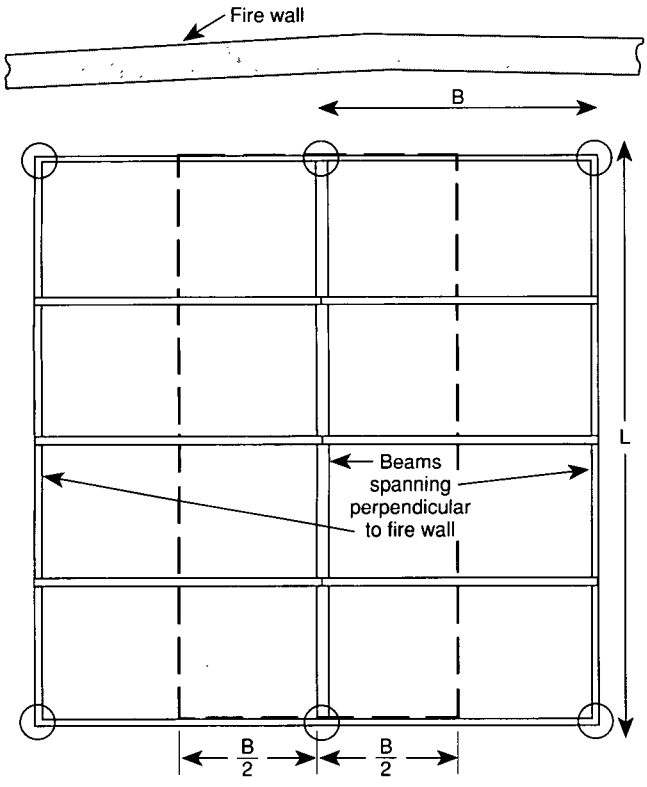

Figure A-2-4(h) Tied fire wall with ties at each beam.

$$H = \frac{wBL^2}{8S}$$

where:

H = Horizontal pull per tie [lb (kg)].
w = Dead load plus 25 percent of the live load of the roof [lb/ft^2 (kg/m^2)].
L = Span of the structural member running perpendicular to the wall [ft (m)].
B = Distance between ties [ft (m)].
S = Sag in ft (m) that may be assumed as:
0.07L for open-web trusses.
0.09L for solid beams.
0.06L for wood trusses.

A-2-5 Where there is an uncontrolled fire on either side of a double wall, one building frame will collapse, pulling the wall on that side with it. The other wall, supported by structural framework on the protected side, will remain in place to stop the spread of fire.

Since there should be no connections between the walls, particular attention should be paid to the details at openings in the walls.

A double fire wall is most adaptable where an addition to a plant requires a fire wall between an existing structure and a new building. The existing wall, which is secured to the building frame, is altered, if necessary, to provide the proper fire resistance. Another fire wall is then constructed adjacent to the existing one and secured to the new building frame.

A-2-6(b) The exterior fire-rated wall above the cantilevered wall should not overlap the cantilevered wall on the side of the lower building. It may be permitted to be installed above the cantilevered wall or overlap the cantilevered wall on the side of the higher building [*see Figures A-2-6(a) and (b)*]. In either case, the integrity of the fire resistance rating of the fire wall should be maintained by protecting the joint between the cantilevered wall and the exterior fire wall attached to the higher building. In some cases, the parapet may be permitted to be omitted from the higher wall only; however, such a judgment should consider the severity of exposure from the occupancy in the lower building and the elevation difference between the exposure and the top of the higher wall.

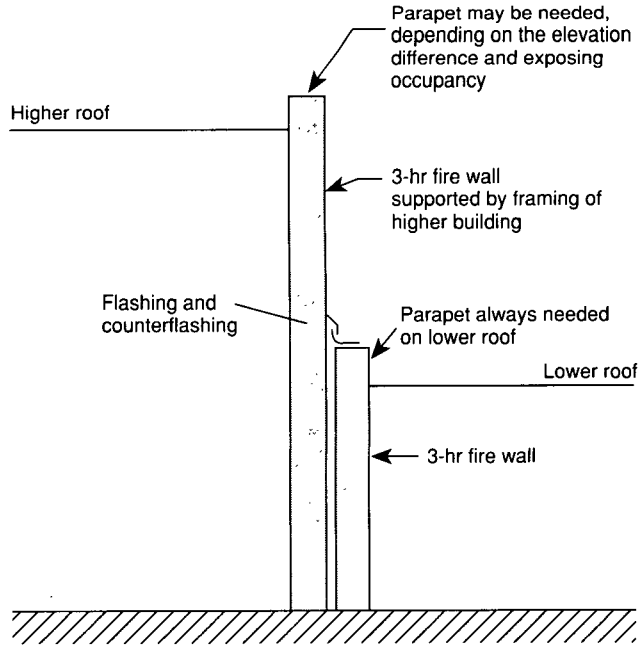

Figure A-2-6(a) Fire wall arrangement at elevation difference (double wall).

