

NFPA 80

Standard for Fire Doors and Fire Windows

1999 Edition



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An International Codes and Standards Organization

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NFPA 80

Standard for

Fire Doors and Fire Windows

1999 Edition

This edition of NFPA 80, *Standard for Fire Doors and Fire Windows*, was prepared by the Technical Committee on Fire Doors and Windows and acted on by the National Fire Protection Association, Inc., at its Fall Meeting held November 16–18, 1998, in Atlanta, GA. It was issued by the Standards Council on January 15, 1999, with an effective date of February 4, 1999, and supersedes all previous editions.

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.

This edition of NFPA 80 was approved as an American National Standard on February 4, 1999.

Origin and Development of NFPA 80

The *Standard for Fire Doors and Fire Windows* can be traced to the early days of the NFPA. Reports covering various phases of the problems of protectives for openings were submitted to the Association by several of the committees concerned and were adopted in 1897, 1898, 1899, 1900, 1901, 1902, and 1908. In 1911, a standard on door openings was presented and adopted, and *Rules for Fire Protection Coverings for Openings in Walls and Partitions on the Interior of Buildings* was adopted in 1912. In 1915, the existing rules were recodified and reorganized. The committee in charge of this document was renamed the Committee on Protection of Openings in Walls and Partitions and was established in 1916. Revisions recommended by the committee were adopted by the NFPA in 1916, 1917, 1918, 1926, 1927, 1928, 1931, 1937, and 1941.

In 1955, the committee was renamed the Committee on Fire Doors and Windows. In 1959, a complete revision of the 1941 edition, including changing the title to correspond with the name of the committee, was adopted. The 1959 edition was revised in 1961, 1962, 1965, 1966, 1967, 1968, 1970, 1973, 1974, 1975, 1977, 1979, 1981, 1983, 1986, and 1990.

In 1992, the committee changed the title of the document to *Standard for Fire Doors and Fire Windows*. Major changes in the 1992 edition included additions to the standard that recognized the technological changes in glazing materials for fire barrier openings and appendix material on radiant heat transfer. Radiant heat transfer, while not included in the performance requirements for fire doors and fire windows, is a consideration in the design of fire barriers.

The 1995 edition reorganized Chapter 2 for better usability, with many changes to improve consistency. Appendix J was also updated to provide more current information on radiant heat transfer.

The chapters have been reorganized in the 1999 edition to correlate the section numbers and their requirements. Requirements that are common to all doors such as clearances and detection have been moved to Chapter 1.

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Committee Scope: The Committee shall have primary responsibility for documents on the installation and maintenance of fire doors, windows, shutters, and other equipment used to restrict the spread of fire, including arrangements for automatic operation in case of fire. This includes installation to protect buildings against external fire and to restrict the spread of fire within buildings. Vault and record room doors are covered by the Technical Committee on Record Protection.

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

Information on referenced publications can be found in Chapter 16 and Appendix K.

Chapter 1 General

1-1* Scope.

1-1.1* This standard regulates the installation and maintenance of assemblies and devices used to protect openings in walls, floors, and ceilings against the spread of fire and smoke within, into, or out of buildings. The fire performance evaluation of these assemblies is tested in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, for horizontal access doors; NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, for fire doors and shutters; and NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*, for fire windows and glass block.

It is not the intent of this standard to establish the degree of protection required or to constitute the approval of any product. These are determined by the authority having jurisdiction.

This standard is based on product and engineering practices recognized as acceptable at the date of issue. Therefore, the provisions of this standard are not intended to be applied retroactively to installations that were in compliance at the time of installation.

1-1.2 Incinerator doors, record room doors, and vault doors are not covered in this standard. For requirements on their installation, see NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment*, and NFPA 232, *Standard for the Protection of Records*.

1-1.3 For requirements on the installation of hoistway doors for elevators and dumbwaiters, see the applicable sections of ASME/ANSI A17.1, *Safety Code for Elevators and Escalators*, or CAN 3-B44, *Safety Code for Elevators*. Requirements for horizontally sliding, vertically sliding, and swinging doors as used in this standard do not apply to hoistway doors for elevators and dumbwaiters.

1-1.4 This standard does not cover fire-resistant glazing materials and horizontally sliding accordion or folding assemblies fabricated for use as walls and tested as wall assemblies in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*. Consult the authority having jurisdiction for the design and installation of such materials and assemblies.

1-2 New Developments.

1-2.1* This standard shall not prohibit the development of new, modified, or improved devices that meet the intent of these requirements. It shall be the responsibility of the manu-

facturer to furnish the information necessary to update the requirements pertaining to such new and improved devices.

1-2.2 For devices not described in this standard, the authority having jurisdiction shall request descriptive information from manufacturers that is provided by a testing laboratory concerning acceptable methods for satisfactory field installation based on fire tests and engineering studies for operation and maintenance considerations, where applicable.

1-3 General Limitations.

1-3.1 Fire doors and windows are classified by the authority having jurisdiction by designating a required fire protection rating expressed in hours or fractions thereof. (See *Appendix E*.)

1-3.2 Fire doors equipped with automatic louvers or special closers for conveying systems shall be used only for protecting openings in required enclosures where the opening is not in a means of egress or otherwise located so that products of combustion flowing through the opening could jeopardize the use of exits prior to operation of the louver.

1-3.3 Fusible links are available in temperature ratings of 125°F to 500°F (51.6°C to 260°C) and in various load ratings. The particular fusible link used shall depend on the temperature and load requirements of the application. Multiple links shall be permitted to be used to meet the load rating requirements where the load rating of a single link is exceeded.

1-3.4 Preparation of fire door assemblies for locks, latches, hinges, remotely operated or remotely monitored hardware, concealed closers, glass lights, vision panels, louvers, and astragals, and the application of plant-ons and laminated overlays shall be performed in accordance with the manufacturer's inspection service procedure and under label service. (See *Appendix F* and *Appendix G*.)

Exception: For job site preparation of surface-applied hardware, function holes for mortise locks, and holes for labeled viewers, a maximum 3/4-in. (19-mm) wood and composite door undercutting, and protection plates (see 2-4.5) shall be permitted. Surface-applied hardware is applied to the face of a door without removing material from the door other than drilling round holes through the face of the door to accommodate cylinders, spindles, similar operational elements, and through-bolts. The holes shall not be permitted to exceed a diameter of 1 in. (25.4 mm) with the exception of cylinders.

1-3.5 Signage. Signs installed on the surfaces of fire doors shall be in accordance with this subsection.

1-3.5.1 Informational signs shall be permitted to be installed on the surface of fire doors in accordance with this subsection.

1-3.5.2 The total of area of all attached signs shall not exceed 5 percent of the area of the face of the fire door to which they are attached.

1-3.5.3 Signs shall be attached to fire doors using an adhesive. Mechanical attachments such as screws or nails shall not be permitted.

1-3.5.4 Signs shall not be installed on glazing material in fire doors.

1-3.5.5 Signs shall not be installed on the surface of fire doors so as to impair or otherwise interfere with the proper operation of the fire door.

1-3.6 Sliding Doors.

1-3.6.1 Sliding doors shall not be used on access openings to exit stairways, fire escapes, or exit ramps nor shall they be used on exits to the exterior of the building. Where sliding doors include an integral swinging door, they shall be permitted to be used on exits to the exterior of the building.

1-3.6.2 The combination unit shall be labeled, and the swinging door shall be furnished without any obstruction to clear passage.

1-4 Definitions.

Access Door. A door assembly, for installation in fire-rated walls or having a specific listing for installation in fire-rated floors or ceilings of floor-ceiling or roof-ceiling assemblies, that is used to provide access to shafts, chases, attics, spaces above ceilings, or other concealed spaces.

Access Door, Horizontal. An access door installed in the horizontal plane used to protect openings in fire-rated floors or ceilings of floor-ceiling or roof-ceiling assemblies.

Access Door, Vertical. An access door installed in the vertical plane used to protect openings in fire-rated walls.

Active Leaf. The first operating door of a pair, which is usually the door in which a lock is installed.

Ambient. The temperature of the room in which the test is being conducted.

Anchor. A device for attaching frames to the surrounding structure.

Approved.* Acceptable to the authority having jurisdiction.

Astragal (Overlapping or Wrap-Around). A horizontal or vertical molding attached to the meeting edge of one leaf of a pair of doors to protect against weather conditions, to minimize the passage of light between the doors, or to retard the passage of smoke, flame, or gases during a fire, and, in the case of a Dutch door, also to ensure that the lower leaf of the door closes in conjunction with the upper leaf.

Astragal (Split). A vertical molding attached to both leaves of a pair of doors at the meeting edges for protection against weather conditions. Astragals can also be permitted to be used where both leaves are active.

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

Automatic Fire Detectors. Either individual devices or prescribed combinations of devices designed to detect flame, heat, smoke, or combustion gases resulting from fire.

Automatic Top and Bottom Bolts. See definition of *Flush Bolts, Automatic*.

Automatic-Closing Device. A device, attached to a door or window frame, that causes the door or window to close when activated as a result of a predetermined temperature, rate of temperature rise, smoke, or other product of combustion detector.

Automatic-Closing Door. Doors that normally are open but that close when the automatic-closing device is activated.

Barrel (Rolling Steel Door). A cylindrical horizontal member at the head of the opening that supports the door curtain and contains the counterbalance springs.

Binders (Sliding Door, Horizontal and Vertical). Pieces of hardware used to hold a sliding door to the wall, preventing lateral movement of the door from the wall.

Biparting. A vertically sliding door in which half of the door moves up and half of the door moves down in order to open, or a horizontal sliding door in which one door moves to the right and one moves to the left in order to open.

Borrowed Lite. A stationary window unit that is installed in an interior partition that allows the passage of natural or artificial light from one area into an adjoining space.

Bottom Bar (Rolling Steel Door). A structural reinforcing member at the lower edge of the door curtain assembly.

Box Track. A type of track used with sliding doors that is formed from a sheet of steel and shaped as shown in Figure 1-4.

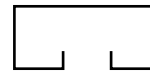


Figure 1-4 Box track.

Brackets (Sliding Door, Rolling Steel). Plates bolted to the wall or to extensions of the guide wall angles that serve to support the barrel and form end closers for the hood.

Builders Hardware. See Section 1-9.

Bumpers (Sliding Door). Stops to limit the closing or opening movement of a sliding door.

Center Latch. A latch used to hold the two halves of a center-parting or biparting fire door together, which is usually two pieces surface-applied to doors and interlocked in the closed position.

Chafing Strip (Sliding Door). A metal strip applied to the back surface of a sliding door to protect the door surface from damage from the wall.

Channel Frame. A frame that consists of head and jamb members of structural steel channels, either shop assembled or field assembled, to be used with masonry walls.

Classified. Products or materials of a specific group category that are constructed, inspected, tested, and subsequently reinspected in accordance with an established set of requirements. The classification process is performed by an organization acceptable to the authority having jurisdiction.

Closing Device. A means of closing a door from the partially or fully opened position.

Concrete Lintel. A precast concrete horizontal member spanning and carrying the load above an opening.

Continuous Glazing Angles or Channels (Window). Continuous steel angles or channels used to hold glass in a window.

Coordinator. A device used on pairs of swinging doors that prevents the active leaf from closing before the inactive leaf closes.

Counterbalancing. A method by which the hanging weight of the door curtain is balanced by helical torsion springs or weights.

Cover Plate (Slide Door, Vertical and Horizontal). A plate to cover the joint between the sections of multiple panel doors, usually applied to the front and back of the door.

Crush Plates. Continuous steel-bearing plates provided where doors are mounted on concrete masonry wall units with hollow cells to accommodate through-wall bolts to prevent crushing of the hollow concrete masonry unit.

Curtain (Rolling Steel). A door closure consisting of interlocked slats and a bottom bar.

Curtain Slats (Rolling Steel). Formed sheet steel members that, where interlocked together, form the door curtain.

Detectors. See definition of *Automatic Fire Detectors*.

Door, Access. See definition of *Access Door*.

Door, Automatic-Closing. See definition of *Automatic-Closing Door*.

Door Closer. A labeled device that, where applied to a door and frame, causes an open door to close by mechanical force. The closing speed can be regulated by this device.

Door Holder/Release Device. A labeled, fail-safe device, controlled by a detection device, used on an automatic-closing door to release the door at the time of fire.

Door, Power-Operated. See definition of *Power-Operated Fire Doors*.

Door Protection Plate. Protective material applied to the face of a door and generally made of approximately 0.05-in. (1.2-mm) thick brass, bronze, aluminum, or stainless steel or 1/8-in. (3.2-mm) thick laminated plastic.

Door, Self-Closing. See definition of *Self-Closing Doors*.

Door, Service Counter. See definition of *Service Counter Door*.

Double Egress Doors. A pair of swinging doors, each leaf of which swings in the opposite direction of the other. (See *Figure B-25*.)

Dutch Door. A door divided horizontally so that the lower part can be shut while the upper part remains open.

Egress Side. The side of an opening from which traffic exits.

Finish Frame. A subframe attached to a rough buck to which the door is attached.

Fire Door.* The door component of a fire door assembly.

Fire Door Assembly. Any combination of a fire door, a frame, hardware, and other accessories that together provide a specific degree of fire protection to the opening.

Fire Door Frame. A component, forming the perimeter of an opening in a fire door assembly, that is supplied welded or knocked down and anchored to the surrounding structure.

Fire Door Frame for Lights. A frame that, in addition to a door opening, contains an opening(s) for use with glazing materials. Various types include transom light, side light, and transom and side light frames. (See *Figures B-66, B-67, and B-68 for elevations*.)

Fire Door Frame for Panels. A frame that, in addition to a door opening, contains an opening(s) for use with fixed panels of solid metal or wood. Various types include transom panel, side panel, and transom and side panel frames. (See *Figures B-69, B-70, B-71, and B-72 for elevations*.)

Fire Door Hardware. Fire door hardware is applied to both swinging and sliding doors and consists of the items referred

to in Tables 3-4.3.3(a), 3-4.3.3(b), and 3-4.3.3(c). [See also *Figures B-29, B-31, B-34, B-37(a-f), and B-41 through B-45*.]

Fire Exit Hardware. Labeled devices for swinging fire doors installed to facilitate safe egress of persons and generally consisting of a cross bar and various types of latch mechanisms that cannot hold the latch in a retracted locked position.

Fire Lock Angles (Sliding Door, Horizontal). A sheet metal angle designed to hold the assembly in position during a fire test.

Fire Protection Rating. The designation indicating the duration of the fire test exposure to which a fire door assembly or fire window assembly was exposed and for which it successfully met all acceptance criteria as determined in accordance with NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, or NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*, respectively. (See *Appendix E*.)

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 Tests of Fire Endurance of Building Construction and Materials*. (See NFPA 220, *Standard on Types of Building Construction*.)

Fire Shutter. A labeled door assembly used for the protection of a window opening in an exterior wall. (See *definition of Shutter*.)

Fire Window Assembly. A window or glass block assembly having a fire protection rating.

Flame Baffle. A hinged piece of sheet metal within the hood that, when released, closes the space between the top of the curtain and the hood of a rolling door.

Flush Bolts, Automatic. A mortised bolt installed near the top or bottom of the inactive leaf of a pair of doors that holds the inactive leaf in a closed position until the active leaf is opened.

Flush Bolts, Manual. A mortised bolt installed near the top or bottom of the inactive leaf of a pair of doors in which the bolts are manually extended or retracted into or out of the header or sill by means of a lever.

Fusible Link. Two pieces of metal held together by low-melting-point solder.

Glazing Angle Clips. Steel clips used to hold glass in place in windows glazed only with glazing compound. Glazing angles are attached to window members with screws and are covered completely by the glazing compound.

Glazing Material.* A transparent or translucent material used in fire door assemblies and fire windows.

Governor (Sliding, Vertical, and Rolling Steel Doors). A mechanical device that limits the speed of descent of the door during automatic closure.

Guide (Sliding, Vertical, and Rolling Steel Doors). Vertical assembly in which the curtain travels and that is fastened to the jamb, retaining the edges of the door curtain and closing the space between the curtain edges and the jamb.

Guide Rail (Sliding Door, Vertical). A steel member, attached to the wall or frame, used with vertical sliding doors to guide the door.

Guide Shoe (Sliding Door, Vertical). A member attached to vertical sliding doors used to guide and retain the door on the guide rail.

Guide Wall Angle (Sliding, Vertical, and Rolling Steel Doors). The component of the guide assembly that is fastened to the jamb.

Hanger (Sliding Door, Horizontal). A member used to attach a horizontally sliding door to track and to cause the door to roll on or in the track.

Heat-Actuated Device. Devices that include fixed temperature releases, rate-of-temperature-rise releases, and door closers with hold-open arms embodying a fusible link.

Hollow Metal Frame. A frame formed from sheet metal.

Hood (Rolling Steel Door). A sheet metal housing that mounts horizontally between the brackets, serving as an enclosure for the coiled curtain and closing the space between the door coil and the lintel.

Impact Switch. A device that can be attached to a power-operated fire door to stop or reverse the closing motion of a power-operated door upon meeting an obstruction.

Inactive Leaf. One door of a pair of doors that ordinarily is latched closed; the second operating door of a pair.

Jackknife Door. A door that folds and unfolds while opening and closing.

Keeper. A guide and a restraint used on latching devices.

Knocked Down Frame. Door frame furnished by manufacturer in three or more basic parts for assembly in the field.

Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Lap-Mounted Door (Sliding Door, Vertical, Horizontal, Rolling Steel; Swinging Door). Doors mounted on the face of a wall and overlapping the opening by a prescribed dimension.

Latching Device. A spring-loaded latch bolt or a gravity-operated steel bar that, after release by physical action, returns to its operating position and automatically engages the strike plate when it is returned to the closed position.

Lintel. A horizontal member spanning and carrying the load above an opening.

Listed.* Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

Louver, Automatic. An opening in a door with a series of slats or blades to allow passage of air and designed to close automatically in the event of fire.

Meeting Edge (Elevator Doors). A resilient member used on the leading edges of elevator doors to prevent crushing or shearing of the edges.

Mullion. A fixed or removable vertical member set in a double door opening that allows both leaves to be active or set between a door and a side light or a separate, framed, glazed area.

Mullion, Window. The separate steel member or members used to join windows in a multiple window opening, either horizontally or vertically.

Muntin. A bar member supporting and separating panes of glass within a sash, door, or glazing frame.

Muntin, Window. A tee-shaped bar in a frame or ventilator, dividing the glass.

Noncombustible. Not capable of supporting combustion.

Plant-On. A decorative trim applied to the surface of a door. (*See Appendix F.*)

Power-Operated Fire Doors. Doors that normally are opened and closed electrically, pneumatically, or mechanically.

Rolling Steel Door. A closure consisting of an interlocking steel slat curtain, bottom bar, wall guides, and an automatic-releasing device that, on release, causes the curtain to close.

Rough Buck. A subframe, usually channel shaped, attached to an existing wall to which the finished frame is attached.

Round Track. A circular, roll-formed steel track used for supporting and guiding horizontal or vertical sliding doors.

Sash, Window. The horizontal or vertical sliding component of a window.

Self-Closing Doors. Doors that, when opened and released, return to the closed position.

Self-Latching Bolt. An automatic-latching device that engages in a keeper to hold a door leaf in a closed position and that can only be released manually.

Service Counter Door. A labeled fire door assembly used for the protection of openings in walls where the primary purpose of the opening is for nonpedestrian use, such as counter service for food, a pharmaceutical dispensary, package and baggage transfer, or observation ports.

Shall. Indicates a mandatory requirement.

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

Shutter. A labeled door assembly that is used for the protection of a window opening in an exterior wall. (*See definition of Fire Shutter.*)

Side Light. An opening in a fire door frame alongside the fire door opening that is filled with glazing material.

Side Light Frame. A fire door frame prepared for the application of a glazing material alongside the door opening. (*See Figure B-67.*)

Side Panel Frame. A door frame prepared for the installation of a fixed solid metal or wood panel alongside the door opening. (*See Figure B-71.*)

Single-Point Latch. A latch located in the edge of a door to engage either in the frame or in the edge of the inactive leaf of a pair of doors.

Sliding Hardware. A system of rails, hangers, rollers, guides, binders, and closing devices that are self-closing by means of gravity, weights, and pulleys or spring-actuated devices.

Smoke Detector. A device that senses visible or invisible particles of combustion.

Snub Rollers. See definition of *Stay Rollers*.

Solid Section Frame. See definition of *Channel Frame*.

Spring Hinge. A closing device in the form of a hinge with a built-in spring used to hang and close the door.

Spring Release Device (Sliding Door, Vertical, Horizontal; Rolling Steel Door). A device that, when activated, releases part of the spring counterbalancing force and causes the door to close.

Stay Rollers (Sliding Door, Horizontal). A device used on horizontally sliding doors at their back lower corners to guide the door and prevent the door from moving away from the wall under fire conditions.

Strike, Electric. A strike that, when activated, either releases or retains a projected latch or dead bolt.

Strike, Open Back. A strike applied to the inactive leaf of a pair of doors and cut away at the back to allow either leaf to open or close independently.

Strike Plate. A wear plate for projecting hardware or a wear plate and keeper for a latch bolt.

Struts. Adjustable vertical members that extend from the head of the hollow metal door frame to the ceiling to hold the frame rigidly in place.

Swing-In Door. A door that swings into a room or building.

Swing-Out Door. A door that swings out of a room or building.

Three-Point Latch. A self-latching device designed to latch a door at the top, bottom, and edge by an interconnected mechanism so that all latches operate simultaneously.

Track Binder (Sliding Doors, Sheet Metal). A device mounted on a sheet metal sliding door that projects behind the track to prevent the door from moving away from the wall under fire conditions.

Transom. An opening in a fire door frame above the door opening that is filled by a solid panel or with glazing material.

Transom and Side Light Frame. A fire door frame prepared for the application of a glazing material above and alongside the door opening. (See *Figure B-68*.)

Transom and Side Panel Frame. A fire door frame prepared for the application of solid metal or wood panels above and alongside the door opening. (See *Figure B-72*.)

Transom Light Frame. A fire door frame prepared for the application of a glazing material above the door opening that has a horizontal member such as a transom bar provided to separate the glazed opening from the door opening. (See *Figure B-66*.)

Transom Panel. A panel, fixed or removable, installed in a frame above the door.

Transom Panel Frame. A fire door frame prepared for the application of a transom panel above the door opening that has a horizontal member such as a transom bar provided to separate the transom opening from the door opening unless transom panel or the bottom of the panel and the top of the door are rabbetted. (See *Figures B-69 and B-70*.)

Trim, Vision Panel. Perforated plates, wire mesh, or metal bars permanently attached to the door structure or vision panel frame to reduce the exposed glass area.

Vent (Sliding Door, Horizontal Tin Clad Only). A hole cut in a fire door to allow for venting of the products of combustion.

Ventilator, Window. The part of a projected window, casement window, or pivoted window that opens.

Vertically Sliding Door. Labeled single-piece doors and sectional doors operating in a vertical direction.

Viewer. A viewing device installed in a door to allow observation of persons opposite the security side of the door without having to open the door.

Wedge (Sliding Door, Horizontal Tin Clad, and Flush Sheet Metal). A plate mounted on the face of a sliding door designed to force the door against the wall.

Window. Integral fabricated units, placed in an opening in a wall, primarily intended for the admission of light, or light and air, and not intended primarily for human entrance or exit.

Window Frame. The perimeter of a window.

Wire Glazing Clips. Small, spring wire clips used to hold glass in place where windows are glazed only with glazing compound.

Wired Glass. A glazing material with embedded wire mesh.

1-5 Listed and Labeled Products. See definitions in Section 1-4.

1-5.1* Listed items shall be identified by a label. Labels shall be applied in locations that are readily visible and convenient for identification by the authority having jurisdiction after installation of the assembly.

1-5.2 The label or the listing shall be considered evidence that samplings of such devices or materials have been evaluated by tests and that such devices or materials are produced under an in-plant, follow-up inspection program.

1-5.3 Specification of items of a generic nature, such as hinges, that are not labeled shall comply with the specifications contained in this standard.

1-6 Classifications and Types of Doors.

1-6.1* Only labeled fire doors shall be used.

1-6.2 The label on doors covers only the design and construction of the door.

Exception No. 1: On fire doors bearing the label reading "Fire Door To Be Equipped with Fire Exit Hardware," the label shall cover the reinforcements or construction features necessary for the exit devices that are required to bear the label reading "Fire Exit Hardware."

Exception No. 2: On doors bearing the label reading "Fire Door," the label shall include the following:

- (a) *On rolling steel doors — wall guides, counterbalancing, and automatic mechanisms*
- (b) *On steel sectional (overhead) doors — hinged steel panels, wall guides, interlock at top edge, vertical and horizontal tracks, roller wheels, counterbalancing, automatic-closing mechanisms, and governors*
- (c) *On elevator doors — see Section 8-2*

Exception No. 3: On doors bearing the label reading "Frame and Fire Door," the label shall also include the following:

- (a) *On access doors — the frame, hinging, and latching mechanism*
- (b) *On acoustical doors — the frame, sill, and latching mechanism*

- (c) On chute doors — the frame, hinging, latching, and closing mechanism
- (d) On dumbwaiter doors — see 8-2.3
- (e) On service counter doors — frames, counters, wall guides, counterbalancing, and automatic-closing mechanisms
- (f) On material conveying systems — the frame, sill guides, and automatic-closing systems (see Appendix C for guidelines)

1-6.3* Authorities having jurisdiction shall be consulted for information on the size of oversize doors that shall be permitted in a given location.

1-7 Glazing Material in Fire Doors.

1-7.1 Only labeled fire resistance-rated glazing material meeting applicable safety standards shall be used in fire door assemblies. (See A-1-4 Glazing Material.)

Exception: Where fire door assemblies are exempt from safety standards.

1-7.2 Glazing materials shall be installed in labeled frames or in tested frames in accordance with the fire door listing.

1-7.3 Glazing material shall not be used in fire doors having a 3-hour fire protection rating or fire doors having a 1½-hour fire protection rating for use in severe exterior fire exposure locations.

Exception:* Glazing material, with no through-opening, not exceeding 100 in.² (0.065 m²) shall be permitted when tested for the desired rating period in accordance with NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*.

1-7.4* Glazing material shall be permitted in fire doors having the following fire protection ratings when tested in accordance with NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, and shall be limited in size and area in accordance with Table 1-7.4.

Table 1-7.4 Fire Door Rating

Fire Door Rating (hr)	Maximum Area of Glazing (per Door Leaf ^{a,b})
1½, 1⅓	Limited to maximum area tested
3/4	Limited to maximum area tested ^c
1 ^d , 1½ ^{a,d}	Limited to maximum area tested
3 ^b	100 in. ² (0.065 m ²)

^aSee also requirements in 1-7.3.

^bSee also requirements in 8-3.

^cMaximum area of individual exposed lights shall be 1296 in.² (0.84 m²) with no dimension exceeding 54 in. (1.37 m) unless otherwise tested.

^dGlazing materials exceeding 100 in.² (0.065 m²) in area are not permitted in temperature rise-rated doors.

1-7.5 Each individual glazing unit shall be identified with a label. The label shall be visible after installation.

1-7.6 Viewers in fire doors shall be labeled.

1-8 Transparent Composite Panels. Transparent composite panels that limit the temperature rise on the unexposed surface and withstand the impact of the hose stream test as required for wall for the required duration in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of*

Building Construction and Materials, and subsequently tested in accordance with NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, or NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*, shall be limited to the maximum area tested in doors or windows having a fire protection rating of 1½ hours or less. (See Appendix E.)

1-9 Classification of Hardware for Fire Doors.

1-9.1 Hardware required for the installation of all types of fire doors is specified in this standard as follows:

- (a) In those sections covering installation
- (b) In Tables 2-4.3.1, 2-4.4.3, 3-4.3.3(a), 3-4.3.3(b), and 3-4.3.3(c) (see illustrations of typical applications in Appendix B)

1-9.2 Hardware for fire doors shall be referred to as builders hardware and fire door hardware. Fire exit hardware is within the category of builders hardware.

1-9.3 In this standard, builders hardware is applied only to swinging doors and consists of the items specified in Tables 2-4.3.1 and 2-4.4.3 (see Figures B-20 through B-28). These include hinges (full mortise, half mortise, half surface, full surface, olive knuckle, paumelle, or spring); single-, two-, or three-point locks and latches; top and bottom bolts (flush, surface, or concealed); and door closers. This type of hardware shall not be required to be shipped from the factory with the fire doors.

Fire exit hardware consists of exit devices that have been labeled for both fire and panic protection. (See Figures B-24 and B-25.)

1-9.4 Fire door hardware is applied to both swinging and sliding doors and consists of the items specified in Tables 3-4.3.3(a), 3-4.3.3(b), and 3-4.3.3(c) [see Figures B-29, B-31, B-34, B-37(a), and B-41 through B-45]. Fire door hardware that is applied to swinging doors consists of surface-mounted strap hinges, surface-applied latches, and closing devices. In this standard, all hardware for sliding doors is fire door hardware. This type of hardware normally is shipped from the factory with the fire doors.

1-10 Placement of Detectors.

1-10.1 This section provides information on the placement of detectors.

1-10.2 All detectors including fusible links shall not be placed in the dead air space developed at the intersection of the wall and ceiling directly above the fire door. (See Figures B-58 and B-59.)

1-10.3 Detectors for the release of fire doors shall be permitted to be part of an overall system, such as a fire alarm, water flow alarm, or carbon dioxide release system, that releases the door.

1-10.4 Where smoke detectors are used, they shall be located in accordance with NFPA 72, *National Fire Alarm Code*[®].

1-10.5 Detectors and their components shall be installed in accordance with the manufacturers' instructions.

1-10.6 Detectors or fusible links shall be installed on both sides of the wall, interconnected so that the operation of any single detector or fusible link causes the door to close. [See Figures B-30, B-32, B-35, B-36(a), B-36(b), B-38, B-39(a), B-39(b), B-45, B-46, B-47, B-48, B-49, and B-50.]

Exception: A detector or fusible link shall not be required on the exterior (outside) wall.

1-10.6.1* Where fusible links are used, one fusible link shall be located near the top of the opening, and additional links shall be located at or near the ceiling on each side of the wall. [See Figures B-41 through B-44(a), B-48 through B-50.]

Exception No. 1: For horizontally sliding doors, one fusible link shall be installed just above the opening or on an arm projecting from the leading edge of the door.

Exception No. 2: For vertically sliding tin clad and sheet metal doors, one fusible link shall be located at the center near the bottom of the door and additional links shall be located at or near the ceiling on each side of the wall. (See Figures B-45 and B-46.)

Exception No. 3: For steel sectional doors, one fusible link shall be located near the top of the opening near the automatic release mechanism on the door in an area where there is no obstruction to the circulation of air, and additional links shall be located at or near the ceiling on each side of the wall. (See Figure B-47.)

Exception No. 4: For shutters, fusible links shall be located in the proximity of the shutter near the top of the opening and in an area where there is no obstruction to the circulation of air.

1-11 Supporting Construction.

1-11.1 Walls.

1-11.1.1 Walls shall be plumb and true, present smooth surfaces, and have a fire resistance rating as required by the authority having jurisdiction.

1-11.1.2 Walls shall be of brick, concrete, or concrete masonry unit construction except that, where hollow concrete masonry units are used, the wall opening shall be reinforced to provide anchorage for door-mounting hardware equal to that of brick or concrete (see Figures B-16, B-18, or B-19).

Exception: In lieu of using brick or filling the hollow concrete masonry units, continuous steel-bearing plates (crush plates) of $\frac{3}{16}$ in. \times 3 in. (4.76 mm \times 76.2 mm) minimum dimensions shall be permitted to be used to bridge the cavities and to prevent the through-wall bolts from crushing the hollow blocks. (See Figures B-17, B-18, or B-19.)

1-11.1.3 Door assemblies shall be used on walls of other construction only if listed for such installation.

1-11.2 Sills.

1-11.2.1 In buildings with noncombustible floors, special sill construction shall not be required, provided the floor structure is extended through the door opening.

1-11.2.2 In buildings with combustible floors or combustible floor coverings, special sill construction shall be required if

the floor structure is extended through the door opening, as combustible floor construction shall not be permitted to extend through the door opening.

Exception: Door openings required to be protected by $\frac{1}{2}$ -hour or $\frac{1}{3}$ -hour rated fire protection door assemblies.

1-11.2.3 Combustible floor coverings shall not extend through openings protected by 3-hour rated fire protection door assemblies.

1-11.2.4 Sills shall be constructed of noncombustible materials.

1-11.2.5* For swinging doors with builders hardware and special purpose horizontally sliding accordion or folding doors with frames having a jamb depth of 4 in. (102 mm) or less, the sill width shall be equal to the jamb depth. Where frames have a greater jamb depth, the sills shall have a minimum width of 4 in. (102 mm) and shall be installed so that the sill extends from the face of the frame on the door side into the frame. (See Figure B-2.)

1-11.2.6 For swinging doors with fire door hardware, sills shall extend at least the depth of the door frame for flush-mounted doors. For lap-mounted doors, sills shall extend beyond the opening for a length equal to the projection of the installed door or doors. (See Figures B-1, B-3, and B-4 for recommended construction.)

1-11.2.7 For horizontally sliding doors, vertically sliding fire doors, and rolling steel doors, sills shall be constructed of noncombustible material and shall extend 6 in. (152 mm) past the edge of the opening on each side and 4 in. (102 mm) out from the face of the wall. (See Figures B-1, B-3, and B-4.)

1-11.2.8 Flush concrete sills shall extend to the wall opening on both sides.

1-11.2.9 For swinging doors with builders hardware, horizontally sliding doors, and special purpose horizontally sliding accordion or folding doors, raised noncombustible sills or thresholds shall be permitted wherever combustible floor coverings are contemplated or are in use on one or both sides of the door openings. (See Figure B-2.)

1-11.3 Lintels. Lintels shall be brick, concrete or masonry arches, steel, or reinforced concrete. If of steel or reinforced concrete, lintels shall be constructed as shown in Figures B-5, B-6, B-7, or B-8 or as acceptable to the authority having jurisdiction.

1-11.4 Clearance. Clearances under the bottoms of doors shall be in accordance with Table 1-11.4.

Table 1-11.4 Clearances Under the Bottoms of Doors

Clearance Between	Swinging Doors with Builders Hardware		Swinging Doors with Fire Door Hardware		Horizontally Sliding Doors		Vertically Sliding Doors		Special Purpose Horizontally Sliding Accordion or Folding Doors	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
Bottom of door and raised										
noncombustible sills	$\frac{3}{8}$	9.5	$\frac{3}{8}$	9.5	$\frac{3}{8}$	9.5	$\frac{3}{8}$	9.5	$\frac{3}{8}$	9.5
Floor where no sill exists	$\frac{3}{4}$	19.1	$\frac{3}{4}$	19.1	$\frac{3}{4}$	19.1			$\frac{3}{4}$	19.1
Rigid floor tile	$\frac{5}{8}$	15.9								
Floor coverings	$\frac{1}{2}$	12.7	$\frac{1}{2}$	12.7	$\frac{1}{2}$	12.7			$\frac{1}{2}$	12.7

1-11.5 Floor Coverings. Combustible floor coverings shall be permitted to extend through openings required to be protected by 1½-hour, 1-hour, or ¾-hour rated fire protection fire door assemblies without a sill where they have a minimum critical radiant flux of 0.22 W/cm² in accordance with NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*.

1-12* Operational Test. After the installation of a fire door, shutter, or fire window is completed, an operational test shall be conducted. This test shall be adequate to determine that the system has been installed and functions as intended.

Chapter 2 Swinging Doors with Builders Hardware

2-1 Doors.

2-1.1 General. This chapter shall cover the installation of swinging doors with builders hardware.

2-1.2 Components. A fire door assembly shall consist of components that are separate products incorporated into the assembly and allowed to have their own subcomponents. The normal components of a fire door assembly include a door, a door frame, hinges, a lock or latch, and a closing device. They also include, but are not limited to, an astragal, an automatic louver, a coordinator, flush or surface bolts, gasketing, a holder/release device, protection plates, and glazing materials.

2-1.3 Mounting of Doors. Swinging composite, hollow metal, flush sheet metal, metal clad (Kalamein), and wood core doors with builders hardware shall be flush mounted in labeled door frames.

2-1.4 Operation of Doors. All swinging doors shall be closed and latched at the time of fire. For the purposes of this section, the operation of doors is divided into three categories.

2-1.4.1 Self-Closing Doors. Self-closing doors shall swing easily and freely and shall be equipped with a closing device to cause the door to close and latch each time it is opened. The closing mechanism shall not have a hold-open feature.

2-1.4.2 Automatic-Closing Doors. Automatic-closing doors shall be permitted to close automatically by means of the installation of a closing device and one of the following:

- (a) A separate, labeled, fail-safe door holder/release device or a hold-open mechanism that shall be permitted to be an integral part of the basic closing device
- (b) An integral closing device that allows the door to swing freely during normal operation and that automatically closes the door during an alarm condition, provided the hold-open mechanisms are released by one or a combination of automatic fire detectors acceptable to the authority having jurisdiction

2-1.4.3 Power-Operated Fire Doors. Power-operated fire doors shall be equipped with a releasing device that shall automatically disconnect the power operator at the time of fire, allowing a self-closing or automatic device to close the door regardless of power failure or manual operation.

2-2 Supporting Construction.

2-2.1 Walls. Wall openings shall be constructed to readily accept the fire door frame. The frame shall be considered to be non-load-bearing except where specifically designed to carry loads. Frames shall be anchored securely to the wall construction.

2-2.2 Sills. Sills shall be installed in accordance with 1-11.2.

2-2.3 Lintels. Separate reinforcing units shall be provided for pressed steel door frames, where necessary, to support overhead wall loads over door openings. Reinforcements of head members of pressed steel door frames shall not be permitted. (See Figures B-5 through B-8.)

2-3 Openings.

2-3.1 Door Frames.

2-3.1.1* Only labeled door frames shall be used.

2-3.1.2* Methods of anchoring shall be as shown in the listing.

2-3.1.3* Door frames intended for drywall installation shall be of the wrap-around type. Anchors shall be appropriately secured to vertical wall studs and floor.

2-3.1.4 Proprietary-type slip-on door frames (for example, those for use on pre-prepared openings in drywall construction) shall be installed in accordance with the manufacturer's installation instructions.

2-3.1.5 Door frames provided with expansion bolt-type anchors shall be installed in masonry walls only.

2-3.1.6 Wood or plastic-faced composite or wood core doors shall be installed in labeled door frames of the single unit type. Steel-faced composite, hollow metal, metal clad (Kalamein), and flush sheet metal doors shall be installed in pressed steel or steel channel frames.

2-3.1.7 The clearance between the edge of the door on the pull side and the frame, and the meeting edges of doors swinging in pairs on the pull side shall be 1/8 in. ± 1/16 in. (3.18 mm ± 1.59 mm) for steel doors and shall not exceed 1/8 in. (3.18 mm) for wood doors.

2-3.2 Frames for Lights or Panels. Where a frame assembly consists of both solid panels and glazed lights, the fire protection rating shall be based on the glazed area.

2-3.3 Frames for Transom Lights, Side Lights, or Both.

2-3.3.1 Transom or side lights shall be fixed.

2-3.3.2 Frames with transom lights, side lights, or both shall be permitted where a ¾-hour fire protection rating or less is required.

2-3.3.3 Only labeled glazing material shall be used to glaze the light openings.

2-3.4 Frames for Transom or Side Panels.

2-3.4.1 Side panels, transom panels, or both shall be fixed. Removable transom panels shall be permitted to allow for movement of materials or equipment through the opening.

2-3.4.2 Frames with transom panels shall be permitted in situations where fire protection ratings up to and including 3 hours are required.

2-3.4.3 Louvers shall not be installed in either transom or side panels.

2-4 Assembly Components.

2-4.1 Closing Devices.

2-4.1.1 Where there is an astragal or projecting latch bolt that prevents the inactive door from closing and latching before the active door closes and latches, a coordinating device shall be used. A coordinating device shall not be required where each door closes and latches independently of the other.

2-4.1.2* A closing device shall be installed on every fire door.

Exception: With approval by the authority having jurisdiction, where pairs of doors are provided for mechanical equipment rooms to allow the movement of equipment, the device shall be permitted to be omitted on the inactive leaf.

2-4.1.3 All components of closing devices used shall be attached securely to doors and frames by steel screws or through-bolts.

2-4.1.4* All closing mechanisms shall be adjusted to overcome the resistance of the latch mechanism so that positive latching is achieved on each door operation.

2-4.1.5 Where door holder/release devices are used, they shall be labeled.

2-4.2* Application of Door Holder/Release Devices. Door holder/release devices shall be installed in accordance with the manufacturer's instructions and only in conformance with the individual manufacturer's published listings.

2-4.3* Builders Hardware. See Figures B-20 through B-28.

2-4.3.1 Hinges. Hinges shall be as specified in Table 2-4.3.1. Labeled full length continuous hinges shall be permitted in accordance with their listing.

2-4.3.2 Attaching Hinges to Doors. Mortise hinges shall be secured to reinforcements in the doors with steel machine screws, and surface hinges shall be attached with steel through-bolts.

Exception: Mortise hinges shall be secured to wood and plastic-covered composite doors or wood core doors with No. 12 \times 1 $\frac{1}{4}$ -in. (31.75-mm), flat, threaded-to-the-head, steel wood screws.

Table 2-4.3.1 Builders Hardware Mortise, Surface, and Full Length Hinges, Pivots, or Spring Hinges for Swinging Doors

Doors up to 60 in. (1.52 m) in height shall be provided with two hinges and an additional hinge for each additional 30 in. (0.76 m) of door height or fraction thereof. The distance between hinges shall be permitted to exceed 30 in. (0.76 m). Where spring hinges are used, at least two shall be provided.									
Door Rating (hr)	Maximum Door Size				Minimum Hinge Size				Hinge Type
	Width		Height		Height		Thickness		
	ft	m	ft	m	in.	mm	in.	mm	
For 1 ³ / ₄ -in. (44.5-mm) or Thicker Doors									
3, 1 ¹ / ₂ , 1, 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	4	1.22	10	3.05	4 ¹ / ₂	114.3	0.180	4.57	Steel, mortise or surface
3, 1 ¹ / ₂ , 1, 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	4	1.22	8	2.44	4 ¹ / ₂	114.3	0.134	3.40	Steel, mortise or surface
1 ¹ / ₂ , 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	3 ¹ / ₆	0.96	8	2.44	6	152.4	0.225	5.72	Steel, olive knuckle or paumelle
3, 1 ¹ / ₂ , 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	4	1.22	10	3.05	4	101.6	0.225	5.72	Steel pivots (including top, bottom, and intermediate)
1 ¹ / ₂ , 1, 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	3	0.91	5	1.52	4	101.6	0.130	3.30	Steel, mortise or surface
1 ¹ / ₂ , 1, 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	2	0.61	3	0.91	3	76.2	0.092	2.34	Steel, mortise or surface
3, 1 ¹ / ₂ , 1, 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	3	0.91	7	2.13	4 ¹ / ₂	114.3	0.134	3.40	Steel, mortise or surface (labeled, self-closing, spring type)
3, 1 ¹ / ₂ , 1, 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	3	0.91	7	2.13	4	101.6	0.105	2.67	Steel, mortise or surface (labeled, self-closing, spring type)
For 1 ³ / ₈ -in. (34.93-mm) Doors									
3, 1 ¹ / ₂ , 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	3	0.91	7	2.13	3 ¹ / ₂	88.9	0.123	3.12	Steel, mortise or surface
3, 1 ¹ / ₂ , 1, 3 ³ / ₄ , 1 ¹ / ₂ , 1 ¹ / ₃	2 ² / ₃	0.81	7	2.13	3 ¹ / ₂	88.9	0.105	2.67	Steel, mortise or surface (labeled, self-closing, spring type)

Notes:

1. All hinges or pivots, except spring hinges, shall be of the ball bearing type. Hinges or pivots employing other antifriction bearing surfaces shall be permitted if they meet the requirements of ANSI A156.1, *Standard for Butts and Hinges*. Spring hinges shall be labeled.

2. Hinges 4 $\frac{1}{2}$ in. (114 mm) high and 0.180 in. (4.57 mm) thick shall be permitted for use on wide and heavy doors or doors that are subjected to heavy use or unusual stress.

3. Some manufacturers can provide fire doors with hinges of lighter weight that are not of the ball bearing type where they are part of a listed assembly, meet the test requirements of ANSI A156.1, *Standard for Butts and Hinges*, and have been tested to a minimum of 350,000 cycles.

4. Pivot sets made up of components that are smaller or of a lighter gauge than shown in this table shall be permitted to be used, provided they meet the requirements of ANSI A156.4, *Door Controls (Closers)*, and are in accordance with the manufacturer's label service procedures.

2-4.3.3 Attaching Hinges to Frames. Hinges shall be secured to frames with steel screws. Types of screws vary depending on material used for the manufacture of labeled door frames. The manufacturer's instructions and published listings for labeled door frames shall be referenced for specific screw requirements.

2-4.3.4 Shimming. When required to meet the clearances stated in 2-3.1.7, the shimming of hinges using steel shims shall be permitted.

2-4.4 Locks or Latches.

2-4.4.1 Only labeled locks and latches or labeled fire exit hardware (panic devices) meeting both life safety requirements and fire protection requirements shall be used. [See A-I-1(c) and (d).]

2-4.4.2 Fire exit hardware shall be installed only on fire doors bearing the marking, "Fire Door To Be Equipped with Fire Exit Hardware." Fire exit hardware shall be labeled for both fire and panic. Fire exit hardware shall have a permanently attached label that bears the serial number and shows the manufacturer's name and type of approval. The label shall differentiate between panic hardware, which is not acceptable for use on fire doors and fire exit hardware.

2-4.4.3 All single doors and active leaves of pairs of doors shall be provided with an active latch bolt that cannot be held in a retracted position as specified in Table 2-4.4.3.

Exception No. 1: Doors other than those used in means of egress shall be permitted to be provided with dead bolts in addition to the active latch bolts or as otherwise permitted by the authority having jurisdiction.

Exception No. 2: Locks with dead bolts that are interconnected with latch bolts and retract when the latch bolt is retracted shall be permitted for use on fire doors within a means of egress.

Exception No. 3: Latching arrangements that do not provide positive latching in the normal mode shall be permitted to be used provided that, in a fire emergency, the door becomes positively latched by means of an automatic fail-safe device that is activated by an automatic fire detector. (See Section 1-10.)

2-4.4.4 Where both leaves are required for exit purposes, they shall be provided with labeled fire exit hardware.

Exception: Where permitted by the authority having jurisdiction, pairs of doors not provided with an astragal shall be permitted to have labeled fire exit hardware and an open back strike installed on the inactive leaf, and either labeled fire exit hardware or any labeled latch capable of being opened by one obvious operation from the egress side installed on the active leaf.

Table 2-4.4.3 Builders Hardware Latching Devices for Swinging Doors*

Material	Door Rating (hr)	Single Swinging Doors				Doors in Pairs				Inactive Leaf
		Maximum Opening Height		Minimum Latch Throw		Maximum Opening Height		Active Leaf Minimum Latch Throw		
		ft	m	in.	mm	ft	m	in.	mm	
Composite wood (flush)	1 ¹ / ₂	10	3.05	1 ¹ / ₂	12.7	8	2.44	3 ³ / ₄	19.05	Top and bottom bolts
	3 ³ / ₄	10	3.05	1 ¹ / ₂	12.7	8	2.44	3 ³ / ₄	19.05	Top and bottom bolts
Composite plastic (flush)	1 ¹ / ₂	9	2.44	1 ¹ / ₂	12.7	7	2.13	3 ³ / ₄	19.05	Top and bottom bolts
	1	9	2.44	1 ¹ / ₂	12.7	8	2.44	3 ³ / ₄	19.05	Top and bottom bolts
	3 ³ / ₄	10	3.05	1 ¹ / ₂	12.7	8	2.44	3 ³ / ₄	19.05	Top and bottom bolts
Composite steel (flush)	3	8	2.44	3-pt. surface						
	3	8	2.44	5 ⁵ / ₈	15.88	7 ¹ / ₂	2.29	5 ⁵ / ₈	15.88	Top and bottom bolts
	1 ¹ / ₂	8	2.44	1 ¹ / ₂	12.7	7 ¹ / ₂	2.29	5 ⁵ / ₈	15.88	Top and bottom bolts
	3 ³ / ₄	8	2.44	1 ¹ / ₂	12.7	1 ¹ / ₂	2.29	5 ⁵ / ₈	15.88	Top and bottom bolts
Hollow metal (flush)	3	10	3.05	1 ¹ / ₂	12.7	8	2.44	3 ³ / ₄	19.05	Top and bottom bolts
	1 ¹ / ₂	10	3.05	1 ¹ / ₂	12.7	9	2.74	3 ³ / ₄	19.05	Top and bottom bolts
	3 ³ / ₄	10	3.05	1 ¹ / ₂	12.7	8	2.44	3 ³ / ₄	19.05	Top and bottom bolts
Hollow metal (panelled or flush)	3, 1 ¹ / ₂ or 3 ³ / ₄	10	3.05	3-pt. concealed		10	3.05	3-pt. concealed		2-pt. concealed
Metal clad (panelled or flush)	1 ¹ / ₂ or 3 ³ / ₄	8	2.44	1 ¹ / ₂	12.7	8	2.44	3 ³ / ₄	19.05	Top and bottom bolts
Sheet metal (panelled or flush)	1 ¹ / ₂ or 3 ³ / ₄	8	2.44	1 ¹ / ₂	12.7	8	2.44	3 ³ / ₄	19.05	Top and bottom bolts
Wood core	1 ¹ / ₃	10	3.05	1 ¹ / ₂	12.7	8	2.44	3 ³ / ₄	19.05	Top and bottom bolts
Wood core	1 ¹ / ₂	9	2.74	1 ¹ / ₂	12.7					

*For alternate assemblies and exceptions, see 2-4.3.

2-4.4.5 Where a pair of doors is needed for the movement of equipment and where the inactive leaf of the pair of doors is not required for exit purposes, labeled, top and bottom, self-latching or automatic flush bolts, or labeled two-point latches shall be permitted.

Exception: Manually operated, labeled, top and bottom flush-mounted or surface-mounted bolts on the inactive leaf of a pair of doors shall be permitted to be used where acceptable to the authority having jurisdiction, provided they do not pose a hazard to safety to life. This provision limits their use to rooms not normally occupied by humans (for example, transformer vaults and storage rooms). The inactive leaf shall not require a closer.

2-4.4.6 The throw of single-point latch bolts shall not be less than the minimum shown on the fire door label. If the minimum throw is not shown or the door does not bear a label, the minimum throw shall be as specified in Table 2-4.4.3.

2-4.4.7 Locks, latches, surface-mounted top and bottom bolts, and fire exit hardware shall be secured to reinforcements in the doors with machine screws or shall be attached with through-bolts. Flush-mounted top and bottom bolts shall be secured to reinforcements in the doors with machine screws.

Exception: Locks and latches shall be attached to wood and plastic-covered composite doors or wood core doors with not less than No. 8, flat, threaded-to-the-head, wood screws or shall be attached with through-bolts. Fire exit hardware and surface-mounted top and bottom bolts shall be attached to wood and plastic-covered composite doors with through-bolts or with steel screws at locations specified in the door manufacturer's installation instructions.

2-4.4.8 Strike plates shall be secured to the frame with steel screws. Types of screws vary depending on the material used for the manufacture of labeled door frames. The manufacturer's instructions and published listings for labeled door frames shall be referenced for specific screw requirements.

Exception: Channel frames shall be provided with holes to accommodate latch bolts and top bolts.

2-4.4.9 Strike plates for doors swinging in pairs shall be secured to reinforcements in the inactive leaf with machine screws.

Exception: Strike plates for wood and plastic-covered composite doors swinging in pairs shall be attached to the inactive leaf with not less than No. 8, flat, threaded-to-the-head, wood screws.

2-4.4.10 Open back strikes shall be permitted to be used in lieu of conventional strikes only where specifically provided for in the published listings. (See Figure B-28.)

2-4.4.11 Electric strikes shall be permitted to be used in lieu of conventional strikes in single swinging doors and pairs of doors where provided for in the published listings. (See Figure B-64.)

2-4.5 Protection Plates. Factory-installed protection plates shall be installed in accordance with the listing of the door. Field-installed protection plates shall be labeled and installed in accordance with their listing.

Exception: Labeling is not required where the top of the protection plate is not more than 16 in. (406 mm) above the bottom of the door.

2-4.6 Automatic Louvers. Only labeled fire door louvers shall be used in fire doors. (See 1-3.2.)

2-4.7 Astragals.

2-4.7.1 Doors swinging in pairs and having a fire protection rating of more than 1¹/₂ hours shall have an overlapping astragal.

2-4.7.2 Doors swinging in pairs, where located within a means of egress, shall not be equipped with astragals that inhibit the free use of either leaf. These forces shall be applied at the latch stile to achieve the minimum required width.

2-4.7.3 Pairs of doors that require astragals shall have at least one attached in place to project approximately ³/₄ in. (19.1 mm) or as otherwise indicated in the individual published listings. (See Figures B-21, B-23, and B-31; also see 2-4.4.4.)

2-4.8 Gasketing. Gasketing on fire doors or frames shall be furnished only in accordance with the published listings of the door, frame, or gasketing material manufacturer.

Exception: Where acceptable to the authority having jurisdiction, gasketing of noncombustible or limited-combustible material (see NFPA 220, Standard on Types of Building Construction) shall be permitted to be applied to the frame, provided closing and latching of the door are not inhibited.

2-5 Application, Installation, and Adjustment.

2-5.1 General. The installation of all components of a fire door assembly shall be in accordance with the specific listing of each component.

2-5.2 Manufacturers' Instructions. All components shall be installed in accordance with the manufacturers' installation instructions and shall be adjusted to function as described in the listing.

2-5.3 Attachment. All components of a fire door assembly shall be attached firmly to walls, doors, and frames in a manner acceptable to the authority having jurisdiction.

2-5.4 Mounting. All mounting screws, bolts, or shields shall be steel.

Exception: Where otherwise permitted by this standard.

2-5.5 Anchorage. Attachments to doors with composite cores shall provide firm anchorage for anticipated use.

Chapter 3 Swinging Doors with Fire Door Hardware

3-1 Doors.

3-1.1 General. This chapter shall cover the installation of swinging doors with fire door hardware.

3-1.2 Components. A fire door assembly shall consist of components that are separate products incorporated into the assembly.

3-1.3 Mounting of Doors.

3-1.3.1 Swinging tin clad doors and flush- or corrugated-type sheet metal doors with fire door hardware shall be flush or lap mounted.

3-1.3.2 Flush-mounted doors shall be hung in steel channel frames securely anchored to the wall construction.

3-1.3.3 Lap-mounted doors shall be hung on the surface of the wall and shall lap the opening at least 4 in. (102 mm) at the top and on each side.

3-1.4 Operation of Doors. The doors shall swing easily and freely on their hinges. The latches shall operate freely.

3-2 Supporting Construction.

3-2.1 Walls. Attachment of the door assembly to the wall shall be by means of through-wall bolts. As an alternate, expansion anchors shall be permitted to be used in concrete, brick, or filled concrete masonry unit walls, provided the following conditions are met (*see Figures B-9 and B-10*):

(a) Expansion anchors shall be manufactured from steel and shall be zinc-coated or cadmium-coated.

(b) Expansion anchors shall conform to Federal Specification FF-S-325.

(c) Expansion anchors shall be of the following types as shown in Federal Specification FF-S-325:

1. Group III, Types 1 and 2
2. Group II, Type 4, Classes 1 and 2
3. Group VIII, Types 1 and 2
4. Group II, Type 3, Class 3

(d) The expansion anchors shall be set in accordance with Federal Specification FF-S-325 in holes that shall be true and clean.

(e) The compressive strength of the concrete shall not be less than 2000 psi (1378 kPa), and the bolt load shall not exceed $1/4$ of the proof test load.

(f) Where used in brick or filled concrete masonry unit walls, the bolt load shall not exceed $1/12$ of the proof test load.

(g) No expansion anchor shall be set closer to the edge of the wall opening than six times the diameter of the anchor or closer to another anchor than eight times the diameter of the anchor.

3-2.2 Sills. Sills shall be installed in accordance with 1-11.2.

3-2.3 (Reserved)

3-2.4 Vents.

3-2.4.1 Each tin clad door formed of 14 in. \times 20 in. (0.36 m \times 0.51 m) sheets shall be provided with 3-in. (76.2-mm) diameter vent holes. (*See Figure B-33.*)

3-2.4.2 The vent holes shall be cut through the sheets on the face of the door to be provided with the fire door hardware, using care to avoid interference with the hardware or injury to the wood core when cutting the holes in the sheets. The metal covering around the opening shall be secured with small nails spaced about 1 in. (25.4 mm) apart, and the exposed wood shall be painted thoroughly.

3-3 Openings.

3-3.1 Frames for Lap-Mounted Doors. Frames shall not be required for lap-mounted doors.

3-3.2* Frames for Flush-Mounted Doors. Only labeled frames of the structural steel type shall be used for flush-mounted doors. The frames shall be erected before the wall is built.

3-4 Assembly Components.

3-4.1* Closing Devices for Swinging Tin Clad and Sheet Metal Fire Doors. Swinging tin clad and sheet metal fire doors shall be equipped with self-closing or automatic-closing devices to ensure that they are closed and latched at the time of fire. Other arrangements acceptable to the authority having jurisdiction shall be permitted.

3-4.2 Coordinating Devices. Where there is an astragal or projecting latch bolt that prevents the inactive door of a pair of doors from closing and latching before the active door closes and latches, a coordinating device shall be used. A coordinating device shall not be required where each door closes and latches independent of the other door.

3-4.3 Fire Door Hardware. See Figures B-29 and B-31.

3-4.3.1 General. Only labeled fire door hardware shall be used. The design and construction of typical fire door hardware for swinging fire doors shall be as illustrated in ANSI A133.1, *Tin-Clad Fire Doors Mounted Singly and in Pairs*.

3-4.3.2 Components. Fire door hardware shall include hinge brackets, hinges, latches, latch keepers, and operating handle mechanisms; hardware for inactive door or pairs of doors includes top and bottom bolts and keepers.

3-4.3.3 Hinges and Latches, Number and Length. See Tables 3-4.3.3(a), 3-4.3.3(b), and 3-4.3.3(c).