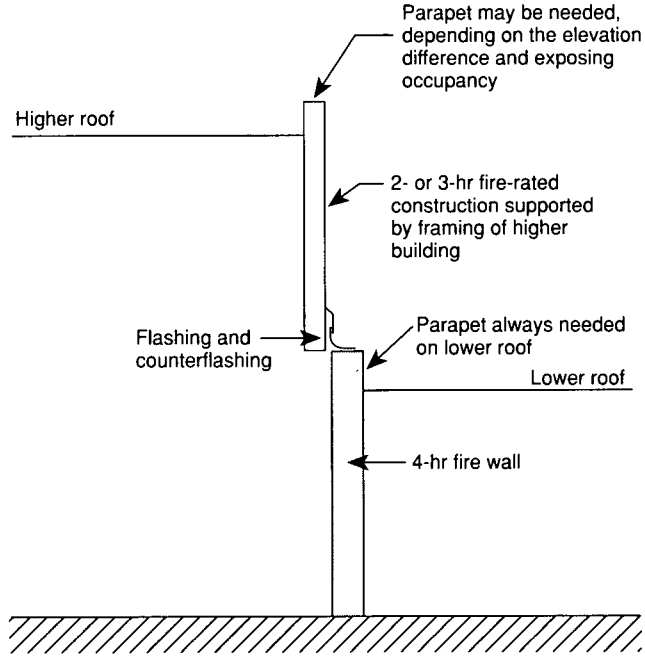

Figure A-2-6(b) Fire wall arrangement at elevation difference (cantilever wall).

A-2-7 Adequate clearance should be provided between storage and fire walls to prevent damage to the wall that might result from swelling of absorbent materials due to contact with water.

In areas of moderate and high seismic risk, sufficient separation should be provided as follows:

(a) Between cantilevered walls and adjacent framing on each side;

(b) Between double walls;

(c) Between one-way walls and building framework to which they are not tied.

This allows independent movement of the elements without contact.

Table A-2-7 Minimum Recommended Clearance Between Unprotected Structural Framework and Fire Walls, or Between Double Fire Walls

Length of Bay Perpendicular to the Fire Wall		Minimum Clearance Between Wall and Structural Framework, and Between Double Walls	
(ft)	(m)	(in.)	(cm)
20	(6.1)	2 1/2	(6.4)
25	(7.6)	3 1/4	(8.3)
30	(9.1)	3 3/4	(9.5)
35	(10.7)	4 1/2	(11.4)
40	(12.2)	5	(12.7)
45	(13.7)	5 3/4	(14.6)
50	(15.2)	6 1/4	(15.9)
55	(16.8)	7	(17.8)
60 or longer	(18.3)	7 1/2	(19.1)

Table A-2-7 is based on steel framework. This table provides clearances that are conservative for other types of framework materials. This table is based on an average temperature of 800°F (427°C) in two adjacent bays. [Source: FMRC DS 1-22, *Criteria for Maximum Foreseeable Loss Fire Walls and Space Separations.*]

A-3-2 Exception. The fire resistance rating of the fire barrier wall is based on specific criteria in NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials.* It is based on both structural stability under the fire and hose stream tests and criteria for temperature transmission through the wall that are designed to prevent ignition of combustible materials on the unexposed side of the wall. The exception recognizes that fire barrier walls may be permitted to terminate at the underside of an individually protected structural member that has the same fire resistance rating as the wall. In the case where the fire resistance rating for the structural member is the same as that for the wall, no additional temperature transmission criteria to prevent ignition of combustible materials is needed.

However, in the event that the structural member does not have a solid web or solid surface along its length for the full height of the structural member, such as an open-web member, the fire protective covering for the structural member must be continuous for the full height of the structural member to prevent the passage of flame and hot gases over the top of the fire barrier wall.