Table 3-4.3.3(a) Fire Door Hardware Hinges and Latches for Different Size Doors of Tin Clad Construction

Height of Door	Number of Latches	Width of Door				
		0 ft to 2 ft 0 in.	2 ft 0 in. to 3 ft 0 in.	3 ft 0 in. to 4 ft 0 in.	4 ft 0 in. to 5 ft 0 in.	5 ft 0 in. to 6 ft 0 in.
		Number of Hinges	Number of Hinges	Number of Hinges	Number of Hinges	Number of Hinges
0 ft to 5 ft 0 in.	2	2	2	2	2	2
5 ft 0 in. to 6 ft 6 in.	2	2	2	2	3	3
6 ft 6 in. to 8 ft 6 in.	3	2	2	3	3	4
8 ft 6 in. to 10 ft 6 in.	4	3	3	3	4	4
10 ft 6 in. to 12 ft 0 in.	5	4	4	4	4	4

For SI units: 1 ft = 0.3048 m.

Table 3-4.3.3(b) Fire Door Hardware Length of Hinges and Latches for Different Widths of Doors of Tin Clad Construction

Width of Door	Length of Hinges	Number of Holes in Hinge	Length of Latches
1 ft 6 in. to 1 ft 9 in. (incl.)	16 in.	2	Not less than 14 ³ / ₄ in.
1 ft 9 in. to 2 ft 0 in.	19 in.	2	Not less than 14 ³ / ₄ in.
2 ft 0 in. to 2 ft 4 in.	22 in.	3	Not less than 14 ³ / ₄ in.
2 ft 4 in. to 2 ft 8 in.	25 in.	3	Not less than 14 ³ / ₄ in.
2 ft 8 in. to 3 ft 0 in.	28 in.	3	Not less than 14 ³ / ₄ in.
3 ft 0 in. to 3 ft 4 in.	31 in.	3	Not less than 14 ³ / ₄ in.
3 ft 4 in. to 3 ft 8 in.	34 in.	4	Not less than 14 ³ / ₄ in.
3 ft 8 in. to 4 ft 0 in.	37 in.	4	Not less than 14 ³ / ₄ in.
4 ft 0 in. to 4 ft 4 in.	40 in.	4	Not less than 14 ³ / ₄ in.
4 ft 4 in. to 4 ft 8 in.	43 in.	4	Not less than 14 ³ / ₄ in.
4 ft 8 in. to 5 ft 0 in.	46 in.	5	Not less than 14 ³ / ₄ in.
5 ft 0 in. to 5 ft 4 in.	49 in.	5	Not less than 14 ³ / ₄ in.
5 ft 4 in. to 5 ft 8 in.	52 in.	5	Not less than 14 ³ / ₄ in.
5 ft 8 in. to 6 ft 0 in.	55 in.	5	Not less than 14 ³ / ₄ in.

For SI units: 1 ft = 0.3048 m; 1 in. = 25.4 mm.

*The intermediate hinge straps (where three or more are used) shall not be permitted to be not more than 8 in. shorter than is indicated.

Table 3-4.3.3(c) Fire Door Hardware Numbers of Latches and Hinges for Sheet Metal Doors

Height of Door	Number of Latches	Number of Hinges
0 ft to 5 ft 3 in.	2	2
5 ft 4 in. to 8 ft 3 in.	3	3
8 ft 4 in. to 10 ft 3 in.	4	4
10 ft 4 in. to 12 ft 4 in.	5	4

Note: For heights in fractional inches, use next higher full inch.

For SI units: 1 ft = 0.3048 m; 1 in. = 25.4 mm.

3-4.3.4 Attaching Fire Door Hardware to Doors. Upper and lower hinges and latches shall be spaced not less than 8 in. (203 mm) or more than 11 in. (279 mm) from the top and bottom of the door.

3-4.3.5 Attaching Fire Door Hardware to Frames for Flush-Mounted Doors. Hinges and latch keepers shall be bolted, riveted, or welded to the frame.

3-4.3.6 Attaching of Wall Strips for Lap-Mounted Doors. Hinges and latch keepers shall be mounted on wall strips bolted to or through the wall (*see 3-2.1*). Bolts of not less than ³/₄ in. (19.05 mm) shall be used for attaching hinge wall strips, and bolts not less than ¹/₂ in. (12.7 mm) shall be used for latch keeper wall strips. (*See Figure B-31.*)

Chapter 4 Horizontally Sliding Doors

4-1 Doors.

4-1.1 General. This chapter shall cover the installation of horizontally sliding doors.

4-1.2 Door Panels. Door panels shall be permitted to be single section or multiple sections. Connection between the panels shall be in accordance with the manufacturer's instructions and the individual published listing. Tin clad and metal clad (Kalamein) doors shall not be furnished in more than two sections. Hollow metal or composite doors shall be furnished in not more than five panels, constructed for either field or factory assembly. For biparting doors, not more than four panels shall comprise a single leaf. Personnel swinging-type pass doors shall be permitted to be used if tested with the sliding door and listed in the manufacturer's individual published listing. The pass door shall be provided with hinges, latchset, spring hinges, or closer. (*See Figure B-65.*)

4-1.3 Mounting of Doors. Horizontally sliding doors shall be wall mounted in a track attached to a wall in accordance with the manufacturer's instructions and individual published listing. [*See Figures B-34, B-37(a), B-41, B-42, B-43, and B-44(a-c).*] When in the closed position, the clearance between the wall and the door or the frame and the door shall not be more than ³/₄ in. (19.05 mm). [*See Figures B-37(d), B-37(e), and B-37(f).*]

4-1.3.1 Unless tested otherwise, doors shall lap openings at least 4 in. (102 mm) at the sides and top. Where doors provide protection of openings located in walls above floor level and no projection sill is provided, the doors shall lap the bottom of the opening at least 4 in. (102 mm).

4-1.3.2 Biparting doors shall have an astragal securely attached in place so as to project a minimum of ³/₄ in. (19.05 mm) [*see Figures B-37(a), B-37(b), and B-37(c)*] unless otherwise required or permitted in the individual manufacturer's published listing.

4-2 Supporting Construction.

4-2.1 Walls. Walls shall be plumb and true and have a fire resistance rating as required by the authority having jurisdiction. They shall be of brick, concrete, or concrete masonry construction except that where tin clad doors are used on hollow concrete masonry units, the wall opening shall be reinforced to provide anchorage for door-mounting hardware equal to that of brick or concrete as illustrated in Figure B-18.

4-2.1.1 Tin clad doors used on hollow concrete masonry units shall be reinforced in accordance with 1-11.1.2.

4-2.1.2 Attachment of the door assembly to the wall shall be by means of through-wall bolts. As an alternate, expansion anchors shall be permitted to be used in concrete, brick, or filled concrete masonry unit walls if the following conditions are met (*see Figures B-9 and B-10*):

(a) Expansion anchors shall be manufactured from steel and shall be zinc-coated or cadmium-coated.

(b) Expansion anchors shall conform to Federal Specification FF-S-325.

(c) Expansion anchors shall be of the following types as shown in Federal Specification FF-S-325:

1. Group III, Types 1 and 2
2. Group II, Type 4, Classes 1 and 2
3. Group VII, Types 1 and 2
4. Group II, Type 3, Class 3

(d) Expansion anchors shall be set in accordance with Federal Specification FF-S-325 in holes that shall be true and clean.

(e) The compressive strength of the concrete shall not be less than 2000 psi (1378 kPa), and the bolt load shall not exceed $1/4$ of the proof test load.

(f) Where used in brick or filled concrete masonry unit walls, the bolt load shall not exceed $1/12$ of the proof test load.

(g) No expansion anchor shall be set closer to the edge of the wall opening than six times the diameter of the anchor or closer to another anchor than eight times the diameter of the anchor.

4.2.2 Sills. Sills shall be installed in accordance with 1-11.2.

4.2.3 Reserved.

4.2.4 Vents.

4.2.4.1 Each tin clad door formed of 14 in. \times 20 in. (0.36 m \times 0.51 m) sheets shall be provided with 3-in. (76.2-mm) diameter vent holes that shall be permitted to be field or factory cut and shall be located as shown in Figure B-40(a). Each section of spliced single doors and each leaf of center-parting doors shall be vented as provided for two-hanger doors in Figure B-40(a). Other types of doors containing combustible core material shall be vented as provided by the manufacturer's procedure under label service.

4.2.4.2 The vent holes shall be cut through the sheets on the face of the door opposite the rear binder pockets, using care to avoid injury to the wood core when cutting the holes in the sheets. The metal covering around the opening shall be secured with small nails spaced about 1 in. (25.4 mm) apart, and the exposed wood shall be painted thoroughly.

4.3 Openings.

4.3.1 Frames. (No Requirements)

4.4 Assembly Components.

4.4.1 Closing Devices.

4.4.1.1 Doors shall be equipped with self-closing or automatic-closing devices to ensure that they shall close or be closed at the time of a fire. Closing devices shall be a system of weights or a listed closing device. Automatic-closing doors shall not have a delay of more than 10 seconds in the initiation of closing or reclosing. [See Figures B-35, B-36(a), B-36(b), B-38, B-39(a), B-39(b), B-41, B-42, B-43, and B-44(a).]

4.4.1.2 The average closing speed shall be not less than 6 in./sec (152 mm/sec), not including any initial delay time. The average closing speed for doors used in buildings where access by the general public is not restricted shall be not more than 24 in./sec (610 mm/sec).

4.4.2* Releasing Devices. Power-operated doors not equipped with standby or emergency power shall be equipped with an

integral or a separate listed releasing device that shall automatically disconnect the door from the control of the power operator at the time of a fire. The releasing device shall be activated at the time of the fire by detectors or fusible links installed on both sides of the wall and interconnected so that the operation of the single detector or fusible link shall allow the door to be disconnected and closed. If closing is achieved by power operation, standby or emergency power shall be provided. The time delay from failure of normal power operation to emergency power operation shall not exceed 10 seconds. The standby or emergency power source shall be sufficient to operate a minimum of 50 closing cycles of the door. If door opening also is achieved by power operation, the standby or emergency power source shall be sufficient to operate a minimum of 50 opening and closing cycles of the door.

4.4.2.1 Power operation shall not allow opening if temperatures on either side of the door reach 500°F (260°C).

4.4.3 Hardware.

4.4.3.1 Only hardware listed for use with the door shall be permitted to be used. Fire door hardware shall include tracks, hangers, track brackets, bumpers, binders, pull handles, stay rollers, center latch and center floor stop if required, astragal, and center binders. Tracks shall be permitted to be flat, box, angle, J section, or round [see Figures B-40(b) through B-40(g)]. Tracks shall be inclined or level, depending on the manufacturer's specific label service procedure.

4.4.3.2 The wall bolts shall not be less than $5/8$ in. (15.8 mm) in diameter unless so listed. The bolt spacing depends on the manufacturer's specific test and label service procedure. Not less than two hangers shall be provided for each door. Tin clad and sheet metal doors for openings in excess of 6 ft (1.83 m) shall have an additional hanger. Two hangers shall be provided on each section of vertically spliced tin clad doors. At least two binders shall be required on the vertical jambs and at least one shall be required at the head unless otherwise listed [see Figures B-44(b) and B-44(c)]. Biparting sliding doors shall be provided with the sill binders or center guides if required by the individual manufacturer's label service procedure. Stay rollers shall be installed in an approved manner [see Figures B-11 through B-15(c)]. Where doors are power operated, center-parting doors requiring a center latch shall be provided with a fusible link arrangement that shall hold the latch in an unlatched position during day-to-day operation while causing the latch to operate and secure the door in the event of a fire. Handles shall be provided for opening the doors from either side. If flush pulls are used, they shall not be located back-to-back on tin clad doors.

Chapter 5 Vertically Sliding Fire Doors

5-1 Doors.

5-1.1 General. This chapter shall cover the installation of vertically sliding fire doors.

5-1.2 Mounting of Doors.

5-1.2.1 Vertically sliding doors of the tin clad, sheet metal (flush and corrugated), and steel sectional (overhead) types shall be wall mounted.

5-1.2.2 The tin clad and sheet metal doors shall lap the opening at least 4 in. (102 mm) at the sides and top. The steel sectional doors shall lap the opening at least 2 in. (50.8 mm) at the sides and top. The sides of the sectional door shall be mounted within wall guides, and the top edge shall engage in an interlock along the lintel.

5-2 Supporting Construction.

5-2.1 Walls. Walls shall be reinforced as necessary to provide anchorage of wall-mounted pulleys that carry the weight of the door and counterbalances.

5-2.1.1 Attachment of the door assembly to the wall shall be by means of through-wall bolts. As an alternative, expansion anchors shall be permitted to be used in concrete, brick, or filled concrete masonry unit walls, provided the following conditions are met (*see Figures B-9 and B-10*):

(a) Expansion anchors shall be manufactured from steel and shall be zinc-coated or cadmium-coated.

(b) Expansion anchors shall conform to Federal Specification FF-S-325.

(c) Expansion anchors shall be of the following types as shown in Federal Specification FF-S-325:

1. Group II, Type 3, Class 3
2. Group II, Type 4, Classes 1 and 2
3. Group III, Types 1 and 2
4. Group VIII, Types 1 and 2

(d) Expansion anchors shall be set in accordance with Federal Specification FF-S-325 in holes that shall be true and clean.

(e) The compressive strength of the concrete shall not be less than 2000 psi (1378 kPa), and the bolt load shall not exceed $\frac{1}{4}$ of the proof test load.

(f) Where used in brick or filled concrete masonry unit walls, the bolt load shall not exceed $\frac{1}{12}$ of the proof test load.

(g) No expansion anchor shall be set closer to the edge of the wall opening than six times the diameter of the anchor or closer to another anchor than eight times the diameter of the anchor.

5-2.2 Sills. Sills shall be installed in accordance with 1-11.2.

5-2.3 Lintels. Lintels shall be brick, concrete or masonry arches, steel, or reinforced concrete. If of steel or reinforced concrete, they shall be constructed as shown in Figures B-5, B-6, B-7, or B-8 or as acceptable to the authority having jurisdiction.

5-2.4 Vents.

5-2.4.1 Each tin clad door shall be provided with 3-in. (76.2-mm) diameter vent holes located as shown in Figure B-40(a). Doors up to 6 ft (1.83 m) wide shall be provided with three vents, and doors over 6 ft (1.83 m) wide shall be provided with four vents, as shown for two-hanger doors.

5-2.4.2 The vent holes shall be cut through the sheets on the face of the door to be provided with the guide shoes, using care to avoid interference with the hardware or injury to the wood core when cutting the holes in the sheet. The metal covering around the opening shall be secured with small nails spaced about 1 in. (25.4 mm) apart, and the exposed wood shall be painted.

5-3 Openings.

5-3.1 Frames. (No Requirements)

5-3.2 Clearances. The clearances between the door and the wall when the door is in the closed position shall not exceed $\frac{3}{8}$ in. (9.53 mm).

5-4 Assembly Components.

5-4.1 Closing Devices.

5-4.1.1 Vertically sliding tin clad, sheet metal, and sectional steel doors shall be equipped to close automatically at the time of fire.

5-4.1.2 Vertically sliding sectional doors shall close automatically upon operation of a fusible link or detector that releases the overhead sectional door, and the governor shall control the rate of descent.

5-4.1.3 Vertically sliding doors shall have an average closing speed of not less than 6 in./sec (152 mm/sec) nor more than 24 in./sec (610 mm/sec).

5-4.2 Automatic Closers. Automatic-closing, vertically sliding doors shall be suspended by a system of weights and ropes, wire cables, or chains over pulleys. All weights shall be enclosed in a substantial metal enclosure for the entire length of travel. Pulleys over which the weight cable or chain passes shall be shielded to prevent the cable or chain from jumping off the pulley.

5-4.3 Fire Door Hardware.

5-4.3.1 Fire Door Hardware for Tin Clad and Sheet Metal Doors. (*See Figure B-45.*) Only labeled fire door hardware shall be used.

5-4.3.1.1 Components. Fire door hardware shall consist of tracks, brackets, guides, bumpers, and counterbalancing mechanisms.

5-4.3.1.2* Track. Two tracks, each with a length equal to twice the height plus 9 in. (229 mm), shall be provided. The track shall be attached with track brackets at each bolt.

5-4.3.1.3 Guides. Two track guides shall be provided for each track for openings 5 ft (1.52 m) or less in height. An additional guide for each track shall be provided for each $2\frac{1}{2}$ ft (0.76 m) or fraction thereof in excess of 5 ft (1.52 m) in height. Each of the track guides shall be bolted through the door.

5-4.3.1.4 Cables. Cables shall be of sufficient strength to support the load. Cable brackets shall be required and shall be bolted through the door. Cable fasteners and thimbles shall be required. Cable pulleys with frames and sheaves shall be bolted through the wall with $\frac{3}{4}$ -in. (19.05-mm) bolts.

5-4.3.1.5 Chafing Strips.

5-4.3.1.5.1 Tin clad and flush-type sheet metal doors shall be provided with two half-oval chafing strips for the back of doors not exceeding 8 ft (2.44 m) in width. The length shall be 2 in. (50.8 mm) less than the height of the door. The strips shall be held by $\frac{1}{4}$ -in. (6.35-mm) through-bolts with countersunk heads and with nuts bearing against washers. Where doors exceed the specified width, three strips shall be required.

5-4.3.1.5.2 Chafing strips shall not be required for corrugated doors.

5-4.3.1.6 Bumpers and Bumper Shoes.

5-4.3.1.6.1 One bumper shall be bolted to the top of each track with wall bolts.

5-4.3.1.6.2 Four bumper shoes shall be installed, one bumper at each corner of the door. Each bumper shall be fastened to the faces and edges of the door by wood screws.

5-4.3.1.7 Rear Binders. Doors shall be provided with one rear binder located at the center of the lintel and attached with $\frac{3}{4}$ -in. (19.05-mm) bolts. (See Figure B-45.)

5-4.3.1.8 Handles. Flush pull handles on the wall side of the door shall be countersunk flush with the surface of the door. Bow-shaped handles shall be bolted to the flush pull by through-bolts or otherwise securely attached.

5-4.3.2 Fire Door Hardware for Steel Sectional Doors.

5-4.3.2.1 Label. The fire door label on a sectional door shall include the hinged steel panels, wall guides, interlock at the top edge, vertical and horizontal tracks, roller wheels, counterbalance, automatic-closing mechanism, and governors.

5-4.3.2.2 Track. The horizontal track section shall extend from the wall a distance of the wall opening height plus 3 ft (0.91 m) and shall be connected by a fusible track link to the vertical track section such that the track breaks away from the vertical track section if subjected to damage from falling materials at the time of fire.

5-4.3.2.3 Guides. The wall guides shall be plumb and bolted to or through the wall. The guides shall extend above the wall opening a distance of $2\frac{1}{2}$ in. (63.5 mm).

5-4.3.2.4 Interlocking. An angle-type interlock shall be bolted to the lintel and shall engage a matching pocket on the top edge of the door when in the closed position.

5-4.3.2.5 Counterbalancing Mechanism. The sectional door shall be counterbalanced by an overhead horizontal helical spring on a shaft. The shaft shall be attached to a reel with a steel cable attached to both sides of the door near the bottom edge.

Chapter 6 Rolling Steel Doors

6-1 Doors.

6-1.1 General. This chapter shall cover the installation of rolling steel doors.

6-1.2 Mounting of Doors.

6-1.2.1 The mounting for rolling steel doors shall be either face-of-wall mounted (see Figure B-48) or between-the-jamb mounted (see Figures B-49 and B-50).

6-1.2.2 The opening shall be protected by either a single or double door installation as determined by the authority having jurisdiction.

6-1.2.3 Doors mounted on the face of the wall and subject to damage from falling debris shall be protected by the building structure.

6-2 Supporting Construction.

6-2.1 Walls. Walls shall be constructed in accordance with 1-11.1.

6-2.2 Sills. Sills shall be installed in accordance with 1-11.2.

6-2.3 Lintels. Heads of door frames shall be reinforced or suitable lintels shall be provided, depending on the type of wall construction and loads to be supported.

6-3 Openings.

6-3.1 Frames. Frames shall not be required for rolling steel door installations. Where frames or jambs are provided, only minimum $\frac{3}{16}$ -in. (4.76-mm) nominal structural steel or formed steel plate shall be used. Frames or jambs shall be in accordance with the door manufacturer's listing.

6-4 Assembly Components.

6-4.1 Closing Devices.

6-4.1.1 An automatic-closing device shall be installed on every rolling steel door.

6-4.1.2 Rolling steel doors shall close automatically upon activation or release of a fusible link or detector.

6-4.1.3 The automatic-closing mechanism shall be enclosed in a metal housing to protect the mechanism from debris and ensure operation in the event of fire.

6-4.1.4 A governor, where employed on a door, shall be an integral mechanism working in coordination with the closing device and shall control the closing speed of the door.

6-4.1.5 Rolling steel fire doors shall have an average closing speed of not less than 6 in./sec (152 mm/sec) nor more than 24 in./sec (610 mm/sec).

6-4.2 Power-Operated Fire Doors.

6-4.2.1 Power-operated fire doors are those that normally are opened or closed by power. They shall be permitted to be furnished with a sensor that causes the door closer to stop or reverse upon contact with an obstruction under normal conditions.

6-4.2.2 Power-operated fire doors shall be equipped with an automatic-closing device that, upon activation, will cause the door to close irrespective of power loss or operation under normal conditions, and remain closed or be capable of opening and then re-closing until the automatic-closing device has been reset.

6-4.3 Assembly of Rolling Doors.

6-4.3.1 Guides.

6-4.3.1.1 The guides shall be mounted plumb and with sufficient clearances allowed for vertical expansion when exposed to fire.

6-4.3.1.2 The guides used between jamb-mounted doors shall be either exposed or concealed in a pocket or wall reveal.

6-4.3.1.3 Attachment of the door assembly to the wall shall be by means of through-wall bolts. As an alternate, expansion anchors shall be permitted to be used in concrete, brick, or filled concrete masonry unit walls if the following conditions are met (see Figures B-9 and B-10):

(a) Expansion anchors shall be manufactured from steel and shall be zinc-coated or cadmium-coated.

(b) Expansion anchors shall conform to Federal Specification FF-S-325.

(c) Expansion anchors shall be of the following types as shown in Federal Specification FF-S-325:

1. Group II, Type 3, Class 3
2. Group II, Type 4, Classes 1 and 2
3. Group III, Types 1 and 2
4. Group VIII, Types 1 and 2

(d) Expansion anchors shall be set in accordance with Federal Specification FF-S-325 in holes that shall be true and clean.

(e) The compressive strength of the concrete shall not be less than 2000 psi (1378 kPa). The bolt load is the result of the shear and tensile load applied to the bolt and shall not exceed $\frac{1}{4}$ of the proof test load.

(f) Where used in brick or filled concrete masonry unit walls, the result of the shear and tensile load applied to the bolt shall not exceed $\frac{1}{12}$ of the proof test load.

(g) No expansion anchor shall be set closer to the edge of the wall opening than six times the diameter of the anchor or closer to another anchor than eight times the diameter of the anchor.

6-4.3.1.4 Where structural steel frames are used at jambs, guides shall be secured to the frame with machine bolts of not less than $\frac{3}{8}$ in. (9.5 mm) diameter.

6-4.3.2 Brackets.

6-4.3.2.1 Brackets mounted on the face of the wall shall be bolted either to the wall or to an extension of the guide wall angle with not less than two through-bolts or machine bolts $\frac{1}{2}$ in. (12.7 mm) in diameter per bracket.

6-4.3.2.2 Brackets mounted between the jambs shall be secured to the lintel or to the side of the jambs by not less than two machine bolts of $\frac{1}{2}$ in. (12.7 mm) diameter.

6-4.3.3* Hoods and Housings. Where the door is mounted on the face of the wall or between jambs, the metal hood and housing shall be secured tightly to the brackets or wall. Where a flame baffle is provided, fusible link connection to the flame baffle shall be permitted to be independent of the detectors or fusible link connections that activate the door's automatic-closing mechanism.

Chapter 7 Special Purpose Horizontally Sliding Accordion or Folding Doors

7-1 Doors.

7-1.1 General. This chapter shall cover the installation of special purpose horizontally sliding accordion or folding doors.

7-1.2 Components. A special purpose horizontally sliding accordion or folding door assembly shall consist of doors, frames, latches, hinges, and closers of special construction or for special use.

7-1.3 Mounting of Doors.

7-1.3.1 Horizontally sliding accordion or folding doors shall be ceiling or wall mounted in track or tracks attached to a lintel or wall in accordance with the manufacturer's instructions and individual published listing. (See Figures B-60 and B-61.)

7-1.3.2 Doors shall lap the opening if mounted completely on the surface of the wall or shall extend across the opening if ceiling mounted or surface mounted. Doors shall completely close the opening. Where doors provide protection of openings located in walls above floor level and no projecting sill is provided, the doors shall extend below the bottom of the opening in accordance with the listing.

7-1.3.3 Single doors shall be affixed to a jamb at one wall and shall close against a strike jamb provided at the other wall in accordance with the individual manufacturer's published listings. (See Figures B-62 and B-63.)

7-1.3.4 Biparting doors shall each be affixed to a jamb at a wall and shall close together at the meeting stiles in accordance with the individual manufacturer's published listings.

7-2 Supporting Construction.

7-2.1 Walls.

7-2.1.1 Jambs attached to dry wall construction shall be installed in accordance with the manufacturer's installation instructions. Structural support shall be provided.

7-2.1.2 Attachment of jambs to masonry, concrete, or brick shall be by expansion bolt-type anchors.

7-2.2 Sills. Sill shall be installed in accordance with 1-11.2.

7-2.3 Lintels.

7-2.3.1 Lintels shall be applied to or be an integral part of the ceiling. (See Figures B-60 and B-61.)

7-2.3.2 If lintels are not a part of the ceiling assembly, they shall not reduce the fire resistance rating of the door assembly.

7-2.3.3 Applied lintels (headers) shall be in accordance with the manufacturer's published listings.

7-2.3.4 Fasteners, if required, shall be in accordance with the manufacturer's installation instructions with spacing over the door stack area equal to half that of normal spacing.

7-3 Openings.

7-3.1* Clearances. Clearances at the lintel, jambs, and meeting stiles shall not exceed $\frac{1}{8}$ in. (3.18 mm).

7-4 Assembly Components.

7-4.1 Closing Devices.

7-4.1.1 Closing devices shall be listed.

7-4.1.2 Doors shall be self-closing or automatic closing and shall not have a delay in the initiation of closing or reclosing of more than 10 seconds.

7-4.1.3 The average closing speed shall be not less than 6 in./sec (152 mm/sec) nor more than 24 in./sec (610 mm/sec).

7-4.2 Power Operators.

7-4.2.1 Only labeled power operators listed for use with the door shall be used.

7-4.2.2 If closing is achieved by power operation, standby or emergency power shall be provided. The time delay from failure of normal power operation to emergency power operation shall not exceed 10 seconds. The standby or emergency power source shall be sufficient to operate a minimum of 50 closing cycles of the door. If door opening also is achieved by power operation, the standby or emergency power source shall be sufficient to operate a minimum of 50 opening and closing cycles of the door.

7-4.2.3 Power operation shall not occur if temperatures on either side of the door reach 500°F (260°C).

7-4.3 Hardware. Only hardware listed for use with the door shall be used.

Chapter 8 Hoistway Doors for Elevators and Dumbwaiters

8-1 Doors.

8-1.1 General. This chapter shall cover only fire door assemblies in hoistway entrances directly connected with closed elevator or dumbwaiter operation and used in the vertical hoistway enclosure for the purpose of preventing the passage of fire through such entrances. Fire door assemblies not connected with access to cars shall be installed as provided in other sections of this standard.

8-1.2 Components. Fire door entrances shall consist of fire door panels, frames, headers, track, hangers (some doors are provided with integral hangers), pendant bolts, sills, sill support plates, sill brackets, retaining angles, and a closer assembly.

8-1.3 Mounting of Doors. Fire door entrances used in elevator hoistways also shall conform to the requirements of ASME/ANSI A17.1, *Safety Code for Elevators and Escalators*, or CAN 3-B44, *Safety Code for Elevators* (see 1-1.3).

8-1.3.1 Fire door assemblies shall have fire protection ratings of $\frac{3}{4}$ hour, 1 hour, $1\frac{1}{2}$ hours, or 2 hours (2 hours in Canada only).

8-1.3.2 Labeled hoistway door assemblies shall be installed in walls of approved fire resistance-rated construction.

8-1.3.3 Hoistway door frame assemblies shall be installed in accordance with the listing and labeling procedures, including the manufacturer's installation instructions.

8-1.3.4 Where horizontal sliding entrances without frames are used in masonry or concrete, the panels shall overlap the sides of the opening at least $\frac{5}{8}$ in. (16 mm) beyond the thickness of any facing used to finish the opening.

8-1.3.5 Where vertically sliding entrances without frames are used in masonry or concrete, the panels shall overlap the top and bottom of the opening by at least 2 in. (25 mm) beyond the thickness of any facing used to finish the opening.

8-1.3.6 Where the entrance is too large for the regularly available test facilities, the certifying organization shall be permitted to issue oversize certificates or oversize labels.

8-2 Types of Doors.

8-2.1 Labeled Swing Hoistway Doors for Elevators and Dumbwaiters — Fire-Rated Entrance. Each entrance shall be labeled. Each label shall bear the name of the manufacturer. Labels shall be provided for elevator entrances in accordance with 8-2.1(a) through (g) and for dumbwaiters in accordance with 8-2.1(h). (See Figure B-51.)

(a) One label shall be provided for the door panels and shall be located so that it is visible after installation.

(b) One label shall be provided for the frame and shall be located so that it is visible after installation.

(c) Where all entrance hardware components have not been tested in a complete assembly, individually labeled hardware components that are designed to be compatible with the entrance assembly shall be provided. One label shall be permitted to be provided for the entrance hardware where the entrance hardware components are equivalent to those tested in a complete assembly.

Exception: One label shall be permitted to be provided for the complete entrance assembly where the components are the same as those tested in a complete assembly.

(d) A master label indicating the name of the manufacturer shall be provided for the door panel and located so that it is visible for review by the authority having jurisdiction after installation.

(e) The components of entrance assemblies, such as frames, sills, and sill supports, shall bear a component label.

(f) Only labeled locks, latches, and closers shall be used.

(g) Labeled entrance hardware components, such as door frames, locks, latches, and closer assemblies, that have not been tested in a complete assembly with the fire doors shall be permitted to be provided if they are designed to be compatible with the entrance hardware components tested in a complete assembly.

(h) A master label indicating the name of the manufacturer shall be provided for the door panel and located so that it is visible for review by the authority having jurisdiction after installation. The label shall specify the design and construction of the door, frame, and hardware.

8-2.2 Labeled Horizontally Sliding Hoistway Doors for Elevators and Dumbwaiters — Fire-Rated Entrance. Each entrance shall be labeled. Each label shall bear the name of the manufacturer. Labels shall be provided for elevator entrances in accordance with 8-2.2(a) through (f) and for dumbwaiters in accordance with 8-2.2(g). (See Figures B-52 and B-53.)

(a) One label shall be provided for the door panels and shall be located so that it is visible after installation.

(b) One label shall be provided for the frame and shall be located so that it is visible after installation.

Exception: No label shall be required where frames are installed in masonry or concrete and where the panel overlaps the opening by $\frac{5}{8}$ in. (9.5 mm) beyond the thickness of any facing used to finish the opening.

(c) Where all entrance hardware components have not been tested in a complete assembly, individually labeled hardware components that are designed to be compatible with the entrance assembly shall be provided. One label shall be permitted to be provided for the entrance hardware where the entrance hardware components are equivalent to those tested in a complete assembly.

Exception: One label shall be permitted to be provided for the complete entrance assembly where the components are the same as those tested in a complete assembly.

(d) A master label indicating the name of the manufacturer shall be provided for the door panel and located so that it is visible for review by the authority having jurisdiction after installation.

(e) The components of entrance assemblies, such as frames, sills, sill support plates, headers, tracks, hangers, pendant bolts, retaining angles, closer assemblies, and interlock mechanisms, shall bear a component label.

(f) Labeled entrance hardware components, such as tracks, closer assemblies, interlock mechanisms, and sills, that have not been tested in a complete assembly with the fire doors shall be permitted to be provided if they are designed to be compatible with the entrance hardware components tested in a complete assembly.

(g) A master label indicating the name of the manufacturer shall be provided for the door panel and located so that it is visible for review by the authority having jurisdiction after installation. The label shall specify the design and construction of the door, frame, and hardware.

8-2.3 Labeled Vertically Sliding Hoistway Doors for Elevators and Dumbwaiters — Fire-Rated Entrance. Each entrance shall be labeled or listed. Each label shall bear the name of the manufacturer. Labels shall be provided for each entrance in accordance with 8-2.3(a) through (f). (See Figures B-54 and B-55.)

(a) One label shall be provided for the door panels and shall be located so that it is visible after installation.

(b) Where a frame is provided or required, one label shall be provided for the frame and shall be located so that it is visible for review by the authority having jurisdiction after installation.

Exception: No label shall be required where frames are made from structural steel channel and are installed in masonry or concrete and where the panel overlaps beyond the thickness of any facing used to finish the opening by 2 in. (51 mm).

(c) Where all entrance hardware components have not been tested in a complete assembly, individually labeled hardware components that are designed to be compatible with the entrance assembly shall be provided. One label shall be permitted to be provided for the entrance hardware where the entrance hardware components are equivalent to those tested in a complete assembly.

Exception: One label shall be permitted to be provided for the complete entrance assembly where the components are the same as those tested in a complete assembly.

(d) A master label indicating the name of the manufacturer shall be provided for the door panel where installed in drywall and shall be located so that it is visible for review by the authority having jurisdiction after installation.

(e) The components of entrance assemblies, such as frames, guides, shoes, and locking assemblies, shall bear a component label.

(f) Labeled entrance hardware components, such as closer and latching assemblies, that have not been tested in a complete assembly with the fire doors shall be permitted to be provided if they are designed to be compatible with the entrance hardware components tested in a complete assembly.

8-3 Hoistway Door Vision Panels. Where required or used, vision panels shall conform to ASME/ANSI A17.1, *Safety Code for Elevators and Escalators*, or CAN 3-B44, *Safety Code for Elevators* (see 1-1.3), and to the requirements of 8-3.1 through 8-3.3.

8-3.1 Muntins, trim, and vision panel protection shall be of noncombustible material and of substantial construction.

8-3.2 Horizontally sliding doors shall be closed when the car is at a landing.

Exception No. 1: When the elevator is operated by a designated operator in the car, when loading or unloading, and when the elevator is actively dispatched by an automatic system that controls the doors.

Exception No. 2: Elevators under fire fighter emergency recall operation conforming to the requirements of ASME/ANSI A17.1, Safety Code for Elevators and Escalators, Rules 211.3 through 211.8, or CAN 3-B44, Safety Code for Elevators, Clause 3.12.15.9.1. (See 1-1.3.)

8-3.3 Where required by the authority having jurisdiction, doors serving elevators required to conform with 8-3.2 shall be automatically closed after a predetermined time interval.

Chapter 9 Chute Doors

9-1 Doors.

9-1.1 Operation. Chute doors shall be of the swinging type that are hinged on side or bottom for intake and on side or top for discharge.

9-1.2* Fire Protection Rating. Chute doors shall have a fire protection rating of 1 hour or 1½ hours.

9-2 Supporting Construction.

9-2.1 Walls. Door assemblies, where used on walls of other construction, shall be as listed. No part of the assembly shall project into the chute.

9-2.2 Sills. Chute door assemblies shall be installed on masonry sills and shall be securely fastened to the sill or the chute.

9-2.3 Lintels. The lintel shall be constructed of noncombustible materials and shall be adequate for the service.

9-3 Openings.

9-3.1 Closing Device. Doors shall be arranged for automatic-closing operation as described in 3-4.1 for swinging doors.

Chapter 10 Fire Shutters

10-1 Shutters.

10-1.1 Construction. Fire doors without glass lights shall be used as fire shutters.

10-1.2 Types. Shutters shall be of the following three general types:

- (a) Swinging door
- (b) Horizontally or vertically sliding door
- (c) Rolling steel door

10-2 Installation. The installation of shutters shall be in accordance with the requirements for installation of swinging, sliding, and rolling steel doors.

10-3 Operation.

10-3.1 Automatic Closing. All shutters shall be equipped to close automatically in the event of fire.

10-3.2* Weather Protection. Where shutters are installed on the outside of an opening, they shall be protected against the weather to ensure proper operation.

10-3.3 Other Requirements. The operation of shutters shall be in accordance with the requirements for operation of swinging, sliding, and rolling steel doors.

Chapter 11 Access Doors

11-1 Doors.

11-1.1 General. This chapter shall cover the installation of both horizontal and vertical access doors in fire-rated walls, floors, and floor-ceiling or roof-ceiling assemblies.

11-1.2 Components. An access door shall be an integral unit including the door, frame, hinges, latch, and closing device (where required) bearing a label that reads "Frame and Fire Door Assembly."

Exception: A vertical access door shall be permitted to have hinges that are not part of the labeled assembly, provided the hinges conform to Table 2-4.3.1.

11-1.2.1 Access doors shall be self-closing.

11-1.2.2 Access doors shall be self-latching.

Exception: A horizontal access door that does not open downward and that remains in place when an upward force of 1 psf (48 N/m²) is applied over the entire exposed surface of the door shall not be required to be self-latching.

11-1.2.3 Self-closing access doors that are intended to be used to allow a person to enter the concealed space behind the door completely shall be operable from the inside without the use of a key or tool.

11-1.2.4 Access doors shall be installed in accordance with their listing.

11-2 Types of Doors.

11-2.1 Horizontal Access Doors.

11-2.1.1 Door assemblies used in fire-rated floors or floor-ceiling or roof-ceiling assemblies shall be tested in the horizontal position in accordance with the procedures described in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, and shall be labeled as horizontal access doors.

11-2.1.2 A horizontal access door shall bear a label that includes the additional wording "For Horizontal Installation."

11-2.1.3 A horizontal access door shall be used in a fire-rated floor or floor-ceiling or roof-ceiling assembly only where it has been tested and listed for use as a component of the assembly.

11-2.1.4 Horizontal access doors shall not be required to be subject to the hose stream test.

11-2.2 Vertical Access Doors.

11-2.2.1 Vertical access doors shall have a fire protection rating of $\frac{3}{4}$ hour, 1 hour, or 1 $\frac{1}{2}$ hours. (See Appendix F.)

11-2.2.2 Vertical access doors shall be used only in walls.

11-2.2.3 Where the authority having jurisdiction determines that a vertical access door is located in proximity to combustibles so that, in a fire condition, the door is likely to transmit sufficient heat to ignite the combustibles, the temperature rise on the unexposed face of the door shall not exceed 250°F (139°C) at the end of a 30-minute exposure to the standard fire test as described in NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*. Such an access door shall bear a label indicating a maximum temperature rise of 250°F (139°C).

11-2.2.4 Closing by means of gravity using top-hinging vertical access doors shall be permitted to meet the requirements for self-closing doors.

11-2.2.5 A vertical access door shall bear a label that includes the additional wording "For Vertical Installation."

Chapter 12 Service Counter Doors

12-1 Doors.

12-1.1 General. This chapter shall cover the installation of service counter doors in fire-rated walls.

12-1.2 Construction. Door construction shall be one of the following types:

- (a) Door panels of a single or multiple section vertical type, integrally mounted in a four-sided frame to form a labeled door and frame assembly
- (b) Door curtains of the interlocking slat type integrally mounted in a four-sided frame to form a labeled door and frame assembly
- (c) Door curtains of the interlocking slat type including guides, brackets, and hoods for mounting directly to masonry walls or noncombustible opening framing

12-1.3 Installation.

12-1.3.1 Service counter doors shall be either factory or field assembled and shall be installed during construction of the wall or in a prepared wall opening.

12-1.3.2 Where service counter doors are mounted in walls other than solid masonry, the frame or guides shall be anchored to structural members not less than $\frac{3}{16}$ in. (1.9 mm) thick that run from the floor to supporting members above, or they shall be installed in accordance with the manufacturer's listing.

12-2 Supporting Construction.

12-2.1 Walls. Walls shall be of brick, concrete, or concrete masonry unit construction. Door assemblies shall be used on walls of other construction only if listed for such installation.

12-2.2 Lintels. Heads of integral door frame assemblies shall not support a wall above. Separate lintels of a size based on the type of wall construction and loads to be supported shall be provided.

12-3 Openings.

12-3.1 Counters. Where counters are supplied separately from the balance of the door assemblies, they shall be labeled and installed in accordance with their listing.

12-3.2 Automatic Closers.

12-3.2.1 All service counter doors shall be equipped to close automatically in the event of fire.

12-3.2.2 A service counter door of the rolling type shall be automatic closing so that, upon activation or release of a fusible link or detector, the door shall close.

12-3.2.3 A service counter door of the swinging or sliding type shall be made automatic closing by a system of weights suspended by ropes, cables, or chains over pulleys that, when activated by release of an automatic fire detector, shall cause the door to close.

12-3.2.4 A governor, where employed on a service counter door, shall work in coordination with the closing device and shall control the closing speed of the door.

12-3.2.5 A service counter door of the rolling type shall have an average closing speed of not less than 6 in./sec (152 mm/sec) nor more than 24 in./sec (610 mm/sec).

Chapter 13 Fire Windows

13-1 Windows.

13-1.1 General. This chapter shall cover the installation of fire windows.

13-1.2 Testing. Fire windows shall be tested in accordance with NFPA 257, *Standard Research Test Method for Determining Smoke Generation of Solid Materials*, for the required fire protection rating of the window opening. Fire windows shall be labeled.

13-1.3 Labels.

13-1.3.1 Fire window frames shall be labeled for such use.

13-1.3.2 The label reading "Fire Window Frame" shall include the design and construction of the frame, ventilator, glazing material retaining members, and hardware. (*See Appendix D for types of fire window ventilators.*)

13-1.3.3 The label on hot-rolled or extruded steel section fire window frames shall include hot-rolled or extruded steel mullions.

13-1.3.4 The label on hollow metal and hollow metal plate steel combination section fire windows shall include hollow metal mullions.

13-1.4 Bearing Mullions. Bearing mullions shall be protected from fire with materials acceptable to the authority having jurisdiction.

13-2 Glazing Material.

13-2.1 Labeled. Only labeled fire protection-rated glazing material shall be used in fire windows.

13-2.2* Size. Glazing material installed in fire windows shall be limited to the size and area in accordance with Table 13-2.2.

Table 13-2.2 Fire Window Rating¹

Fire Window Rating (hr)	Maximum Area of Glazing Material per Light
1/3, 1/2	Limited to maximum area tested
3/4	Limited to maximum area tested ²
1, 1 1/2, or 3	No rating available

¹See also Appendix J for interior applications.

²Individual glazing material exposed area shall not exceed 1296 in.² (0.84 m²) with no dimension exceeding 54 in. (1.37 m) unless otherwise tested.

13-2.3 Identification. Each individual glazing unit shall be identified with a label. The label shall be visible after installation.

13-2.4 Safety. Glazing material installed in fire windows and borrowed lights that are subject to human impact shall meet applicable safety standards as determined by the authority having jurisdiction unless exempted. (*See A-1-4 Glazing Material.*)

13-3 Types of Windows.

13-3.1 Fire Window Applications.

13-3.1.1 Fire windows shall be used to protect openings in interior and exterior partitions required to be protected by the authority having jurisdiction. Borrowed lights shall be used to protect window openings in interior partitions.

13-3.1.2 Glass block assemblies shall be installed in accordance with Chapter 14.

13-3.1.3 In exterior walls, the maximum size openings shall be limited to those specified in 13-3.2.2, 13-3.3.5, and 13-3.4.2.

13-3.2 Hollow Metal Windows.

13-3.2.1 Hollow metal windows shall consist of formed steel sheet, reinforced as required, and shall be of the double hung, casement, pivoted, stationary, tilting, hinged, or projected types.

13-3.2.2 Maximum size openings for hollow metal windows shall be as follows:

- (a) Single window, other than casement: 5 ft × 5 ft (1.52 m × 1.52 m)
- (b) Multiple windows, other than casement: 7 ft × 10 ft (2.13 m × 3.05 m)
- (c) Single casement window: 3 1/2 ft × 10 ft (1.07 m × 3.05 m)
- (d) Multiple casement window: 7 ft × 10 ft (2.13 m × 3.05 m)

13-3.3 Hot-Rolled or Extruded Steel Section Windows.

13-3.3.1 The heavy intermediate window frame and ventilator sections shall be a minimum depth of 1 5/16 in. (33 mm) with integrally rolled weathering contacts.

13-3.3.2 The standard intermediate window frame and ventilator sections shall be a minimum depth of 1 1/4 in. (32 mm) with integrally rolled weathering contacts.

13-3.3.3 The residential-type window frame and ventilator sections shall be a minimum depth of 1 in. (24.5 mm) with integrally rolled weathering contacts.

13-3.3.4 The industrial-type window frame and ventilator sections shall be a minimum depth of 1 1/4 in. (32 mm) with applied weathering contacts.

13-3.3.5 Maximum openings for hot-rolled or extruded steel section windows are as follows:

(a) The heavy intermediate and industrial types shall be used for openings not exceeding 84 ft² (7.8 m²), with neither dimension exceeding 12 ft (3.66 m). Where multiple units are installed, the distance between unprotected vertical steel mullions shall not exceed 7 ft (2.13 m).

(b) The standard intermediate types shall be used for openings not exceeding 60 ft² (5.57 m²), with neither dimension exceeding 10 ft (3.05 m). Where multiple units are installed, the distance between unprotected vertical steel mullions shall not exceed 6 1/2 ft (1.98 m).

(c) Residential-type windows shall be used for openings not exceeding 6 1/2 ft (1.98 m) for either dimension. Where multiple units are installed, the distance between unprotected vertical steel mullions shall not exceed 3 1/2 ft (1.07 m).

13-3.4 Hollow Metal Plate Steel (Combination) Windows.

13-3.4.1 Hollow metal plate steel windows shall consist of formed sheet steel frame sections at the head, jambs, and sill, and a plate steel window. They shall be of the double hung, counterbalanced, or stationary type.

13-3.4.2 Maximum size openings for hollow metal plate steel windows are as follows:

- (a) Single window: 5 ft × 5 ft (1.52 m × 1.52 m)
- (b) Multiple windows: 7 ft × 10 ft (2.13 m × 3.05 m)

13-3.5 Borrowed Lights. Borrowed lights shall be limited to the maximum size openings indicated in their individual listings.

13-4 Installation.

13-4.1 Frames. Frames shall be fastened securely to the wall and shall be capable of resisting all wind stresses and any other stresses for which the window was designed.

13-4.2 Fire Lock Angles.

13-4.2.1 Fire lock angles shall be designed to hold the ventilator in the frame as the assembly expands under exposure to fire.

13-4.2.2 Where the window is provided with fire lock angles, the fire lock angles shall be adjusted so that they pass one another with a minimum of clearance.

13-4.3 Glazing Material.

13-4.3.1 Wire clips, glazing angle clips, continuous glazing channels, or continuous glazing angles shall be used to retain the glazing material. Where wire clips or glazing angle clips are used for glazing the window, one wire clip or glazing angle clip shall be installed in each mounting hole. Where continuous glazing angles or channels are used, a screw or bolt and nut shall be installed in each mounting hole.

13-4.3.2 Glazing materials shall be installed in accordance with their individual listing.

13-5 Closing Devices. All fire windows shall be of a fixed type or shall be automatic closing. The automatic-closing device can be an integral part of the assembly or a separate system, such as weights suspended by ropes, wire cables, or chains over pulleys, arranged so that operation of the automatic fire detector shall cause the ventilator to close.

Chapter 14 Glass Block

14-1 General. This chapter covers the installation of glass block.

14-1.1 Labeled. Only labeled glass block shall be used.

14-1.2 Size. Glass block shall be permitted for the protection of openings not exceeding 120 ft² (11.15 m²) with neither the width nor height exceeding 12 ft (3.66 m).

14-2 Installation. Glass block shall be installed in accordance with its individual listing.

Chapter 15 Care and Maintenance

15-1* General. This chapter covers the care and maintenance of fire doors and fire windows.

15-1.1 Removal of Window. Where a door or window opening is no longer in use, the opening shall be filled with construction equivalent to that of the wall.

15-1.2 Operability. Doors, shutters, and windows shall be operable at all times. They shall be kept closed and latched or arranged for automatic closing.

15-1.3 Replacement. Where it is necessary to replace fire doors, shutters, windows or their frames, hardware, and closing mechanisms, replacements shall meet the requirements

for fire protection and shall be installed as required by this standard for new installations.

15-1.4 Repairs. Repairs shall be made and defects that could interfere with operation shall be corrected immediately.

15-2 Specific Requirements.

15-2.1* Inspections.

15-2.1.1* Hardware shall be examined frequently and any parts found to be inoperative shall be replaced immediately.

15-2.1.2 Tin clad and Kalamein doors shall be inspected regularly for dry rot.

15-2.1.3 Chains or cables employed on suspended doors shall be inspected frequently for excessive wear and stretching.

15-2.2 Lubrication and Adjustments.

15-2.2.1 Guides and bearings shall be kept well lubricated to facilitate operation.

15-2.2.2 Chains or cables on biparting, counterbalanced doors shall be checked frequently and adjustments shall be made to ensure proper latching and to keep the doors in proper relation to the opening.

15-2.3 Prevention of Door Blockage.

15-2.3.1 Door openings and the surrounding areas shall be kept clear of anything that could obstruct or interfere with the free operation of the door.

15-2.3.2 Where necessary, a barrier shall be built to prevent the piling of material against sliding doors.

15-2.3.3 Blocking or wedging of doors in the open position shall be prohibited.

15-2.4 Maintenance of Closing Mechanisms.

15-2.4.1 Self-closing devices shall be kept in proper working condition at all times.

15-2.4.2 Swinging doors normally held in the open position and equipped with automatic-closing devices shall be operated at frequent intervals to ensure proper operation.

15-2.4.3 All horizontal or vertical sliding and rolling fire doors shall be inspected and tested annually to check for proper operation and full closure. Resetting of the release mechanism shall be done in accordance with the manufacturer's instructions. A written record shall be maintained and shall be made available to the authority having jurisdiction.

15-2.4.4 Fusible links or other heat-actuated devices and release devices shall not be painted.

15-2.4.5 Care shall be taken to prevent paint accumulation on any movable part such as, but not limited to, stay rolls, gears, and closing mechanisms.

15-2.5 Repair of Fire Doors and Windows.

15-2.5.1 Broken or damaged glazing material shall be replaced with labeled glazing. Wire glass shall be well embedded in putty and all exposed joints between the frame and the glass shall be struck and pointed. Other glazing materials shall be installed in accordance with their individual listing.

15-2.5.2 Any breaks in the face covering of doors shall be repaired immediately.

15-2.5.3 Where a fire door, frame, or any part of its appurtenances is damaged to the extent that it could impair the door's proper emergency function, it shall be repaired with parts obtained from the door's manufacturer. Upon completion of the repairs, the door shall be tested to ensure emergency operation and closing.

15-2.5.4 When holes are left in a door or frame due to changes or removal of hardware or plant-ons, the holes shall be repaired by the following methods:

- (a) Install steel fasteners that adequately fill the holes
- (b) Fill the screw or bolt holes with the same material as the door or frame

15-2.6 Fire Prevention.

15-2.6.1 Combustible material shall be kept well away from openings.

15-2.6.2 Devices that utilize an open flame shall not be used to test fusible links, heat, smoke, or other automatic devices.

Chapter 16 Referenced Publications

16-1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix K.

16-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 72, *National Fire Alarm Code*®, 1996 edition.

NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment*, 1999 edition.

NFPA 232, *Standard for the Protection of Records*, 1995 edition.

NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, 1995 edition.

NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, 1995 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, 1995 edition.

NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*, 1996 edition.

16-1.2 Other Publications.

16-1.2.1 ANSI Publications. American National Standards Institute, Inc., 11 West 42nd Street, 13th floor, New York, NY 10036.

ANSI A133.1, *Tin-Clad Fire Doors Mounted Singly and in Pairs*, 1993.

ANSI A156.1, *Standard for Butts and Hinges*, 1988.

ANSI A156.4, *Door Controls (Closers)*, 1992.

16-1.2.2 ASME Publication. American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

ASME/ANSI A17.1, *Safety Code for Elevators and Escalators*, 1993.

16-1.2.3 CSA Publication. Canadian Standards Association, 178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3.

CAN 3-B44, *Safety Code for Elevators*, including Supplement No. 1, 1987.

16-1.2.4 U.S. Government Publication. U.S. Government Printing Office, Washington, DC 20402.

Federal Specification FF-S-325 (September 1957) and Interim Amendment 3 (July 1965).

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A-1-1

(a) Each class of device (e.g., doors, shutters, windows) has certain advantages and limitations, and the importance of each of these characteristics needs to be considered for the specific opening under consideration. A device cannot be expected to perform properly except under the condition for which it was designed. Assemblies incorporating fire-resistant glazing materials also have been developed that have been tested and evaluated as components of fire doors or fire-resistive walls rather than as glass lights or fire windows. Users first should ascertain from the authority having jurisdiction which type of device or material, if any, is acceptable in the location proposed, and the contract should be subject to the approval of the authority having jurisdiction.

(b) Fire door assemblies for the protection of openings depend on the use of labeled fire doors and frames, listed or labeled latching devices, listed swinging and sliding hardware, and closing devices having the required fire protection ratings that close or are closed at the time of fire. The effectiveness of the entire assembly as a fire barrier could be destroyed if any component is omitted or if one of substandard quality is used. Except where restricted by individual published listings, a fire door assembly may be permitted to consist of the labeled, listed, or classified components of different organizations that are acceptable to the authority having jurisdiction.

(c) Where fire doors are used in a means of egress, NFPA 101®, *Life Safety Code*®, specifies that they are required to swing with the exit travel except for doors on individual small rooms, which may be permitted to swing in; and that for horizontal exits, where fire doors are required on both sides of the wall, one door may be permitted to be an automatic horizontally sliding door, normally open, and the other door may be permitted to be a self-closing door that swings with the exit travel, normally closed. The following types of doors may not be permitted to be used on exits:

1. Rolling steel doors or shutters
2. Vertical sliding doors
3. Jackknife doors

(d) Labeled fire exit hardware that meets the requirements for safety to life and fire protection is available for use on labeled fire doors. Fire doors for use with this hardware are required to bear the following marking on the label: "Fire Door To Be Equipped with Fire Exit Hardware."

(e) NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, provides detailed guidance in determination of the fire exposure severity and the corresponding degree of protection of the opening that is warranted.

(f) Fusible link or similar door-closing arrangements are of limited value for exit purposes because quantities of smoke can pass through the door opening before there is sufficient heat to fuse the link.

(g) Doors of small to moderate sizes are more suitable for exit purposes than very large doors because of the relative ease of operation of smaller doors.

(h) Horizontally sliding doors for exit purposes are not suitable because they are difficult to reopen once they are closed in the case of fire. Swinging doors that are integral with the sliding fire doors are considered suitable if they are tested and listed and if they are furnished without any obstruction to clear passage.

(i) Structural requirements specified in this standard generally refer to materials and assemblies that, through field experience, have been found acceptable for such application. Walls and lintels, provided they are of fire-rated construction, should provide the support required for the type of door to be installed. Materials and structural designs other than those specifically covered herein may be permitted to be employed if judged equivalent by the authority having jurisdiction.

(j) Despite the provision of protection specified in this standard, walls with openings have less fire resistance than unpierced walls. Fire doors, shutters, and fire windows are designed to protect an opening under normal conditions of use, with a clear space on both sides of the opening. Where the opening is not used and combustible material is piled against the door, window, or shutter, the designed protection cannot be expected. For this reason, combustible material should be kept well away from openings. Where a door or window opening is no longer in use, the opening should be closed with construction having a fire resistance rating equivalent to that of the wall.

(k) Any assembly provided in accordance with the provisions of this standard does not necessarily provide the same degree of protection against the spread of fire that is provided by the wall in which the assembly is installed, assuming that the wall has fire resistance established in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*. Therefore, the size and number of openings in any wall required to have fire resistance should be kept to the minimum necessary for the normal or emergency operation of the occupancy. The use of assemblies covered in this standard only for decorative, aesthetic, and similar purposes in fire-resistive walls is not recommended. However, there are glazing systems using fire-resistant glazing materials that are actually fire-resistive walls tested in accordance with NFPA 251. Such systems may be permitted to be used as fire-resistive walls and are not within the scope of this standard.

There are new developments in the area of glazing that demonstrate a resistance to the passage of heat beyond that discussed in Appendix J. Historically, the fire resistance of glazing has been based on wired glass, which is capable of successfully meeting the fire exposure test criteria of NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*, and has been accepted as having a fire protection rating of 45 minutes. The newly developed glazing materials are capable of meeting the fire test criteria for as much as 3 hours and some have a low radiant heat transfer capability for as much as 1 hour and 1½ hours.

Safety glazing is also an important consideration where using glazing materials in fire doors and in fire resistance-rated walls that could be subject to accidental human impact.

In such applications, all model building codes contain requirements for safety glazing based on 16 *CFR* 1201, U.S. Consumer Product Safety Commission "Standard for Architectural Glazing." However, wired glass used in fire-rated assemblies is exempt from this CPSC standard and, instead, may be permitted to meet the performance criteria of ANSI Z97.1, *Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings*, which requires significantly less impact resistance.

(l) Access doors installed in a horizontal plane (horizontal access doors) for use in fire-rated floors, or floor-ceiling or roof-ceiling assemblies are designed to maintain the fire resistance rating of the assembly based on tests performed in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*. The size and number of such door openings should be limited in accordance with the listing for the fire-rated assembly.

Horizontal access doors differ from access doors installed in the vertical plane (vertical access doors) because they are tested to perform as an essential component of the fire-rated assembly in which they are installed so that the rating of the entire assembly is maintained by the installation of the horizontal access door. Therefore, these doors do not have a fire protection rating. Vertical access doors, however, are tested in accordance with the same test used to measure the fire performance of standard size doors using NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, to obtain a fire protection rating. [See A-1-1(j) and (k) and Appendix E.]

(m) Fire doors, shutters, or fire windows are of value only if properly maintained so that they close or are closed at the time of fire. Periodic inspection of doors, shutters, and fire windows, with immediate attention to any necessary repairs and correction of any defects that could interfere with operation, is an important responsibility of the management of the property. (See Chapter 15.)

(n) The use of swinging, nonrated doors mounted in openings in fire walls, which could interfere with the closing of the fire doors, should not be permitted.

A-1-1.1 The authority having jurisdiction might require upgrading of existing installations to meet current standards and requirements only where the lack of compliance with this standard presents a serious fire or life safety hazard. It should be noted that care and maintenance of materials for ongoing and existing installations should be maintained in accordance with the standards under which they were installed. Protected openings provide access, ingress, egress, observation, passage of light, natural ventilation (other than ducts or transfer grilles), or movement through fire-resistive walls and ceilings that have been tested in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*.

A-1-2.1 The development of fire doors and related devices is a continuous process; therefore, this standard is not always current. This standard is intended to be current only at the date of publication.

A-1-4 Approved. 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 that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-4 Authority Having Jurisdiction. 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.