A-4-1 Methods for calculating the fire endurance of assemblies can be found in the following publications:

(a) Concrete and Masonry.

ACI 216R, *Guide for Determining the Fire Endurance of Concrete Elements.*

Concrete and Masonry Industry Firesafety Committee, *Analytical Methods of Determining Fire Endurance of Concrete and Masonry Members — Model Code Approved Procedures.*

CRSI, *Reinforced Concrete Fire Resistance.*

PCI, *Design for Fire Resistance of Precast Prestressed Concrete.*

(b) Steel.

AISI, *Designing Fire Protection for Steel Columns.*

AISI, *Designing Fire Protection for Steel Beams.*

AISI, *Designing Fire Protection for Steel Trusses.*

(c) Wood.

National Forest Products Assn., *Design of Fire-Resistive Exposed Wood Members.*

UBC, *Methods for Calculating Fire Resistance of Wood-Framed Walls, Floors and Roofs.*

A-5-2 An example of an arrangement where the alternative of providing two fire doors on a freestanding, fire-resistive vestibule is used, and the opening is not used as part of the means of egress, is shown in Figure A-5-2. Where this alternative is used and the opening is used for egress, the vestibule should be long enough to allow both doors to swing in the same direction and open completely.

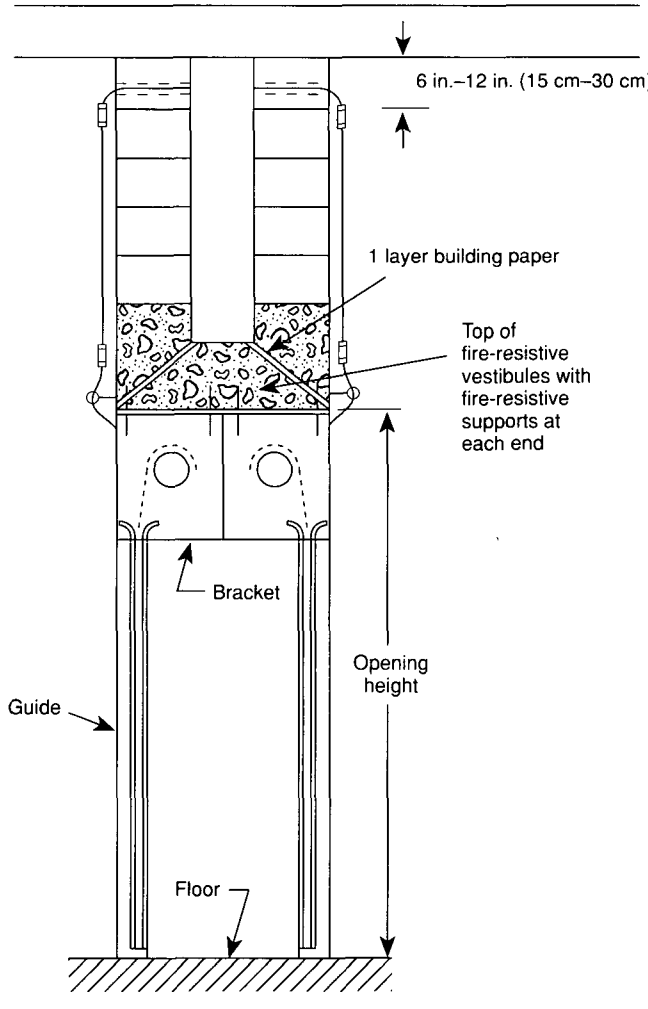

Figure A-5-2 Double doors on a freestanding vestibule.

A-6-1 Location of Combustibles. Combustibles should be kept at least 1 ft (0.3 m) away from pipes, ducts, plates, and conduit where they penetrate the wall. Alternatively, a penetration seal with a T rating (as defined by ASTM E814, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops*) of not less than 1 hr should be provided.

Mechanical connections, such as double-threaded elbows (*see Figure A-6-1*) or flexible braided steel pipe that are acceptable to the authority having jurisdiction and that will limit stress on the wall should be considered.

Steel-faced fire walls with gypsum board core or gypsum board on stud fire walls should be provided with a concrete stanchion where pipe, conduit, or cables penetrate fire walls with a required fire resistance rating of 4 hr.