A-1-4 Fire Door. The fire protection rating of a fire door presumes that the door is installed with the appropriate frame, hardware, and other accessories required by this standard. In any instance where any of the required elements are omitted, the assembly rating is void for the purposes of this standard and the opening protection is not considered equivalent to the labeled or otherwise indicated fire protection rating of the door component.

A-1-4 Glazing Material. Safety is also an important consideration where using glazing materials in fire doors and in fire resistance-rated walls subject to accidental human impact. In such applications, all model building codes contain requirements for safety glazing based on 16 *CFR* 1201, U.S. Consumer Product Safety Commission Safety “Standard for Architectural Glazing.” However, wired glass used in fire-rated assemblies is exempt from this CPSC standard. Wired glass is required by the model building codes to meet the performance criteria of ANSI Z97.1, *Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings*.

Some glazing materials are designed to limit the temperature rise on the unexposed surface and to withstand the impact of the hose stream test as required for walls in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*. These materials were originally intended to be used as a substitute for fire-resistive walls where large areas of glazing were required or desirable. These glazing materials actually achieve a fire resistance rating as compared to a glazing material, which achieves only a fire protection rating as defined in this standard. These glazing materials may be permitted to be used as a component of a fire door assembly to meet the fire performance requirements for a fire door rather than as a glazing material installed in a fire door. Or they may be permitted to be used as part of a fire-resistive wall assembly that is not limited in size or area in accordance with the requirements for fire windows provided in this standard.

A-1-4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations 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.

A-1-5.1 Labels may be permitted to be of metal, paper, or plastics or may be permitted to be stamped or diecast into the item.

A-1-6.1 Doors are of several classifications, types, and methods of operation. Fire door assemblies consist of individually labeled components that are essential to the satisfactory performance of the complete assembly. Some labels cover one or more components in addition to the door. (*For specific information, see 1-6.2 and Appendix E.*)

A-1-6.3 Testing laboratories might provide a label or certificate of inspection for door assemblies larger than the maximum size indicated in the manufacturer’s fire door listing. Door assemblies exceeding these size limitations have not been subjected to the standard fire tests. In certain cases, the testing laboratory might be prepared to furnish a label or certificate of inspection for such oversize door assemblies. This label or certificate does not indicate that the door assemblies are capable of furnishing standard fire protection but only that they conform to the requirements of design, materials, and construction as established by the individual listings.

A-1-7.3 Exception. NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, permits the dislodging of small portions of glass lights (glazing material) during the hose stream test. Since the glazing material as used in this exception does not constitute a glass light, no dislodging of the glazing material is permitted.

A-1-7.4 Doors containing special fire-resistant glazing materials fabricated and tested as door assemblies in accordance with NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, to determine a fire protection rating should be regulated by this standard as a fire assembly and not as a glazing material permitted in fire door assemblies as prescribed in Section 1-7.

A-1-10.6.1 The arrangements shown in Figures B-48, B-49, and B-50 are recommended to provide the performance intended. Other arrangements acceptable to the authority having jurisdiction may be permitted to be used.

A-1-11.2.5 The jamb is the vertical component or member of an opening whether framed or not.

A-1-12 Fire doors, shutters, or fire windows are of value only if properly installed so that they close at the time of fire.

A-2-3.1.1 Door frames might carry a label stating the hourly rating. The rating of the installed assembly should carry the rating of the door or the door frame, whichever is less.

A-2-3.1.2 Door frames should be installed following the general guidelines shown in Figure B-26(b). The door frame installations shown in Figure B-26(b) do not represent all types of installations but do illustrate some typical door frame installation techniques required for the proper installation of fire door frames.

A-2-3.1.3 Test information suggests that a door frame butted to the end of a drywall construction does not perform under standard fire and hose stream test methods.

A-2-4.1.2 In communicating doors between hotel/motel sleeping rooms, the closing devices may be omitted with the approval of the authority having jurisdiction.

A-2-4.1.4 Adequate spring power is essential for hydraulic door closers to close a fire door with sufficient force to overcome the resistance of the latching mechanism. However, too much spring power causes opening resistance and makes it difficult for the handicapped, infirm, and young children to open doors.

Closers are classified in sizes from 2 to 6 with an increased closing force for higher numbers. Generally, a size 4 minimum closer should be used on exterior fire doors and a size 3 minimum closer should be used on interior fire doors. Door widths greater than $3\frac{1}{6}$ ft (0.97 m) exterior and $3\frac{1}{3}$ ft (1.02 m) interior, parallel or single lever arm applications, and abnormal air pressures usually require an increase to the next size. A combination of these factors could necessitate an increase of two sizes. Individual manufacturer recommendations should be consulted.

Spring hinges should be adjusted to achieve positive latching when allowed to close freely from an open position of 30 degrees.

A-2-4.2 Labeled door holder/release devices for swinging doors should, wherever possible, be installed at the top of the door as close as possible to the lock edge and should be located to avoid interference with any other hardware. If necessary, the holder/release may be permitted to be located at the bottom of the door as close as possible to the lock edge with the device installed on the wall or floor.

A-2-4.3 Individual listed or labeled hardware products are usually suitable for fire door assemblies of any construction or hourly rating. There are, however, some exceptions because of limitations found either in individual door or frame construction or in the hardware products.

Some latches, for example, are listed for use only in $\frac{1}{3}$ -hour assemblies. Another example is that some pairs of doors might be equipped only with latches having a latch throw of $\frac{3}{4}$ in. (19 mm), while those produced by a different manufacturer might have been tested with latches having a latch throw of $\frac{1}{2}$ in. (12.7 mm).

Other products such as concealed door closers, electric strikes, open back strikes, viewers, or spring hinges are limited in use either by door and frame construction, size, or maximum hourly protection.

Organizations offering a labeling and listing service should indicate such limitations on the label or supplementary marking. The authority having jurisdiction should refer to the individual manufacturer's published listings when specific information is needed.

A-3-3.2 Structural steel frames consist of head and jamb members, either shop or field assembled.

A-3-4.1 Self-closing devices for these doors consist of a system of weights suspended by ropes, wire cables, or chains over pulleys arranged to return the door to the normally closed position each time it is used.

Automatic-closing devices consist of a system of weights suspended by ropes, wire cables, or chains over pulleys and a hold-open device with a release mechanism that is activated by an automatic fire detector. Upon the detection of fire, additional closing weights are released, causing the door to close and latch.

The automatic-closing system described above may be permitted to be used with a listed releasing device in addition to fusible links and in conjunction with a fire detection system in order to actuate the closing system.

All weights shall be enclosed in a substantial metal enclosure for their entire length of travel. Pulleys over which the weight cable or chain passes should be shielded to prevent the cable or chain from jumping off the pulley and thereby possi-

bly preventing the door from closing. Typical arrangements are shown in Figures B-30 and B-32.

A-4-4.2 If the power operator is of a type that does not close under power failure, then the door should be disconnected from the operator and caused to close under fire conditions. This is accomplished by a listed releasing device activated by the closing system that then closes the fire door. If the power operator is to close the door under fire conditions, its logic circuit should be such that, upon a signal from the fire detection system, it closes under power operation.

A-5-4.3.1.2 The length of the track is expressed in terms of the height of the opening, with 4 in. (102 mm) allowed for the lap of the door, 4 in. (102 mm) for the attachment of the bumper, and 1 in. (25.4 mm) for clearance when the door is fully open.

A-6-4.3.3 A flame baffle might be an integral part of the hood or curtain and utilized where required to protect the opening.

A-7-3.1 Where door assemblies are used for smoke or draft control, gasketing or reduced clearances might be necessary. (See NFPA 105, *Recommended Practice for the Installation of Smoke-Control Door Assemblies*.)

A-9-1.2 Some chute doors, depending on location, might be required to have a temperature rise of not more than 250°F (121°C) at the end of a 30-minute exposure to the standard fire test as described in NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*.

A-10-3.2 Shutters may be permitted to be installed on the inside or outside of an opening or between jambs, but preferably on the inside or between jambs for ease of maintenance and protection from adverse weather conditions.

A-13-2.2 The authority having jurisdiction should be consulted on local building code requirements that might have more restrictive limitations on the maximum size and the total area of fire windows and borrowed lights required to protect openings in interior partitions and exterior walls.

A-15-1 Walls with openings have less fire resistance than unpierced walls. Fire doors, shutters, and fire windows are designed to protect the opening under normal conditions of use, with clear spaces on both sides of the opening. Where the opening is not used and combustible material could be piled against or near the door, window, or shutter, the designed protection cannot be expected.

A-15-2.1 Fire doors, shutters, and windows are of no value unless they are properly maintained and closed or are able to close at the time of fire. A periodic inspection and maintenance program should be implemented and should be the responsibility of the property management.

A-15-2.1.1 Hinges, catches, closers, latches, and stay rolls are especially subject to wear.

Appendix B Drawings of Fire Door Assemblies and Components

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

B-1 Figures B-1 through B-72 illustrate standard good practice. Other methods acceptable to the authority having jurisdiction may be permitted to be used.

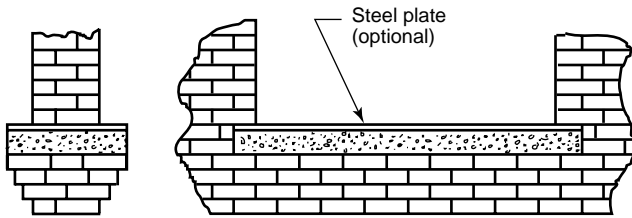


Figure B-1 Concrete sill supported by a corbel of brick used with combustible floors.

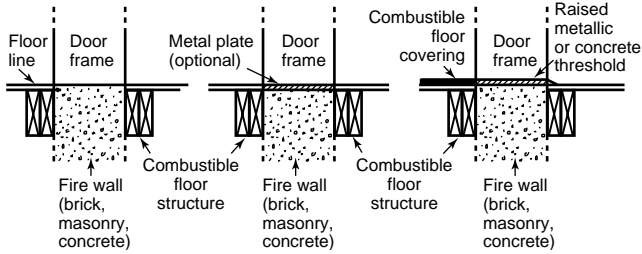


Figure B-2 Noncombustible sill used with combustible floors for doors swinging into steel frame.

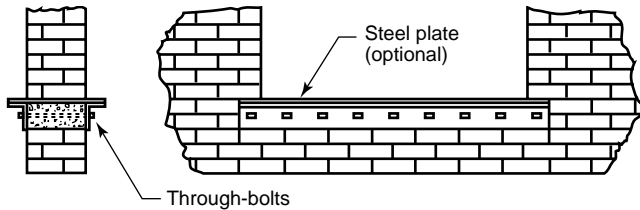


Figure B-3 Angle iron and concrete sill used with combustible floors.

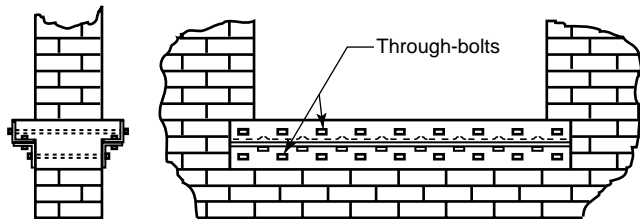


Figure B-4 Z-bar and concrete sill used with combustible floors.

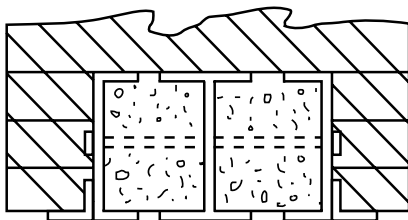


Figure B-5 Steel lintel.

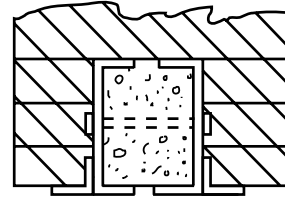


Figure B-6 Steel lintel.

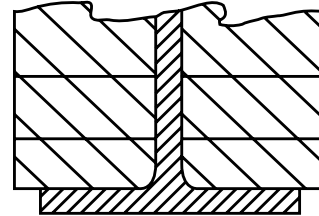


Figure B-7 Steel lintel.

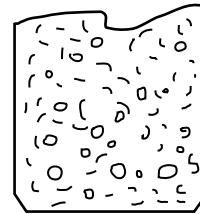


Figure B-8 Reinforced concrete lintel.

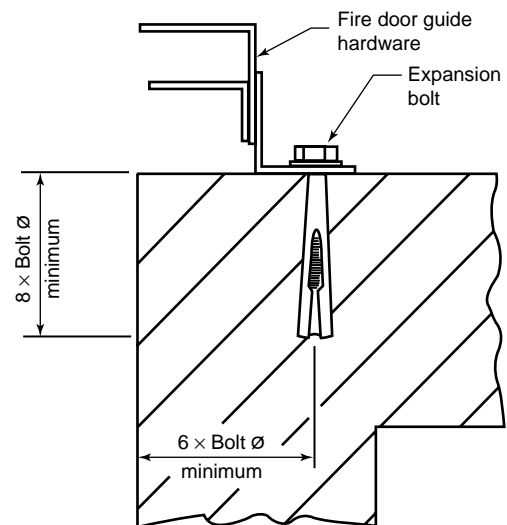


Figure B-9 Corner walls.

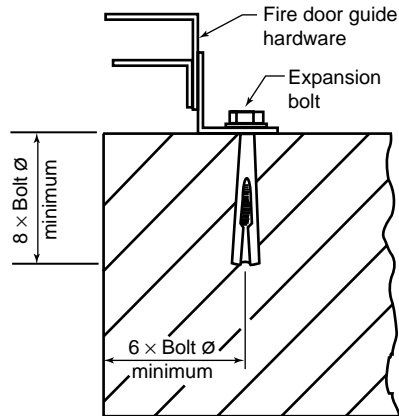


Figure B-10 Unusually thick walls.

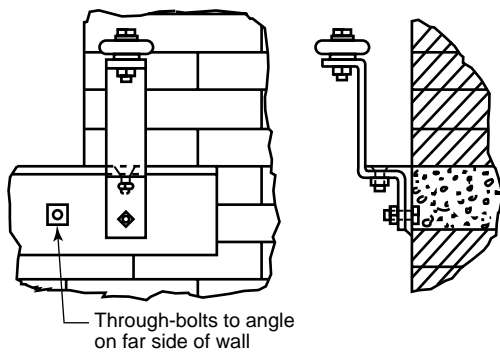


Figure B-11 Stay roll.

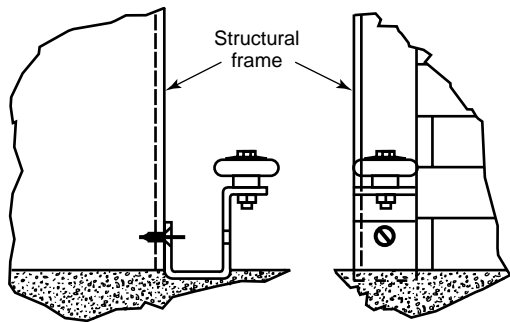


Figure B-12 Stay roll.

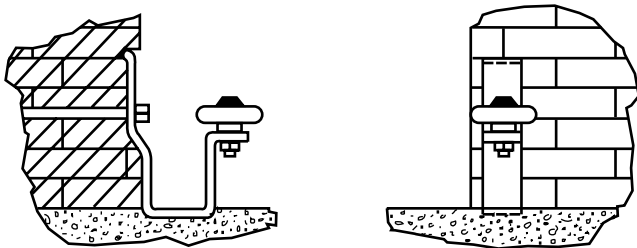


Figure B-13 Stay roll.

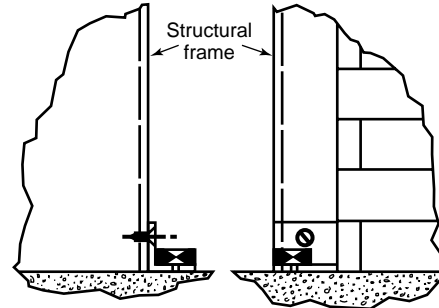


Figure B-14 Concealed-type stay roll.

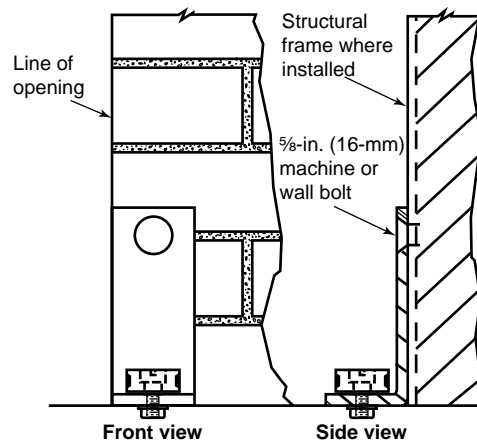


Figure B-15(a) Concealed-type stay roll.

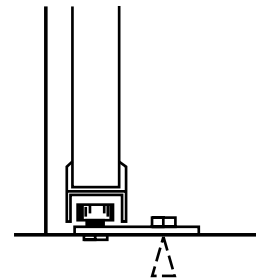


Figure B-15(b) Stay roll.

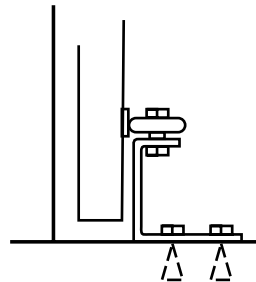
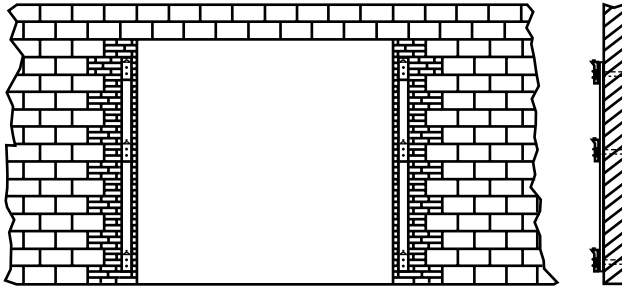
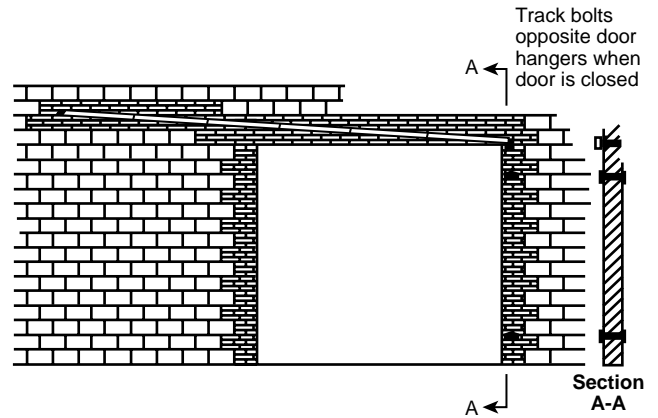


Figure B-15(c) Stay rolls.



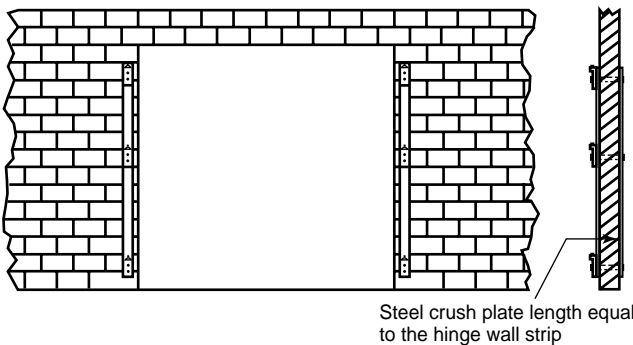
This figure illustrates typical reinforcement of a hollow concrete masonry wall opening to provide adequate anchorage of the door-mounting hardware. Brick reinforcement may be permitted to be omitted, provided all hollow cells within 16 in. (0.41 m) of the opening are filled with concrete. It is recommended where openings are subjected to heavy traffic that jambs be protected with steel frames extending the full thickness of the wall.

Figure B-16 Hollow concrete masonry wall prepared for doors swinging in pairs — lap mounted, standard method.



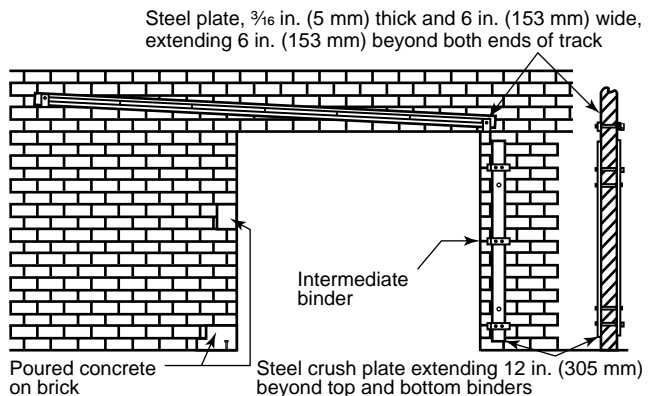
This figure illustrates typical brick reinforcement of a hollow concrete masonry wall opening to provide adequate anchorage of the door-mounting hardware. Brick reinforcement may be permitted to be omitted, provided all hollow cells within 16 in. (0.41 m) of the opening on each side and all cells where track is mounted are filled with concrete. It is recommended where openings are subjected to heavy traffic that jambs be protected with steel frames extending the full thickness of the wall.

Figure B-18 Hollow concrete masonry wall prepared for single tin clad or sheet metal sliding door — standard method.



This figure illustrates typical reinforcement for anchorage of door-mounting hardware by use of steel plates to bridge cavities in the hollow concrete masonry units and to prevent their crushing. It is recommended where openings are subjected to heavy traffic that jambs be protected with steel frames extending the full thickness of the wall.

Figure B-17 Hollow concrete masonry wall prepared for doors swinging in pairs — lap mounted.



Note: Steel plates installed on both sides of wall with 1/2-in. (13-mm) through-bolts. Binders, track, and stay rolls secured with 3/4-in. (19-mm) through-bolts.

This figure illustrates typical reinforcement for anchorage of door-mounting hardware by use of steel plates to bridge the cavities in the hollow concrete masonry units and to prevent their crushing.

Figure B-19 Hollow concrete masonry wall prepared for a single sliding door.

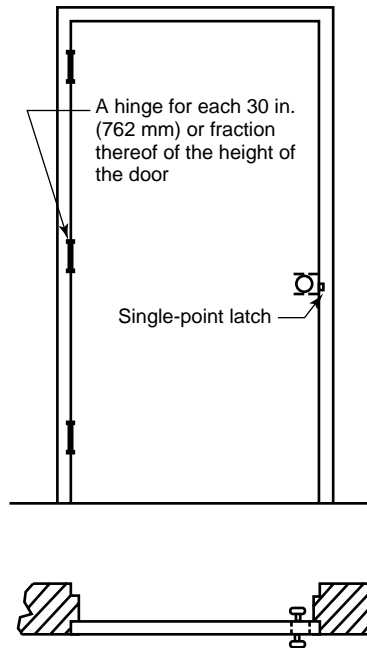


Figure B-20 Builders hardware (single swinging door with single-point latch — flush mounted).

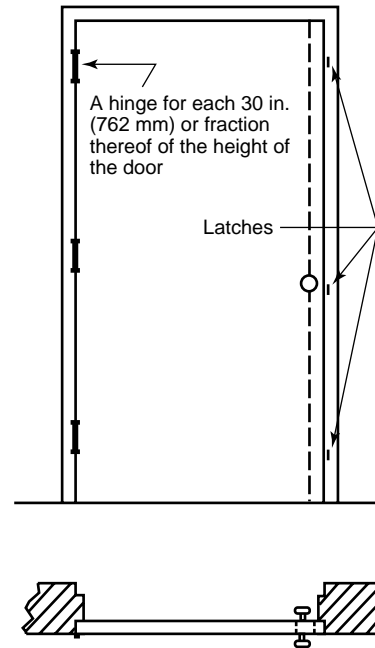
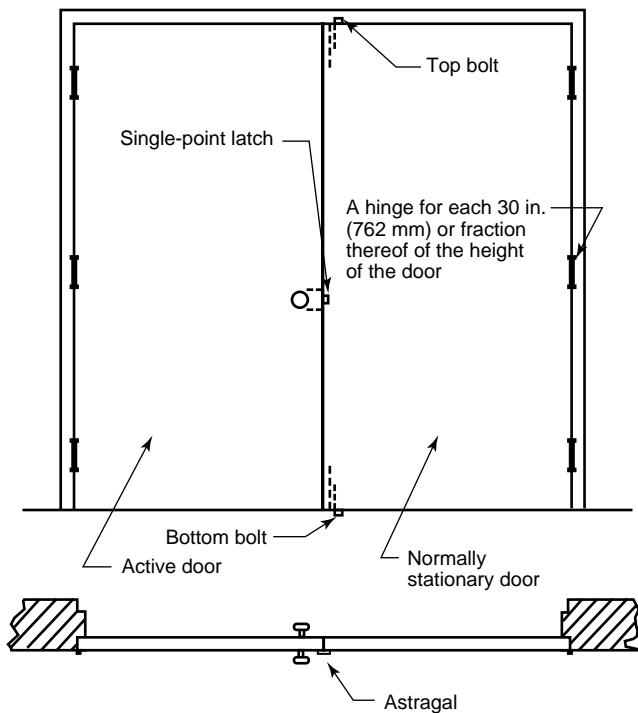


Figure B-22 Builders hardware (single swinging door with concealed three-point latch — flush mounted).



Note: The astragal may be permitted to be attached to the inside of the inactive leaf or the outside of the active leaf.

Figure B-21 Builders hardware (doors swinging in pairs with single-point latch — flush mounted).

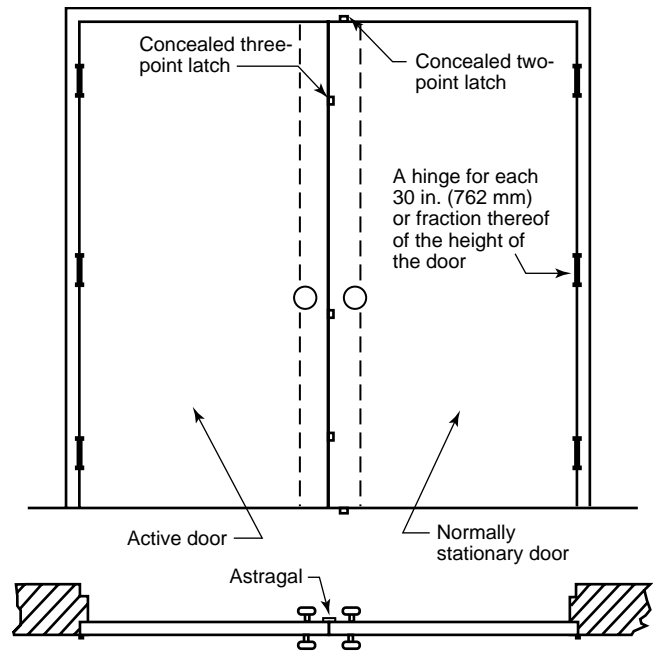


Figure B-23 Builders hardware (doors swinging in pairs with concealed two- and three-point latches — flush mounted).

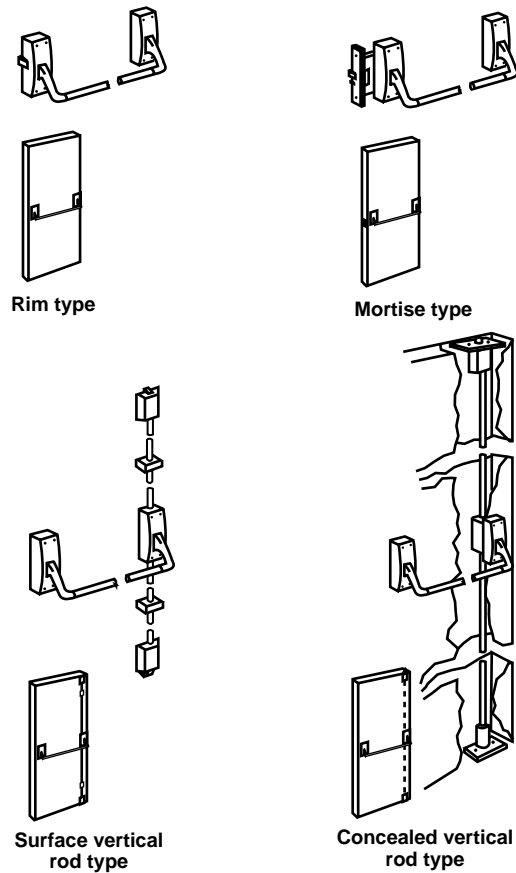


Figure B-24 Types of fire exit hardware.

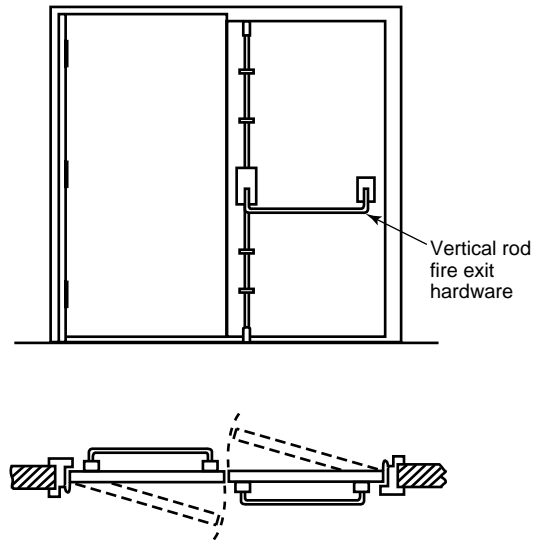
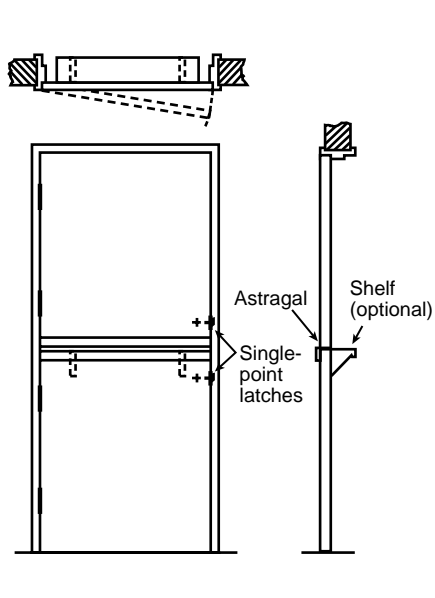
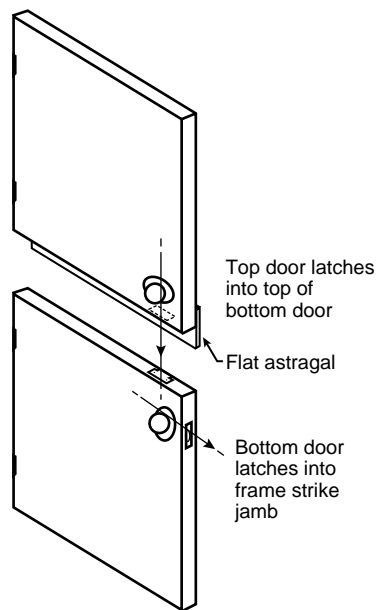


Figure B-25 Double egress door and frame.



Dutch door with two latches



Dutch door

Figure B-26(a) Dutch door and Dutch door with two latches.

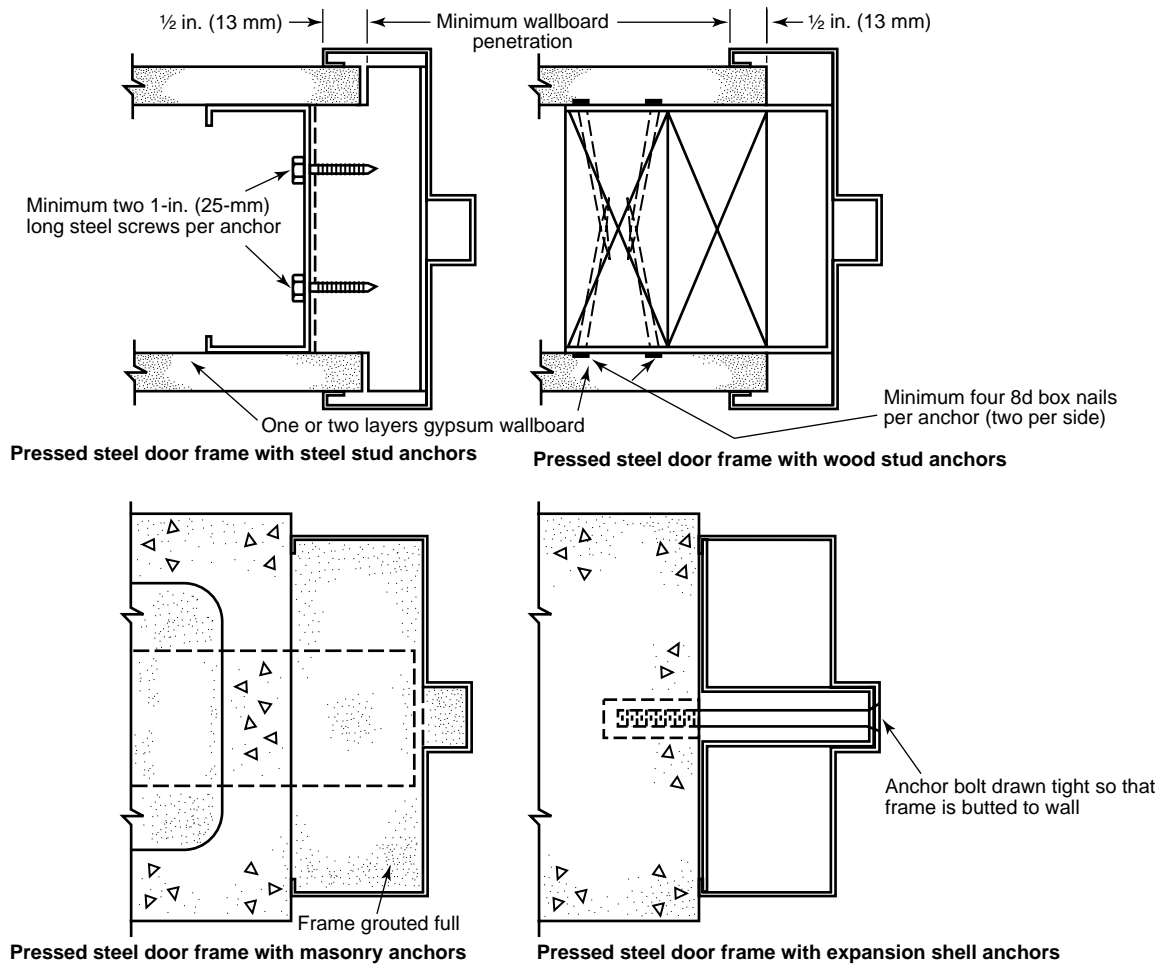


Figure B-26(b) Typical pressed steel door frame installations.

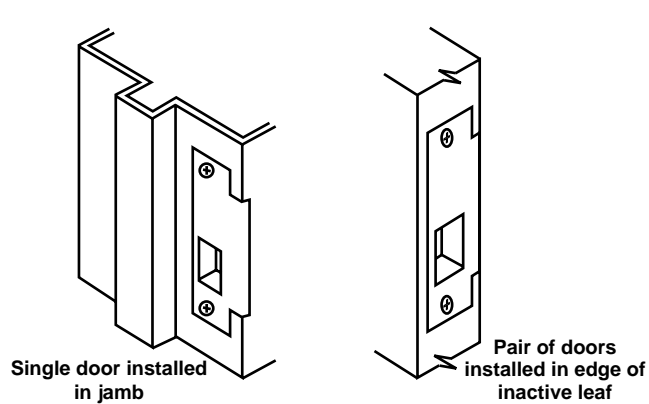


Figure B-27 Typical latch strike for single or pair of doors.

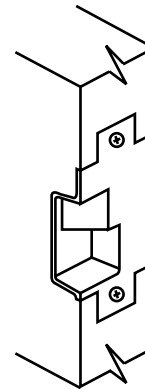


Figure B-28 Typical "open-back" latch strike for pair of doors installed in edge of inactive leaf where permitted by individual published listings.

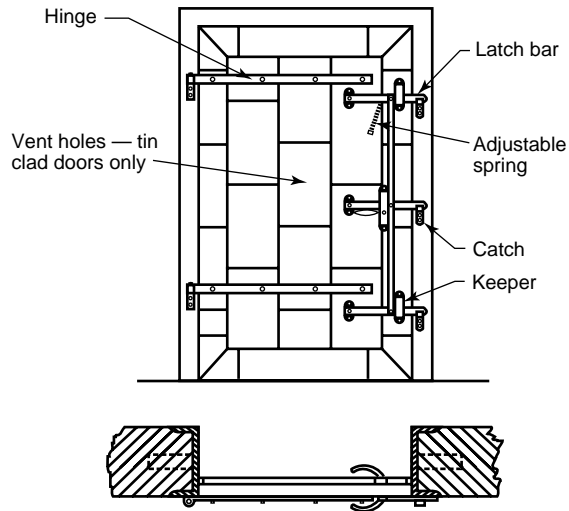


Figure B-29 Fire door hardware (single swinging door — flush mounted).

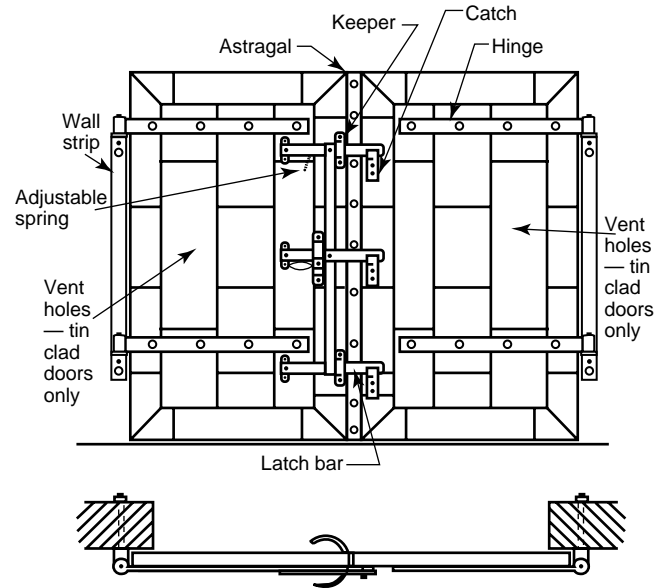
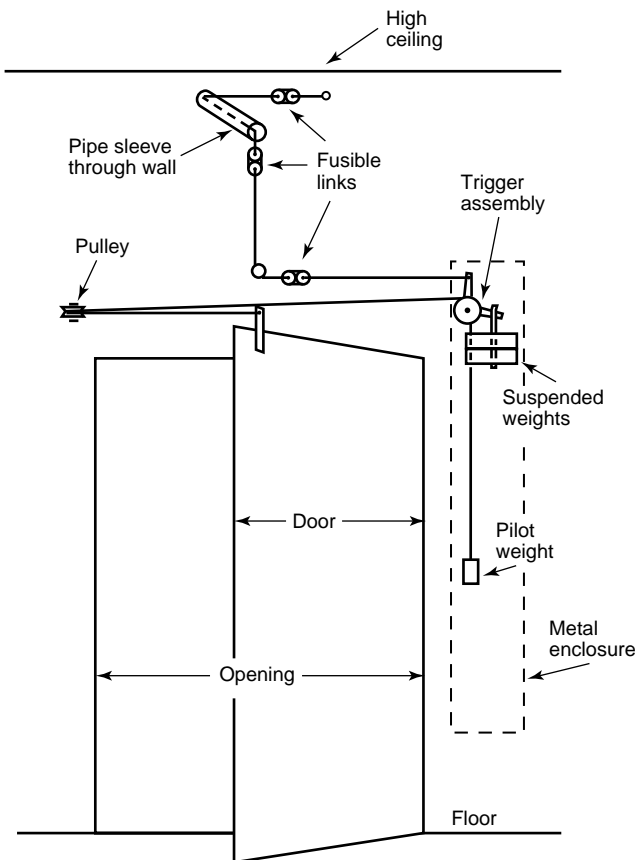
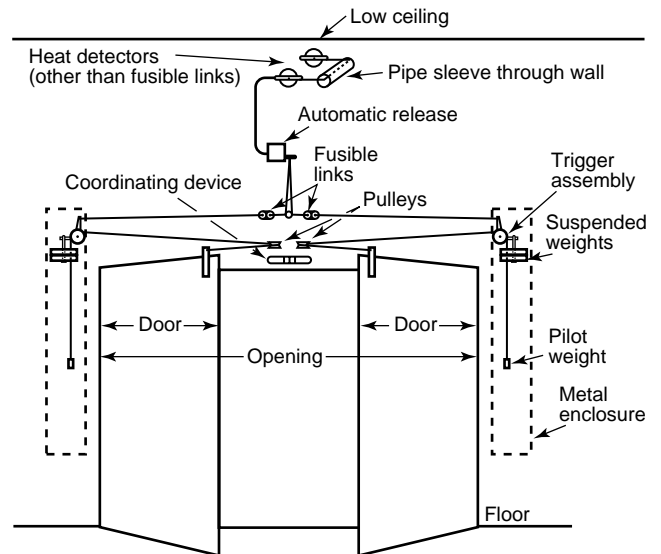


Figure B-31 Fire door hardware (doors swinging in pairs — lap mounted).



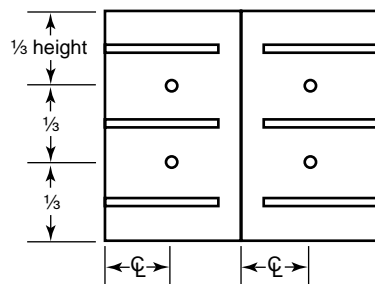
Note: Fusible links are needed on both sides of the wall.

Figure B-30 Closing devices for single swinging door.

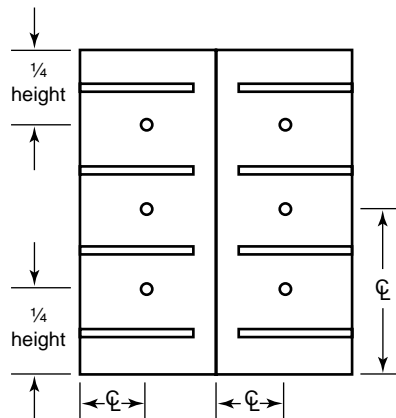


Note: See appropriate section for the required hardware for the normally stationary door.

Figure B-32 Closing devices for doors swinging in pairs.



Two 3-in. (76-mm) diameter vent holes required for each door leaf up to and including 8 ft 6 in. (2.6 m) in height.



Three 3-in. (76-mm) diameter vent holes required for each door leaf up to and including 12 ft 3.7 m) in height.

Figure B-33 Location of vent holes for swinging doors.

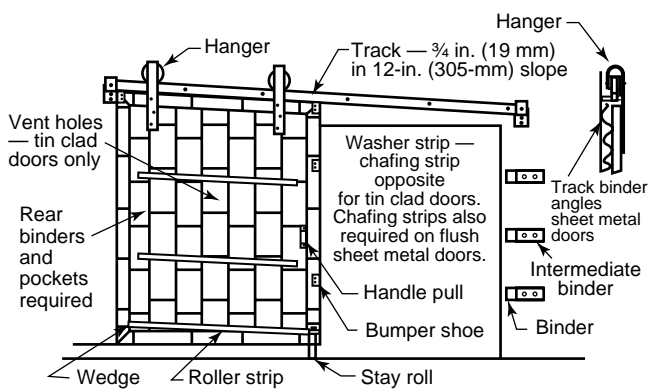
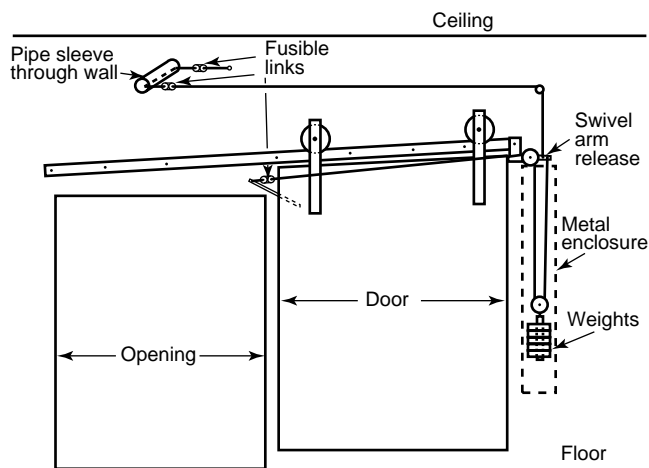


Figure B-34 Single sliding door (inclined track).



Note: Fusible links are needed on both sides of the wall.

Figure B-35 Closing devices for single sliding door (inclined track).

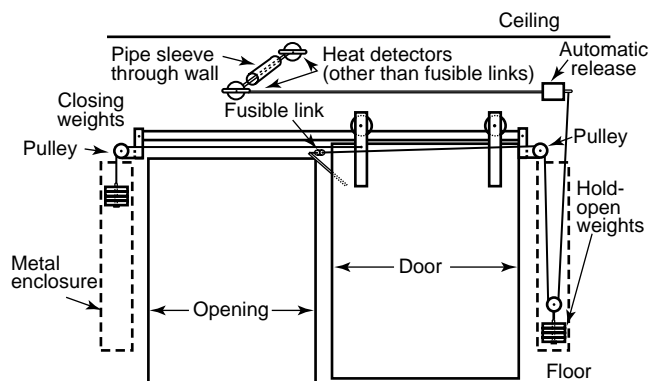


Figure B-36(a) Closing devices for single sliding door (level track).

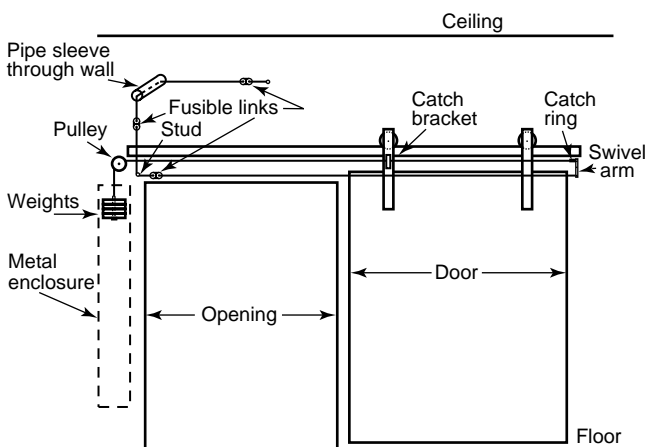
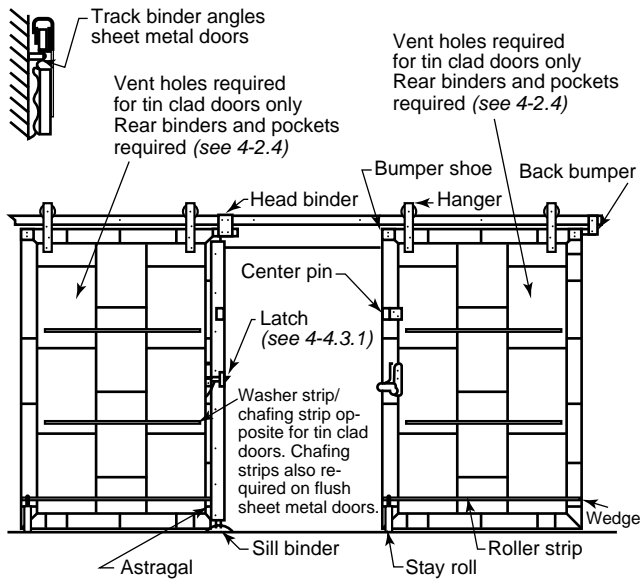


Figure B-36(b) Closing devices for single sliding door (level track).



Note: Binder and pocket required. Vent holes required for tin clad doors only.

Figure B-37(a) Center-parting, horizontally sliding doors (level track).

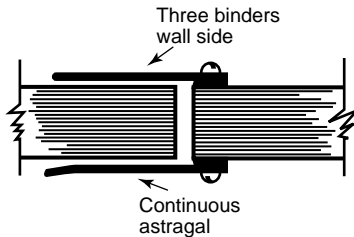


Figure B-37(b) Astragal arrangements.

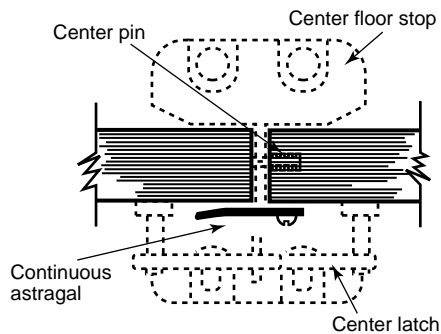


Figure B-37(c) Astragal arrangements.

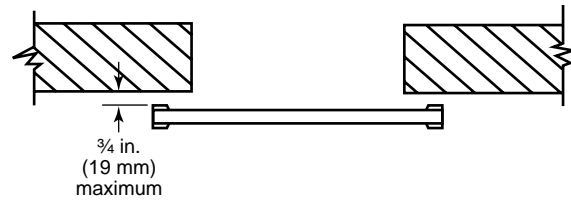


Figure B-37(d) Astragal arrangements.

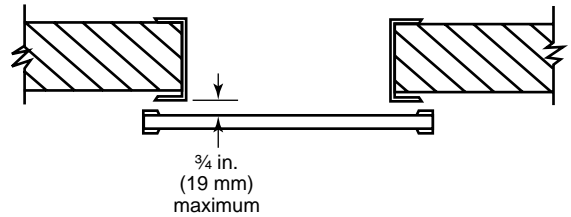


Figure B-37(e) Astragal arrangements.

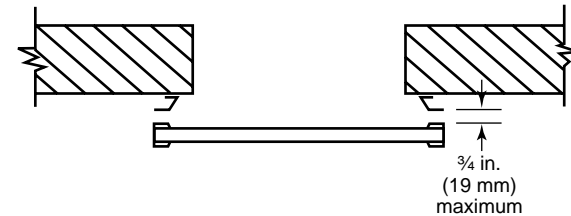
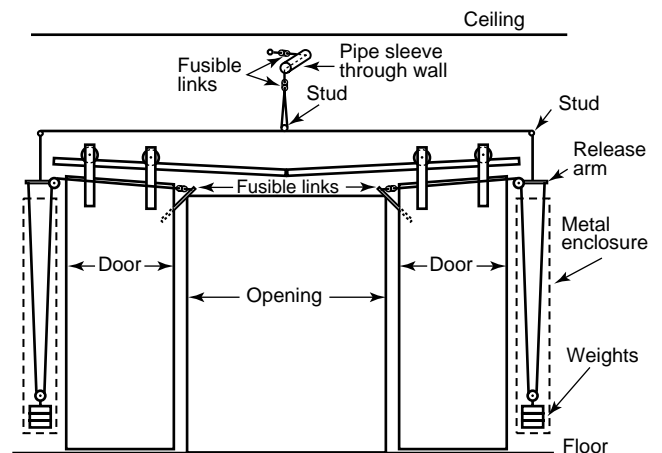


Figure B-37(f) Astragal arrangements.



Note: Fusible links are needed on both sides of the wall.

Figure B-38 Closing devices for center-parting, horizontally sliding doors (inclined track).

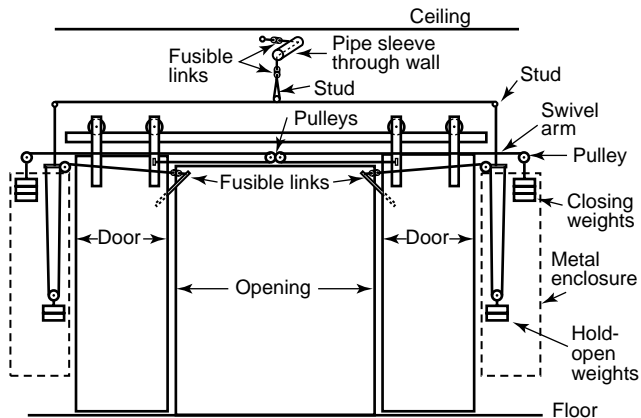


Figure B-39(a) Closing devices for center-parting, horizontally sliding doors (level track).

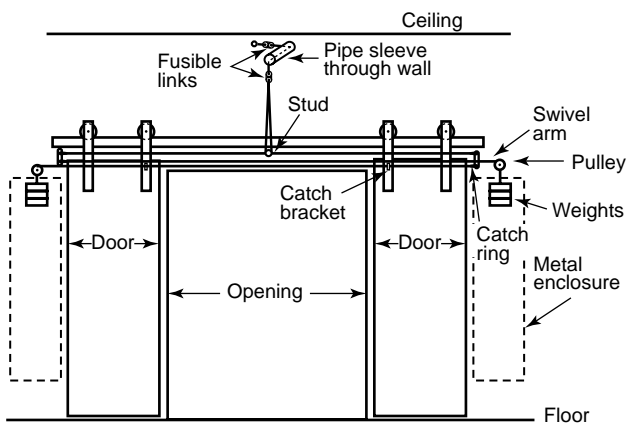
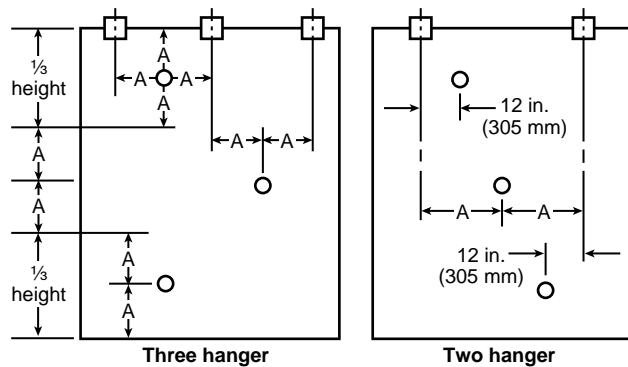
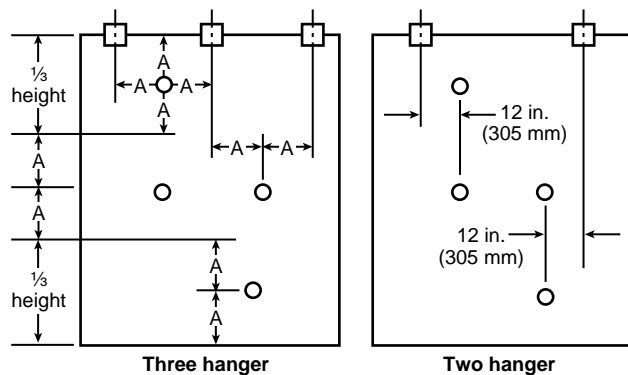


Figure B-39(b) Closing devices for center-parting, horizontally sliding doors (level track).



Three 3-in. (76-mm) diameter vent holes required for doors up to and including 9 ft 0 in. (2.7 m) in height

A = equal distances from centerlines



Four 3-in. (76-mm) diameter vent holes required for doors over 9 ft 0 in. (2.7 m) and up to and including 12 ft 4 in. (3.8 m) in height

A = equal distances from centerlines

Note: For vertically sliding doors, the vent holes are to be positioned similarly but without interfering with the attached hardware.

Figure B-40(a) Location of vent holes for horizontally sliding doors.

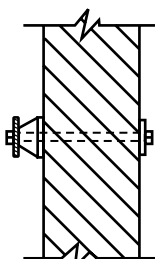


Figure B-40(b) Tracks.

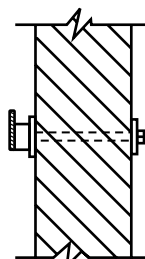


Figure B-40(c) Tracks.

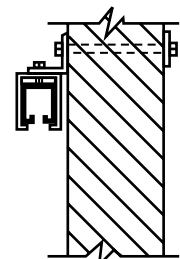


Figure B-40(d) Tracks.

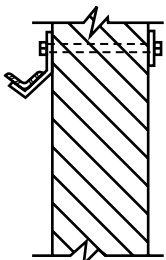


Figure B-40(e) Tracks.

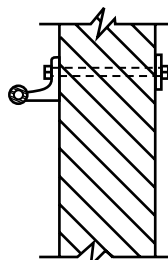


Figure B-40(f) Tracks.

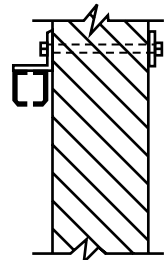
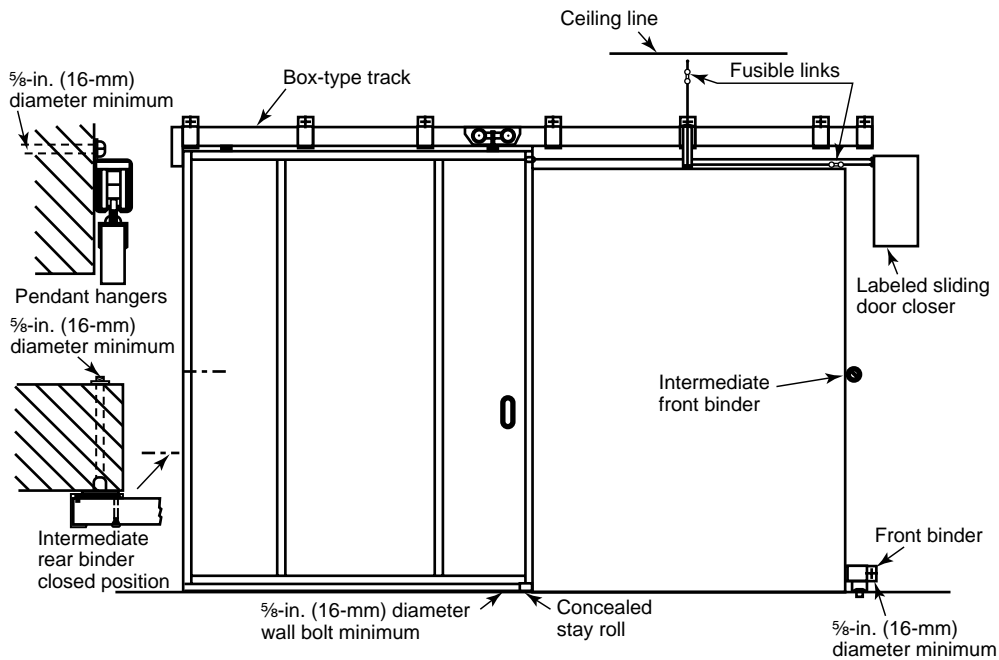
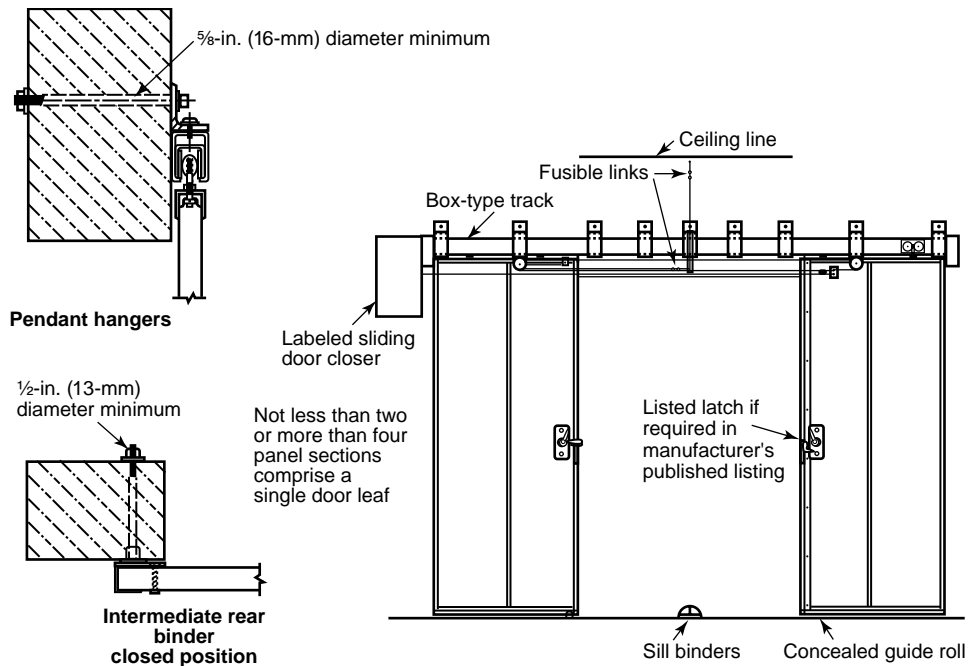


Figure B-40(g) Tracks.