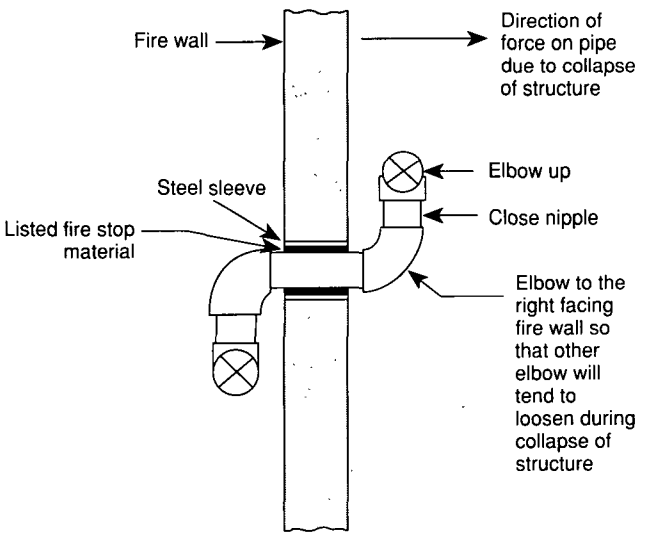

Figure A-6-1 Pipe penetration.

A-6-3 High hazard materials transported by piping or ductwork passing through fire walls have been shown to be a significant avenue of fire propagation across the fire wall and should be avoided. Where necessary for these systems to penetrate a fire wall with a fire resistance rating of less than 4 hr, the flow of the high hazard materials must be interrupted or otherwise protected by engineered devices or systems specifically designed for such purpose and approved by the authority having jurisdiction. Devices that may be permitted to be used for this protection include, but are not limited to, excess-flow valves and fire-safe shutoff valves, pneumatic knife or gate dampers, blower/vacuum shutdown devices, or encapsulation of the piping or ductwork and its supports with material having a fire resistance rating at least equal to that required of the fire wall.

Combustible and flammable materials include flammable gases and combustible and flammable liquids used in piping systems and combustible dusts used in air conveying systems.

A-7-1 Where a higher building or higher portion of a building adjoins a lower building at a fire wall, the lower building should always have a minimum 30-in. (9.76-m) high parapet. A parapet may be permitted to be omitted on the higher building if there is at least a 15-ft to 50-ft (4.6-m to 15.2-m) elevation difference, depending on the severity of the fire exposure from the lower building. Also, see NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures,* Table 2-4. Where the parapet is not needed, the exterior fire-rated wall construction should extend at least up to the gravel stop. Gravel surfacing or equivalent is still recommended for at least 25 ft (7.6 m) from the fire wall in each direction on the higher and lower roof.

A-7-2 For existing construction where the roof strength is not adequate to support gravel surfacing, the roof should be structurally reinforced to support the gravel. As an alternative, or for new or existing construction where the roof slope is excessive for gravel, the roof should be coated with an approved, lightweight, exterior grade, fire-resistant coating.

For single-ply roofs, where the roof is not adequate to support the specified weight of the ballast stone or paver blocks, it should be similarly reinforced, or the top surface of the roof should be protected with an approved coating as described previously if the roof membrane is totally adhered. Mechanically-attached, single-ply roof covers normally flex between fasteners, which could cause cracking of a coating.

A-7-3 Where required separation is not practical, a minimum of 25 ft (7.6 m) of separation should be provided, and fire-rated barriers should be constructed on the exposed side of the roof projection. The fire resistance rating should be a minimum of 2 hr if a 4-hr fire wall is required and 1 hr where fire walls of 3 hr or less are required.

A-7-5 An example of such an end wall configuration is a 4-hr fire wall with 2-hr end walls.

Appendix B Referenced Publications

B-1 The following documents or portions thereof are referenced within this standard for informational purposes only and thus are not considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

B-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 30, *Flammable and Combustible Liquids Code*, 1993 edition.

NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, 1993 edition.

NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*, 1990 edition.

B-1.2 Other Publications.

B-1.2.1 ACI Publication. American Concrete Institute, 22400 W. Seven Mile Road, Box 19150, Redford Station, Detroit, MI 48219.

ACI 216R, *Guide for Determining the Fire Endurance of Concrete Elements*, 1989.