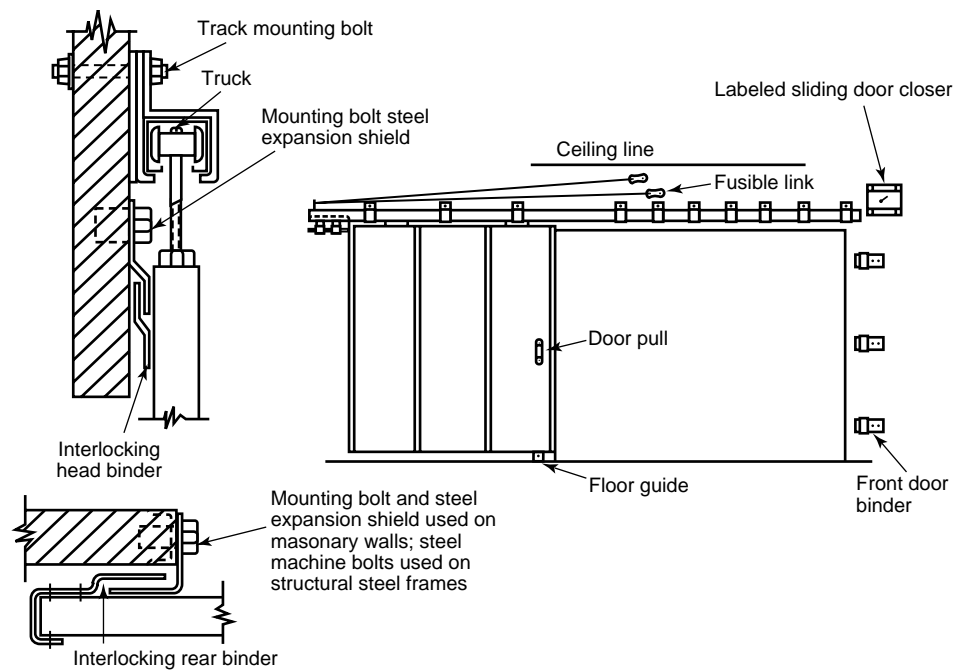
Note: Fusible links are needed on both sides of the wall.

Figure B-41 Horizontally sliding composite door.



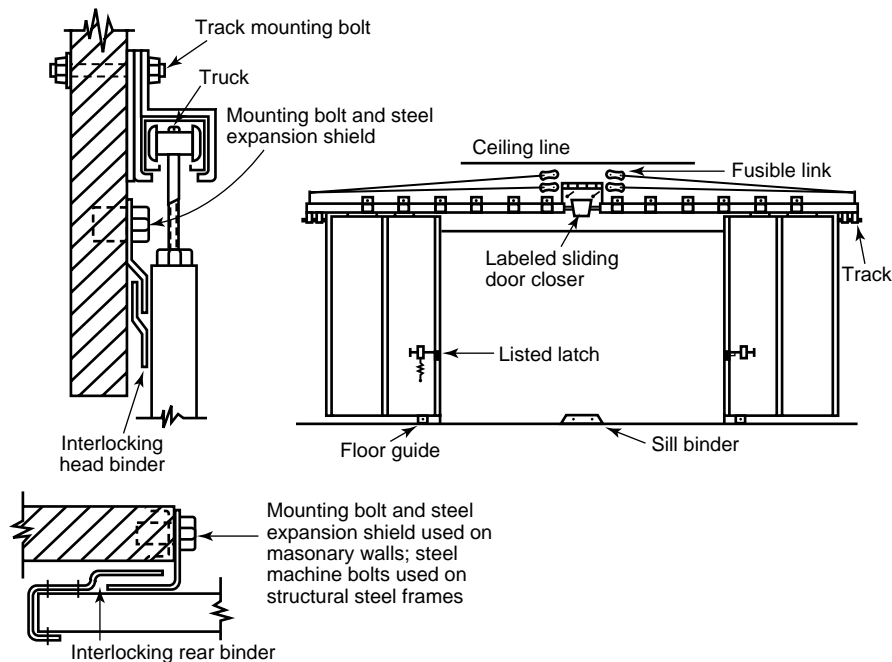
Note: Fusible links are needed on both sides of the wall.

Figure B-42 Center-parting, horizontally sliding composite door.



Note: Fusible links are needed on both sides of the wall.

Figure B-43 Horizontally sliding hollow metal door.



Note: Fusible links are needed on both sides of the wall.

Figure B-44(a) Center-parting, horizontally sliding hollow metal door.

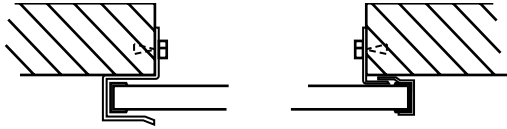


Figure B-44(b) Binder arrangements.

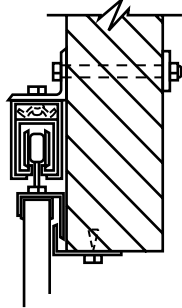
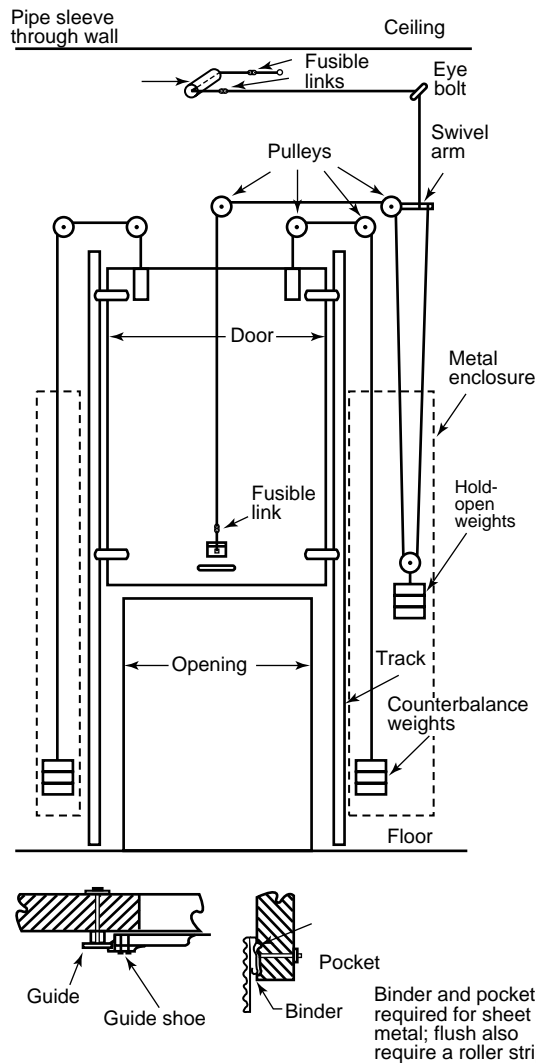
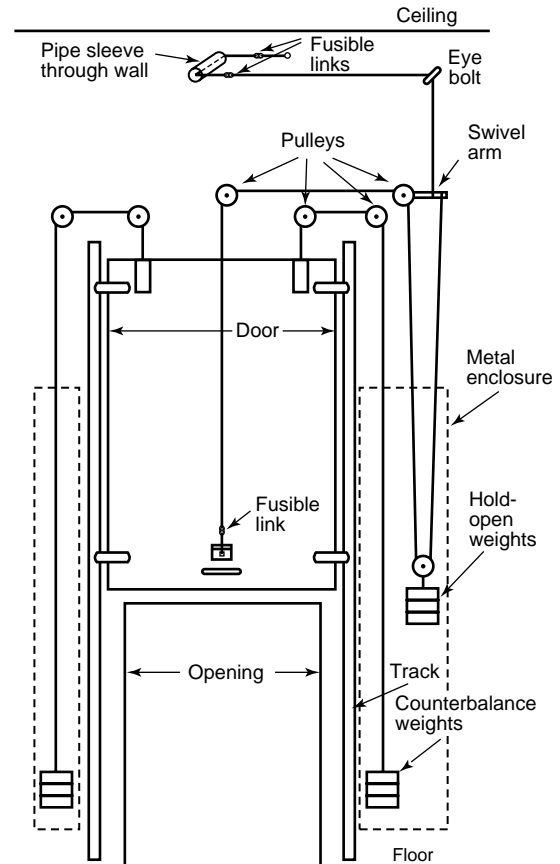


Figure B-44(c) Binder arrangements.



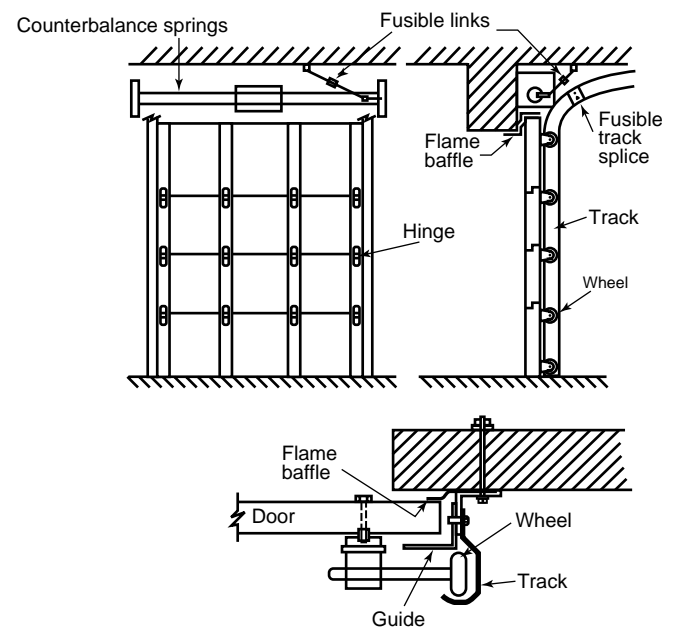
Note: Fusible links are needed on both sides of the wall.

Figure B-45 Vertically sliding door.



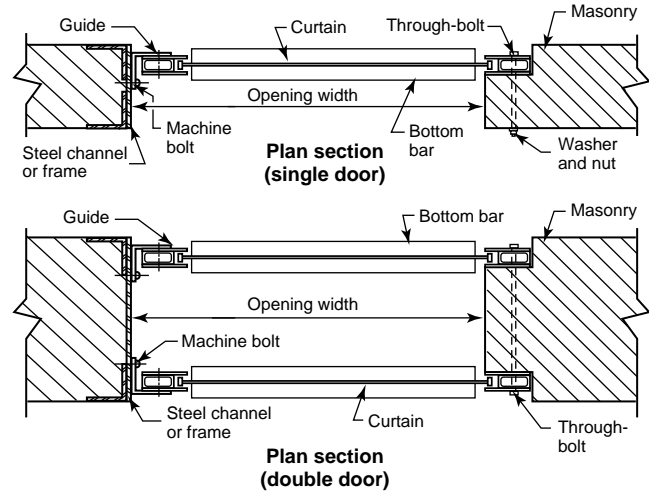
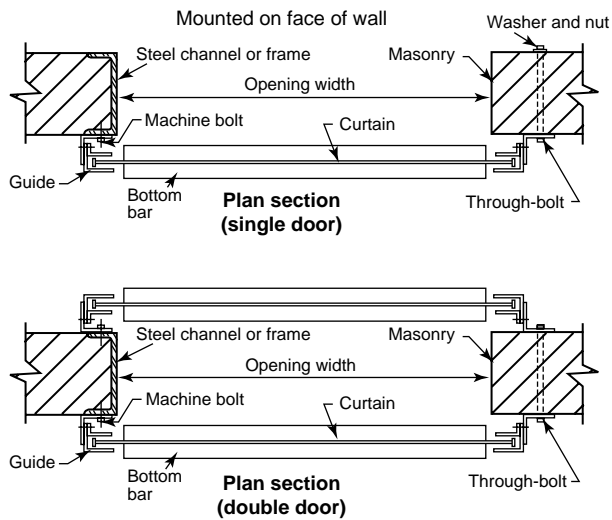
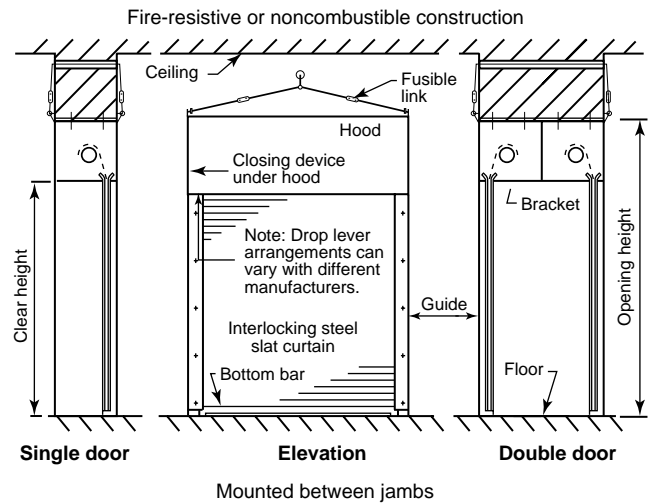
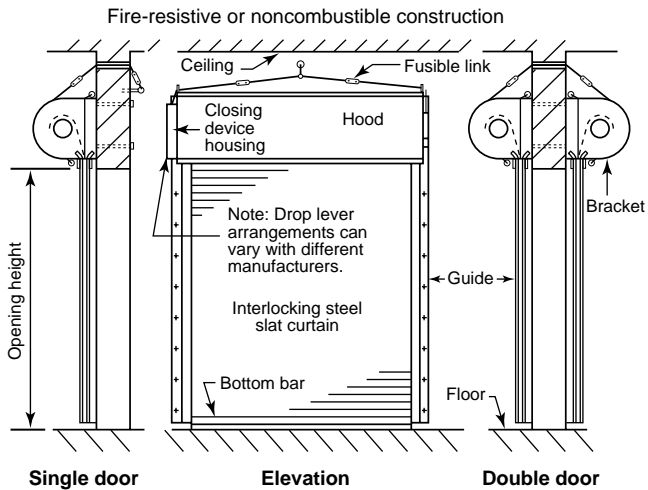
Note: Fusible links are needed on both sides of the wall.

Figure B-46 Closing devices for vertically sliding door.



Note: Fusible links are needed on both sides of the wall.

Figure B-47 Vertically sliding, steel-sectional overhead door.



Note: Fusible links are needed on both sides of the wall.

Figure B-48 Rolling steel doors — surface mounted.

Note: Fusible links are needed on both sides of the wall.

Figure B-49 Rolling steel doors — between-jamb mounted.

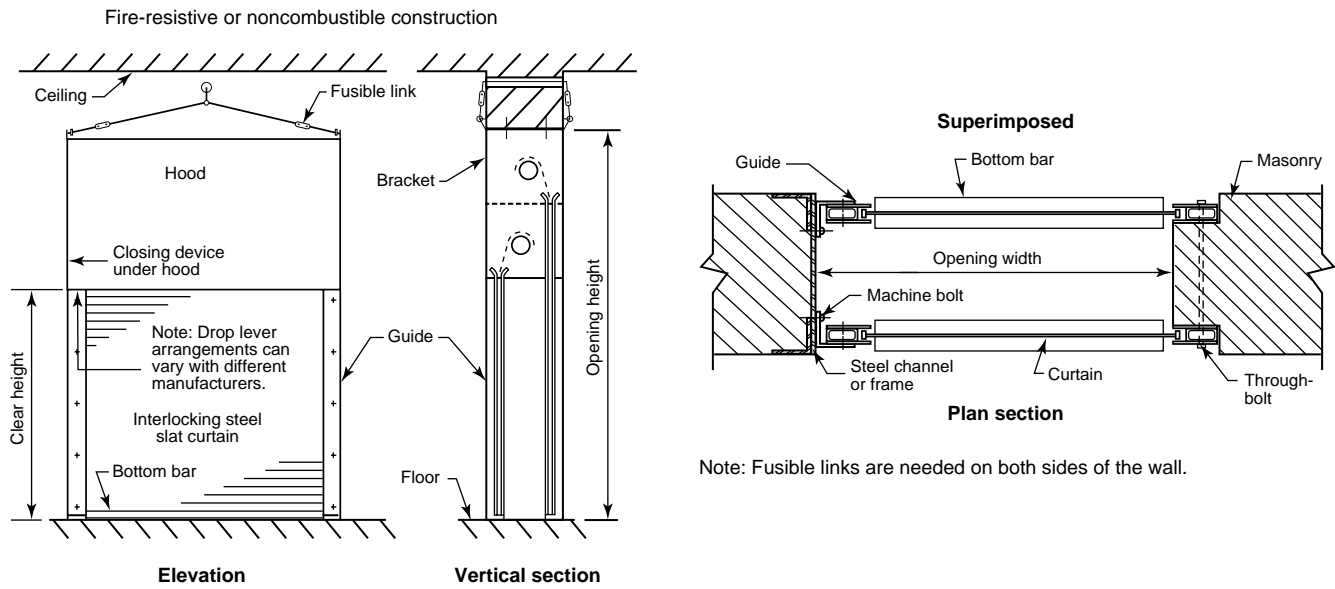


Figure B-50 Rolling steel doors — between-jamb, superimposed mounted.

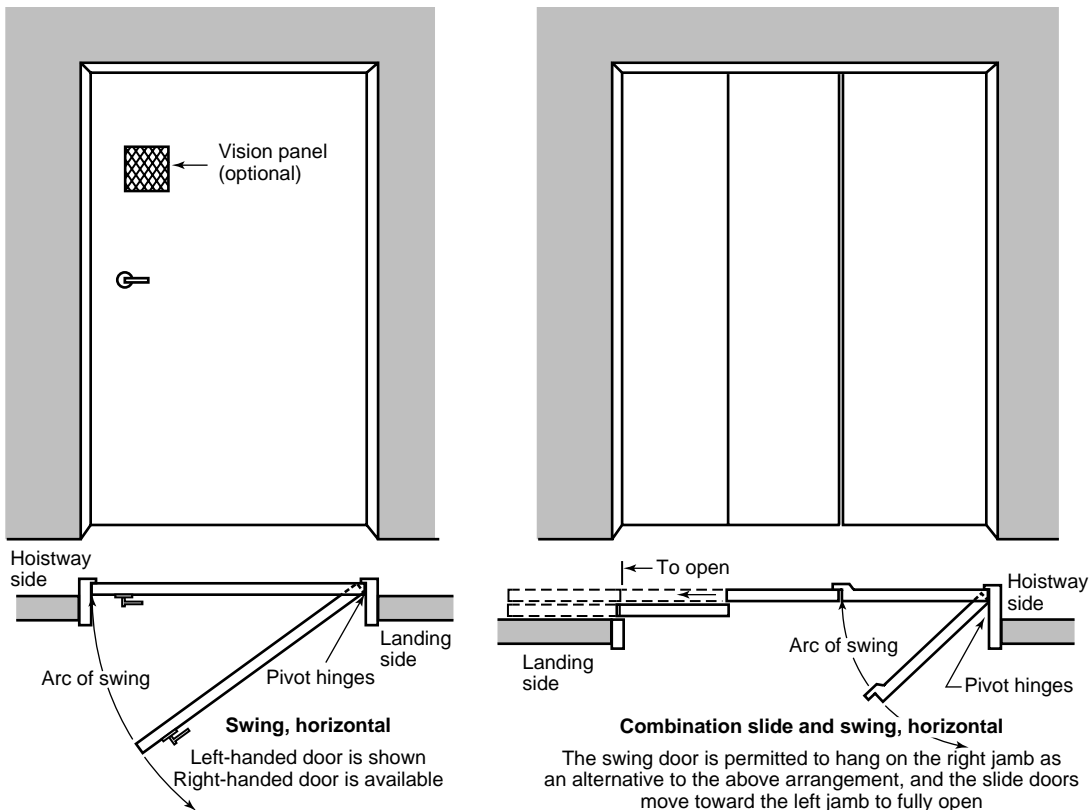


Figure B-51 Horizontal swinging and horizontal combination sliding and swinging doors. (Courtesy of ASME Handbook on A17.1.)

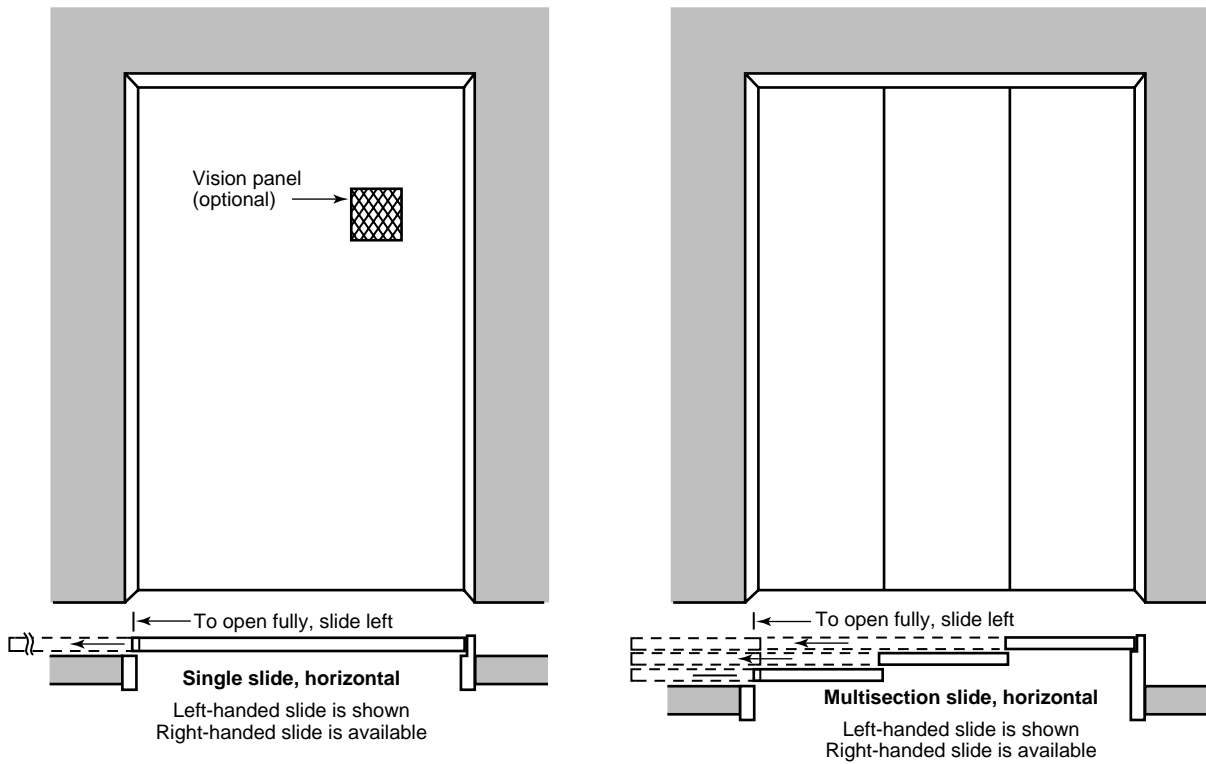


Figure B-52 Horizontal single sliding and horizontal multisection sliding doors. (Courtesy of ASME Handbook on A17.1.)

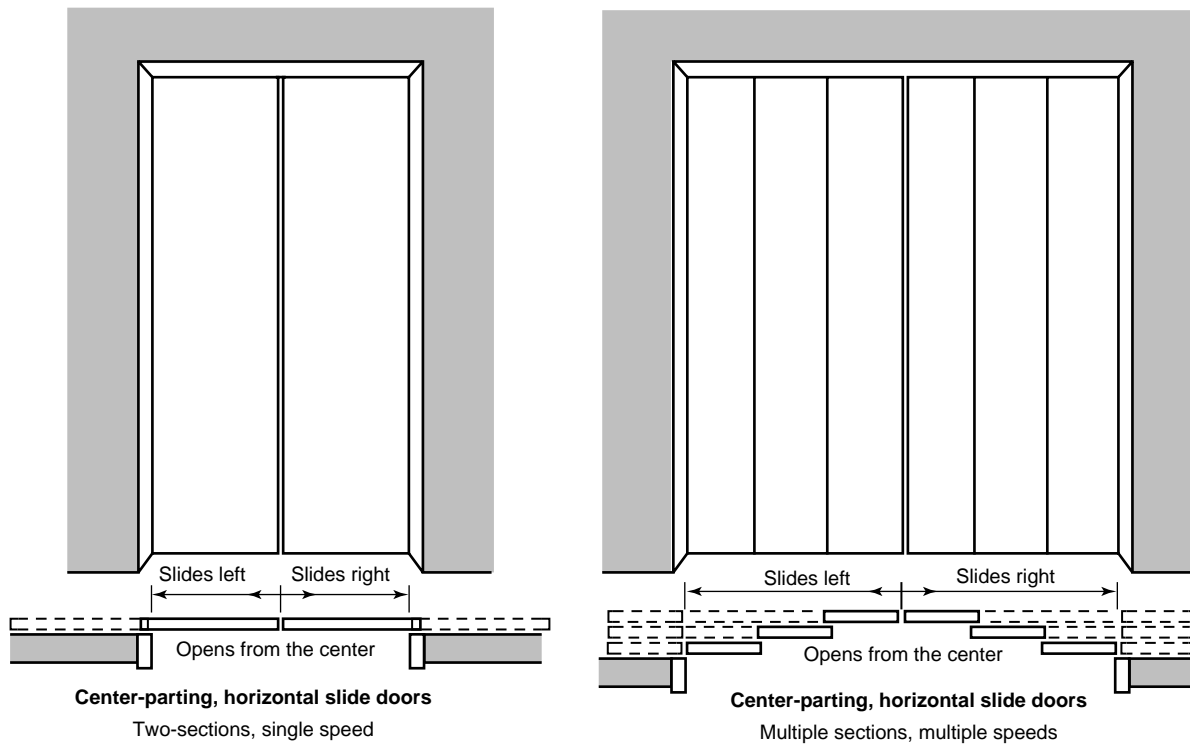


Figure B-53 Center-parting, two section, single speed and multiple sections, multiple speeds horizontally sliding doors. (Courtesy of ASME Handbook on A17.1.)

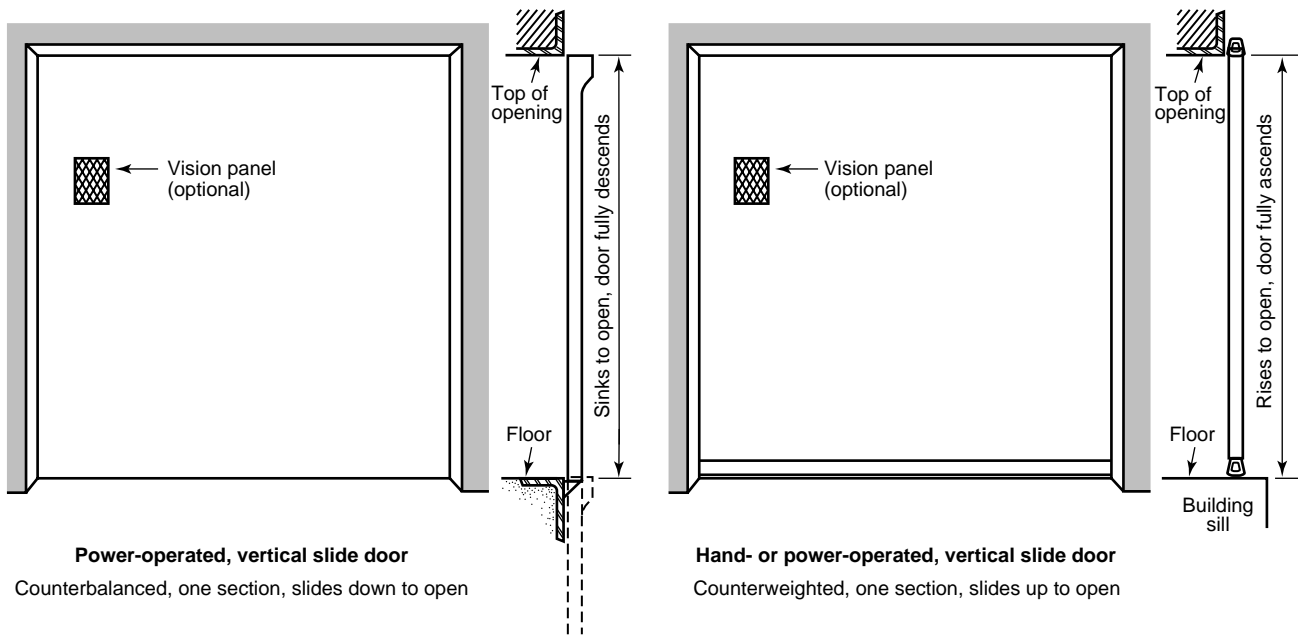


Figure B-54 Power-operated, vertically sliding door and hand- or power-operated, vertically sliding door.
 (Courtesy of ASME Handbook on A17.1.)