B-1.2.2 AISI Publications. American Iron and Steel Institute, 1133 15th Street NW, Suite 300, Washington, DC 20005.

Designing Fire Protection for Steel Columns, 1980.

Designing Fire Protection for Steel Beams, 1984.

Designing Fire Protection for Steel Trusses, 1981.

B-1.2.3 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, 1988.

ASTM E152, *Standard Methods of Fire Tests of Door Assemblies*, 1981.

ASTM E814, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops*, 1988.

B-1.2.4 Concrete and Masonry Industry Firesafety Committee, 5420 Old Orchard Road, Skokie, IL 60077-1083.

Document No. SR267, *Analytical Methods of Determining Fire Endurance of Concrete and Masonry Members — Model Code Approval Procedures.*

B-1.2.5 CRSI Publication. Concrete Reinforcing Steel Institute, 933 Plum Grove Road, Schaumburg, IL 60173.

Reinforced Concrete Fire Resistance, 1980.

B-1.2.6 FMRC Publications. Factory Mutual Research Corporation, 1151 Boston-Providence Turnpike, Norwood, MA 02061-9102.

Approval Guide, 1977.

Data Sheet 1-21, *Fire Resistance of Building Assemblies*, 1977.

Data Sheet 1-22, *Criteria for Maximum Forseeable Loss Fire Walls and Space Separations*, 1993.

Data Sheet 1-23, *Protection of Openings*, 1976.

Specification Tested Products Guide.

B-1.2.7 GA Publications. Gypsum Association, 810 First Street, NE, Suite 510, Washington, DC 20002.

GA 219, *Recommendations for Installation of Steel Fire Door Frames in Steel Stud-Gypsum Board Fire-Rated Partitions*, 1989.

GA 600, *Fire Resistance Design Manual*, 1992.

B-1.2.8 IRI Information Publications. Industrial Risk Insurers, 85 Woodland Street, Hartford, CT 06102.

IRI Information IM.2.2.1, *Fire Walls, Fire Barriers and Fire Partitions*, 1992.

IRI Information IM.2.2.2, *Fire Doors and Through-Penetration Protection*, 1991.

B-1.2.9 National Forest Products Association Publication. National Forest Products Association, 1250 Connecticut Avenue, NW, Suite 200, Washington, DC 20036.

Design of Fire-Resistive Exposed Wood Members, 1985.

B-1.2.10 PCI Publication. Precast Prestressed Concrete Institute, 175 West Jackson Boulevard, Chicago, IL 60604.

Design for Fire Resistance of Precast Prestressed Concrete, 1989.

B-1.2.11 UBC Publication. Uniform Building Code, 5360 South Workman Mill Road, Whittier, CA 90601.

Methods for Calculating Fire Resistance of Wood-Framed Walls, Floors and Roofs.

B-1.2.12 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 10B, *Fire Tests of Door Assemblies*, 1993.

UL 263, *Fire Tests of Building Construction and Materials*, 1992.

UL 1479, *Fire Tests of Through-Penetration Firestops*, 1993.

Fire Resistance Directory, Vol. I, 1993.

Fire Resistance Directory, Vol. II, 1993.

B-1.2.13 Warnock Hersey, 8431 Murphy Drive, Middleton, WI 53562.

Listings, 1993 Certification.

Index

The NFPA Codes and Standards Development Process

Since 1896, one of the primary purposes of the NFPA has been to develop and update the standards covering all areas of fire safety.

Calls for Proposals
The code adoption process takes place twice each year and begins with a call for proposals from the public to amend existing codes and standards or to develop the content of new fire safety documents.

Report on Proposals
Upon receipt of public proposals, the technical committee members meet to review, consider, and act on the proposals. The public proposals – together with the committee action on each proposal and committee-generated proposals – are published in the NFPA's Report on Proposals (ROP). The ROP is then subject to public review and comment.

Report on Comments
These public comments are considered and acted upon by the appropriate technical committees. All public comments – together with the committee action on each comment – are published as the Committee's supplementary report in the NFPA's Report on Comments (ROC).

The committee's report and supplementary report are then presented for adoption and open debate at either of NFPA's semi-annual meetings held throughout the United States and Canada.

Association Action
The Association meeting may, subject to review and issuance by the NFPA Standards Council, (a) adopt a report as published, (b) adopt a report as amended, contingent upon subsequent approval by the committee, (c) return a report to committee for further study, and (d) return a portion of a report to committee.

Standards Council Action
The Standards Council will make a judgement on whether or not to issue an NFPA document based upon the entire record before the Council, including the vote taken at the Association meeting on the technical committee's report.

Voting Procedures
Voting at an NFPA Annual or Fall Meeting is restricted to members of record for 180 days prior to the opening of the first general session of the meeting, except that individuals who join the Association at an Annual or Fall Meeting are entitled to vote at the next Fall or Annual Meeting.

"Members" are defined by Article 3.2 of the Bylaws as individuals, firms, corporations, trade or professional associations, institutes, fire departments, fire brigades, and other public or private agencies desiring to advance the purposes of the Association. Each member shall have one vote in the affairs of the Association. Under Article 4.5 of the Bylaws, the vote of such a member shall be cast by that member individually or by an employee designated in writing by the member of record who has registered for the meeting. Such a designated person shall not be eligible to represent more than one voting privilege on each issue, nor cast more than one vote on each issue.

Any member who wishes to designate an employee to cast that member's vote at an Association meeting in place of that member must provide that employee with written authorization to represent the member at the meeting. The authorization must be on company letterhead signed by the member of record, with the membership number indicated, and the authorization must be recorded with the President of NFPA or his designee before the start of the opening general session of the Meeting. That employee, irrespective of his or her own personal membership status, shall be privileged to cast only one vote on each issue before the Association.

Sequence of Events Leading to Publication of an NFPA Committee Document

Call for proposals to amend existing document or for recommendations on new document.

▼

Committee meets to act on proposals, to develop its own proposals, and to prepare its report.

▼

Committee votes on proposals by letter ballot. If two-thirds approve, report goes forward. Lacking two-thirds approval, report returns to committee.

▼

Report is published for public review and comment. (Report on Proposals - ROP)

▼

Committee meets to act on each public comment received.

▼

Committee votes on comments by letter ballot. If two-thirds approve, supplementary report goes forward. Lacking two-thirds approval, supplementary report returns to committee.

▼

Supplementary report is published for public review. (Report on Comments - ROC).

▼

NFPA membership meets (Annual or Fall Meeting) and acts on committee report (ROP and ROC).

▼

Committee votes on any amendments to report approved at NFPA Annual or Fall Meeting.

▼

Complaints to Standards Council on Association action must be filed within 20 days of the NFPA Annual or Fall Meeting.

▼

Standards Council decides, based on all evidence, whether or not to issue standard or to take other action, including hearing any complaints.

▼

Appeals to Board of Directors on Standards Council action must be filed within 20 days of Council action.

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts 02269-9101
Fax No. 617-770-3500

Note: All proposals must be received by 5:00 p.m. EST/EDST on the published proposal-closing date.

If you need further information on the standards-making process, please contact the Standards Administration Department at 617-984-7249.

Date 9/18/93 **Name** John B. Smith **Tel. No.** 617-555-1212

Company _____

Street Address 9 Seattle St., Seattle, WA 02255

Please Indicate Organization Represented (if any) Fire Marshals Assn. of North America

1. a) NFPA Document Title National Fire Alarm Code **NFPA No. & Year** NFPA 72, 1993 ed.

b) Section/Paragraph 1-5.8.1 (Exception No.1)

FOR OFFICE USE ONLY
Log # _____
Date Rec'd _____

2. Proposal recommends: (Check one)
- ☐ **new text**
- ☐ **revised text**
- ☒ **deleted text**

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

Delete exception.

4. Statement of Problem and Substantiation for Proposal: (Note: State the problem that will be resolved by your recommendation; give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

5. ☒ This Proposal is original material. (Note: Original material is considered to be the submitter's own idea based on or as a result of his/her own experience, thought, or research and, to the best of his/her knowledge. is not copied from another source.)

☐ **This Proposal is not original material; its source (if known) is as follows:** _____

Note 1: Type or print legibly in black ink.
Note 2: If supplementary material (photographs. diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

I hereby grant NFPA the non-exclusive, royalty-free rights, including non-exclusive, royalty-free rights in copyright, in this proposal and I understand that I acquire no rights in any publication of NFPA in which this proposal in this or another similar or analogous form is used.

John B. Smith
Signature (Required)

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