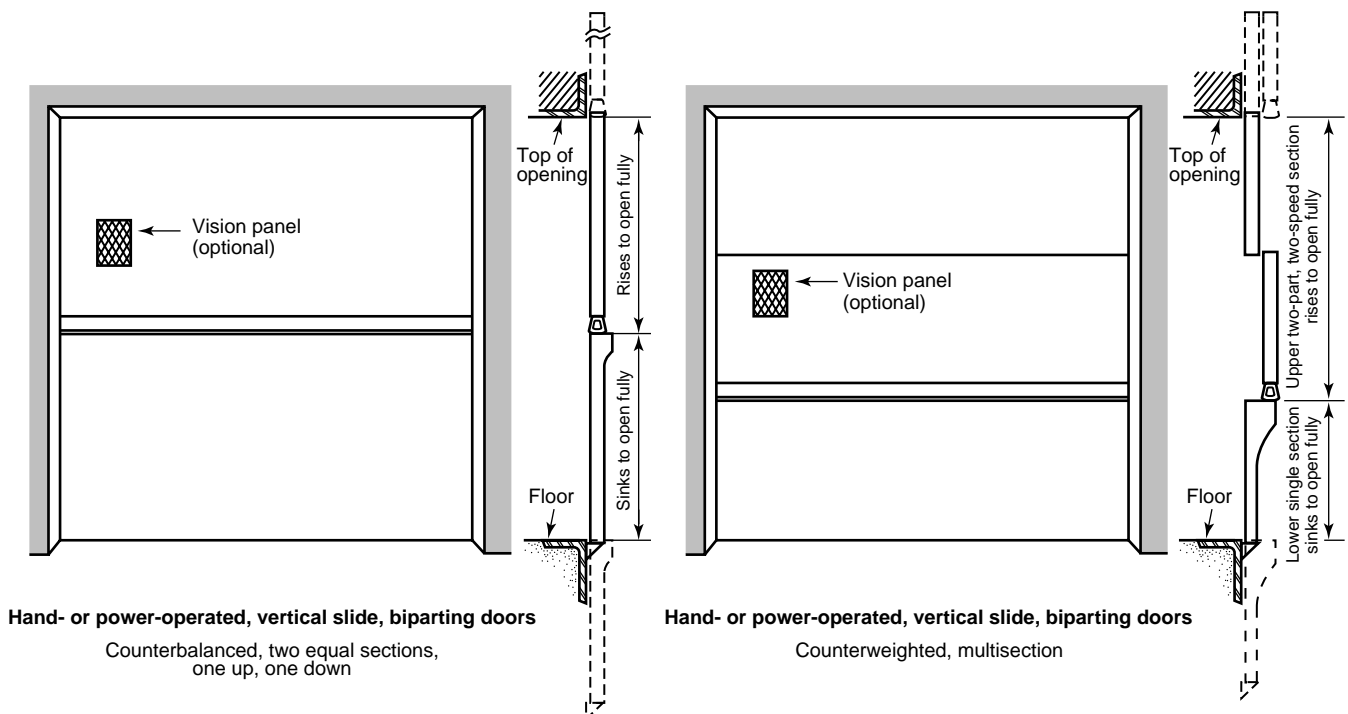


Figure B-55 Hand- or power-operated, vertically sliding, biparting and slide-parting doors. (Courtesy of ASME Handbook on A17.1.)

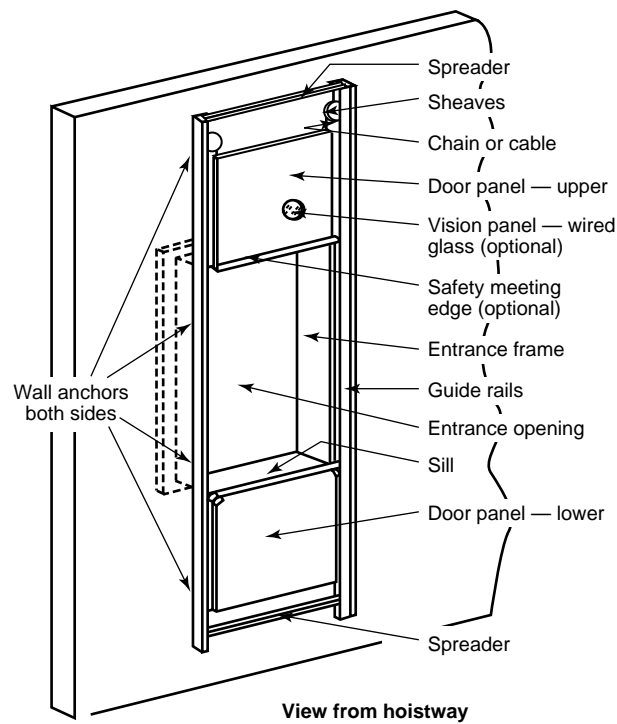


Figure B-56 Dumbwaiter assembly installation for vertically biparting doors.

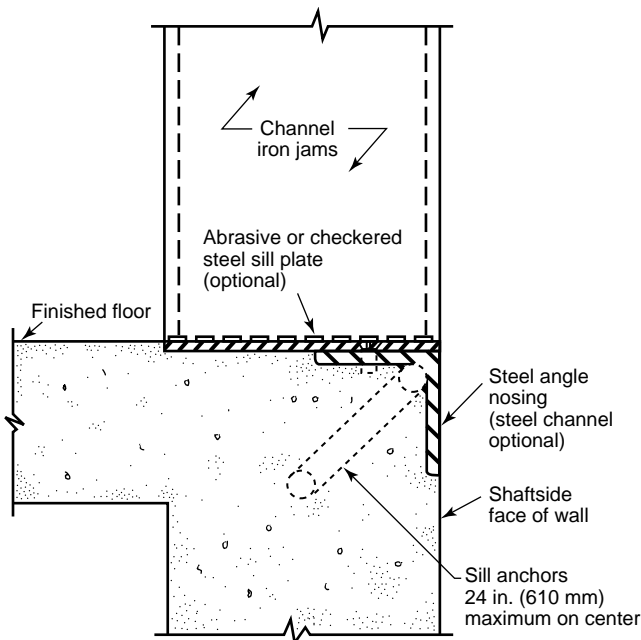


Figure B-57 Sill section showing recommended construction for biparting doors.

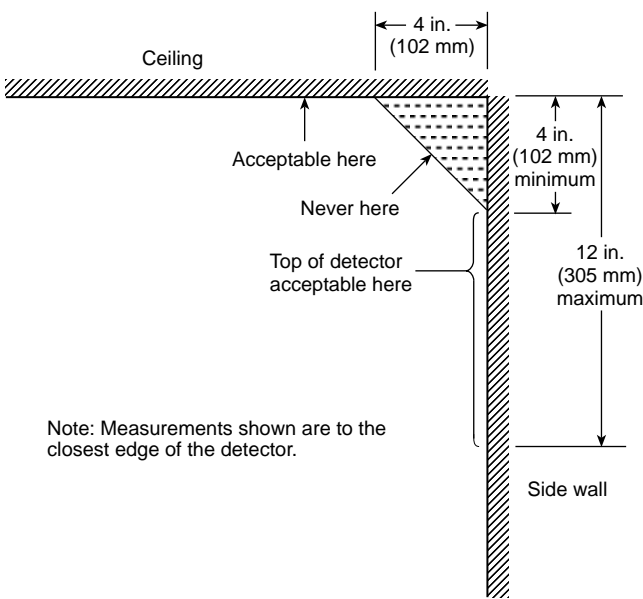


Figure B-58 Example of proper mounting for detectors.

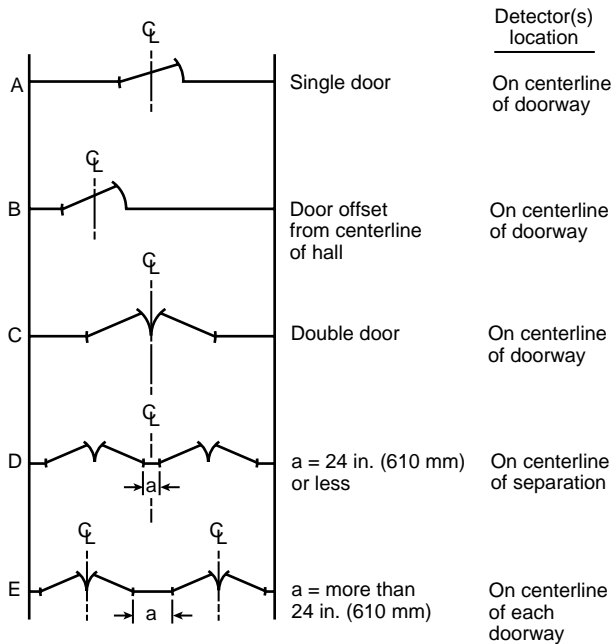


Figure B-59 Detector location.

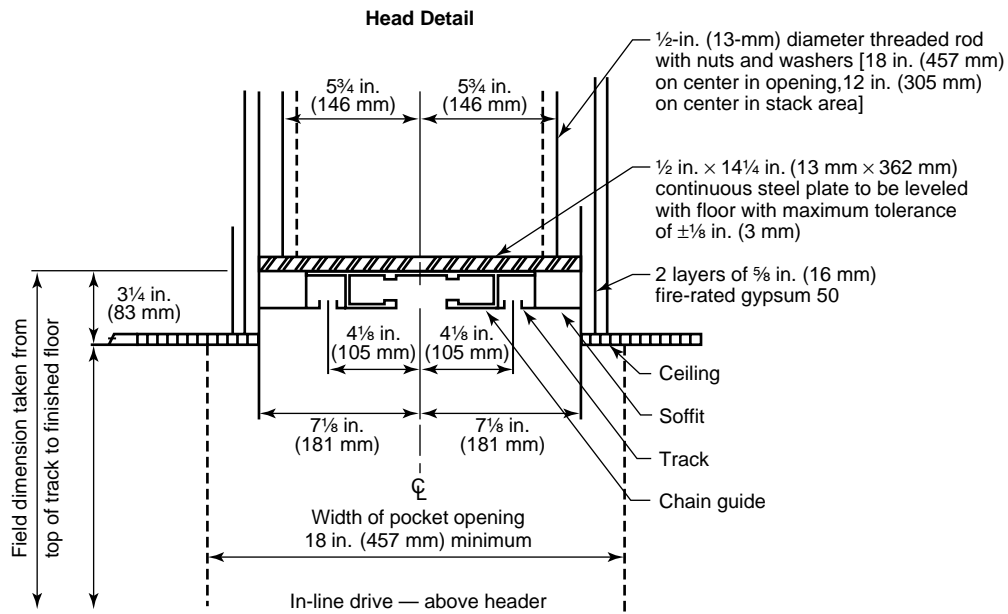


Figure B-60 Typical lintel detail for horizontally sliding accordion or folding door.

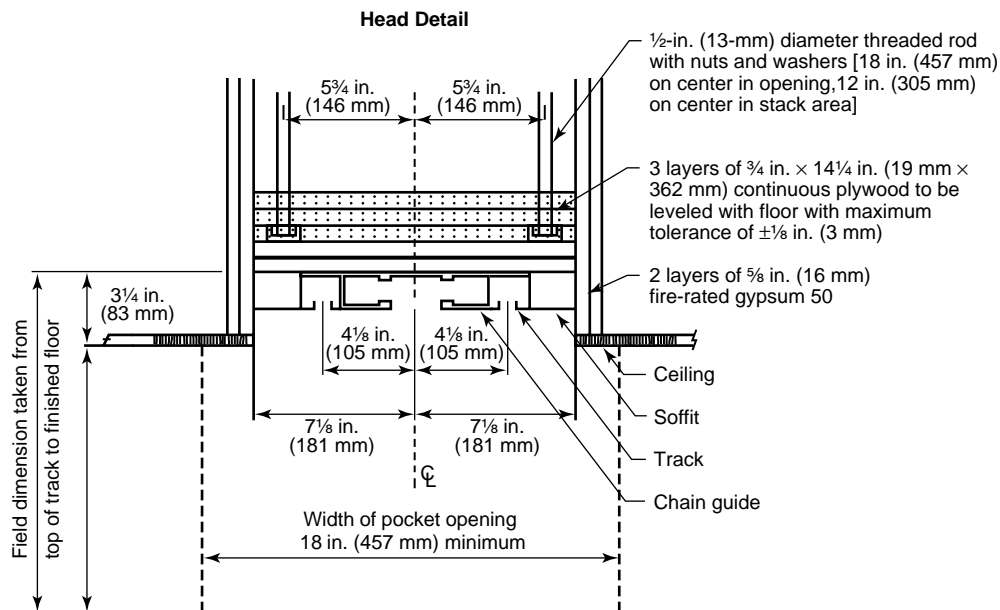


Figure B-61 Typical applied lintel (head) detail for horizontally sliding accordion or folding door.

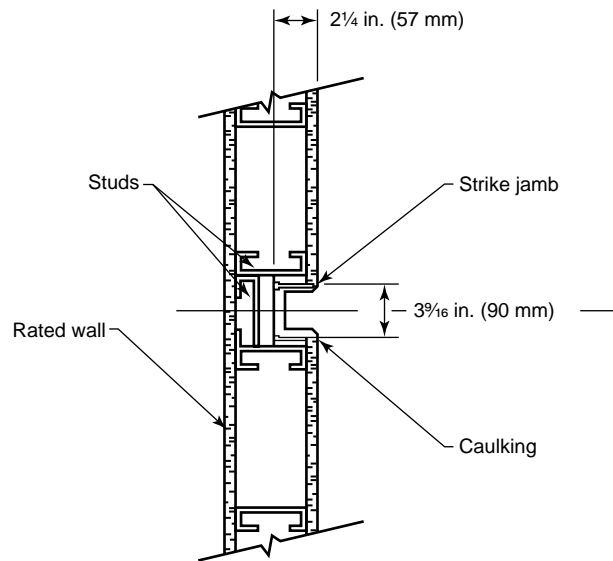


Figure B-62 Typical strike jamb for horizontally sliding accordion or folding door.

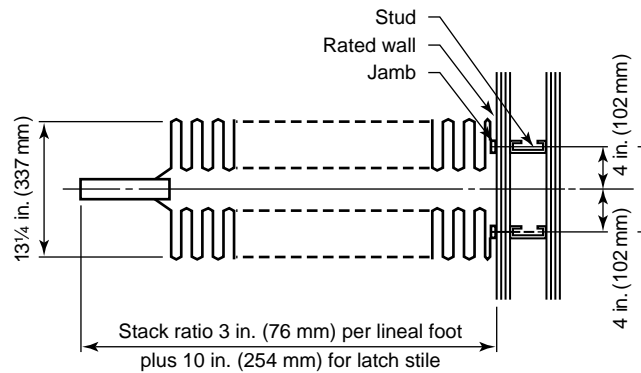


Figure B-63 Typical horizontally sliding accordion or folding door with no pocket.

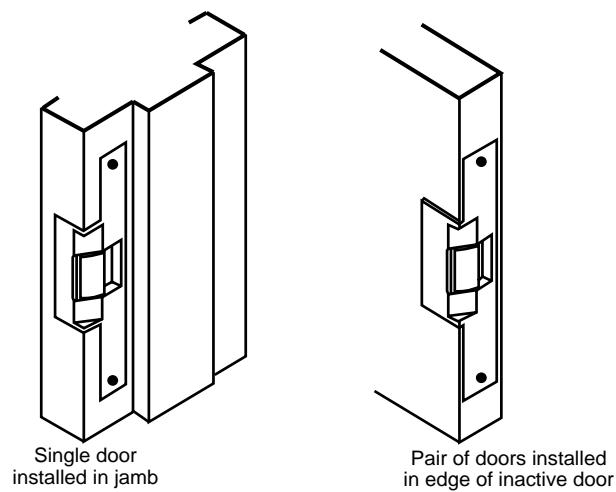


Figure B-64 Typical "electric strike" for single swinging and pair of doors where permitted by individual listings.

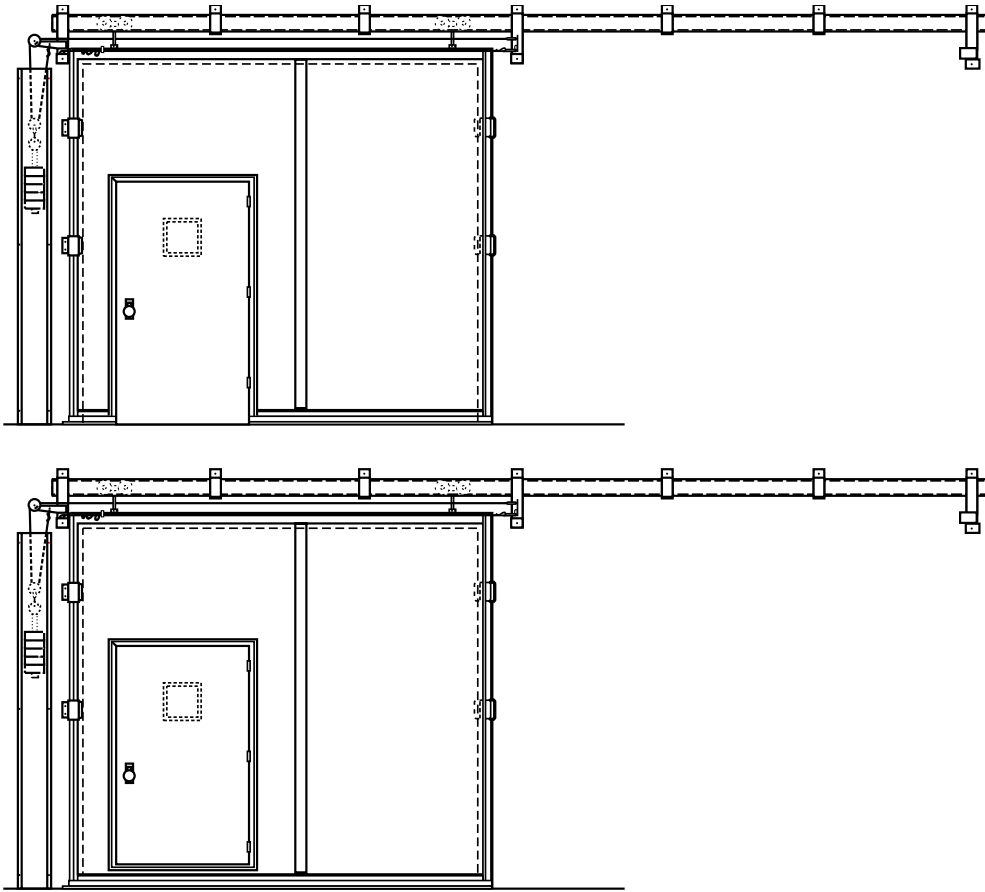


Figure B-65 Combination swinging pass door and sliding door.

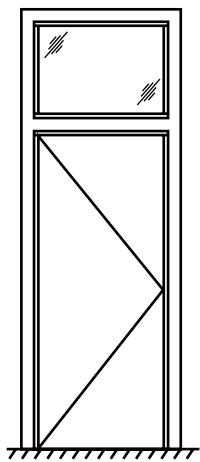


Figure B-66 Transom light frame.

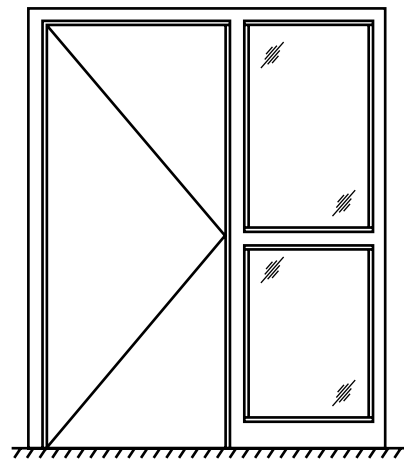


Figure B-67 Side light frame.

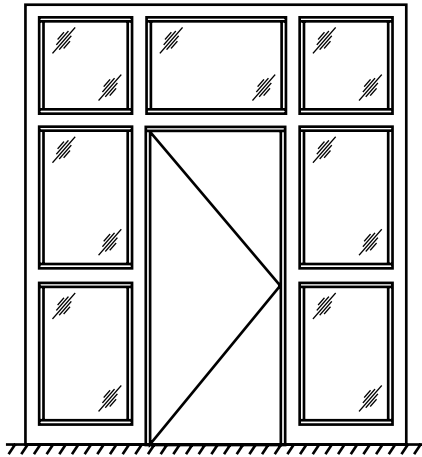


Figure B-68 Transom and side light frame.

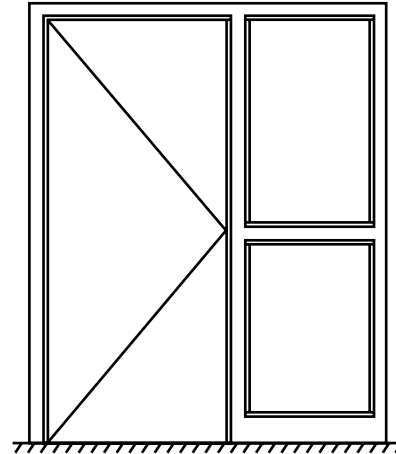


Figure B-71 Side panel frame.

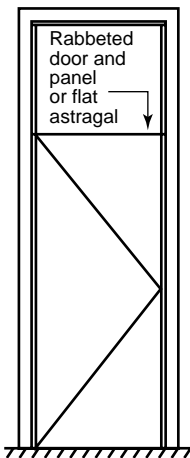


Figure B-69 Transom panel frame.

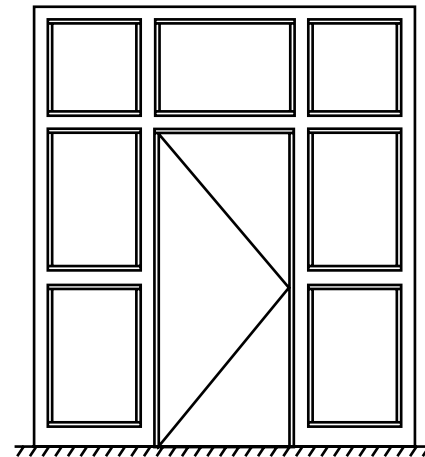


Figure B-72 Transom and side panel frame.

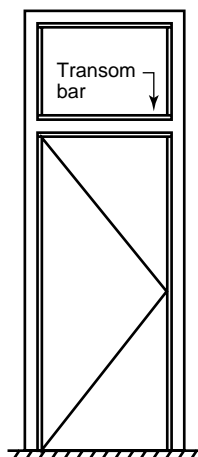


Figure B-70 Transom panel frame.

Appendix C Fire Doors: Protection of Conveyor Openings

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

C-1 Material-handling systems extensively employ conveyors to transport raw materials, components, and finished goods to their destination within the building, and frequently their routes pass through more than one fire division. To correct a misconception that conveyor openings cannot be protected by fire doors, this appendix provides guidance on and illustrations of several methods of engineered fire door applications that have been employed successfully. Ingenuity might suggest other designs. In all cases, the authority having jurisdiction should be consulted for approval.

C-2 Where possible, conveyor penetration of a fire wall should be avoided by rerouting or, as is sometimes feasible with a one-story building, by running the conveyor through the roof, over the fire wall, and down within an inverted "V" housing arranged to vent fire readily to the atmosphere. (See Figure C-1.)

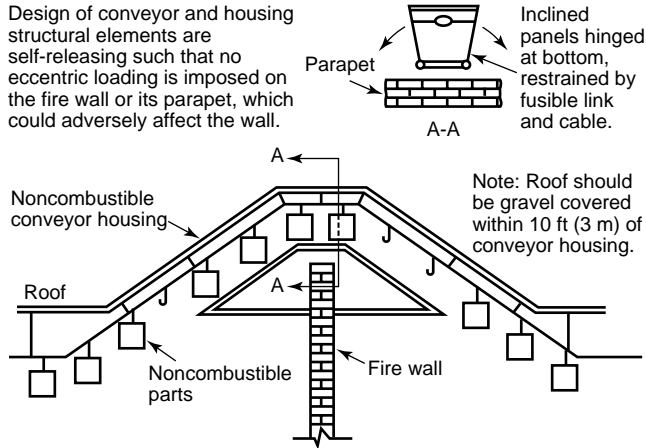


Figure C-1 Conveyor carried over a fire wall.

C-3 Any cutout of a labeled fire door done in the field to allow for closure around a conveyor track or other component voids its label. This practice should be avoided, if possible. Where notching is distinctly advantageous, a certificate can be furnished by the testing laboratory, at the request of the manufacturer, to the manufacturer, the property owner, and the enforcing authority, provided that inspection indicates that the notched door is in compliance with the laboratory standards in all other respects.

C-4 Figures C-2 through C-6 illustrate various conveyor designs, programming devices, or combinations thereof, that minimize or eliminate the threat of obstruction to complete fire door closure by the conveyor or conveyed stock. Labeled doors and hardware should be used for the protection of these openings. If the opening is above floor level and no sill is provided, the door should lap the bottom of the opening by at least 4 in. (102 mm). Special stay rolls and special center guides for doors in pairs would be necessary in such a situation.

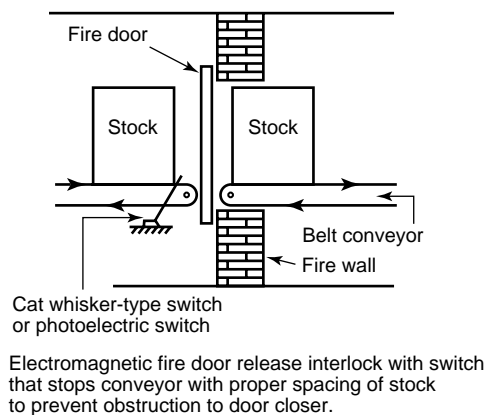


Figure C-2 Protection of opening where belt conveyor can be interrupted.

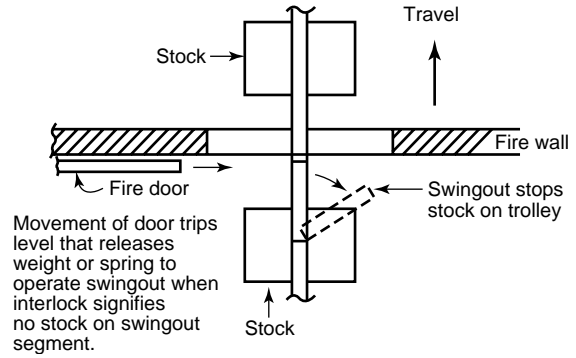


Figure C-3 Protection of opening for gravity overhead trolley.

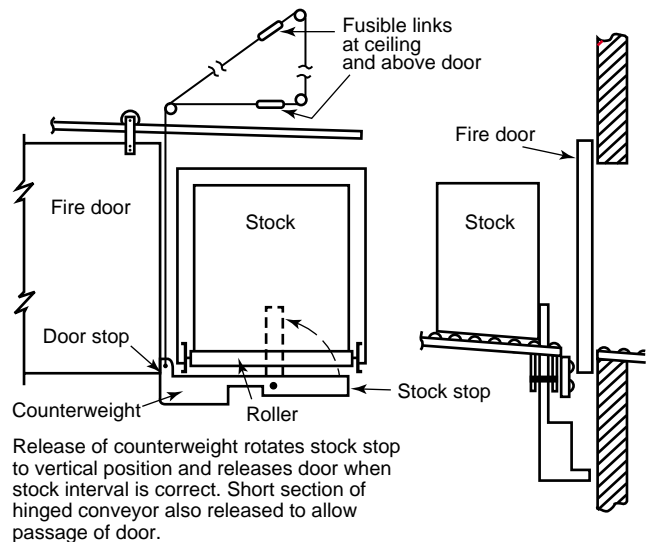


Figure C-4 Method of stopping stock on a gravity roller conveyor.

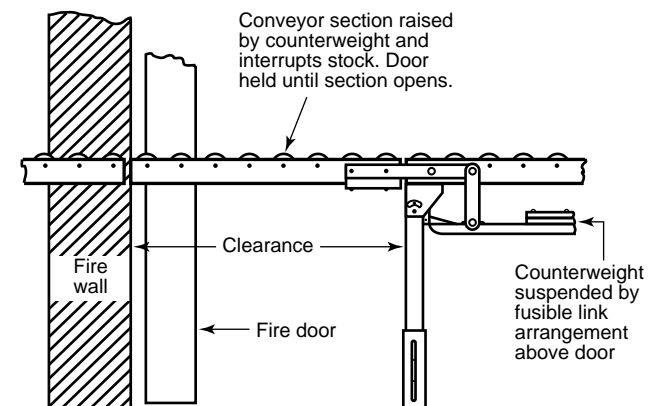


Figure C-5 Counterweight-hinged section of roller conveyor.

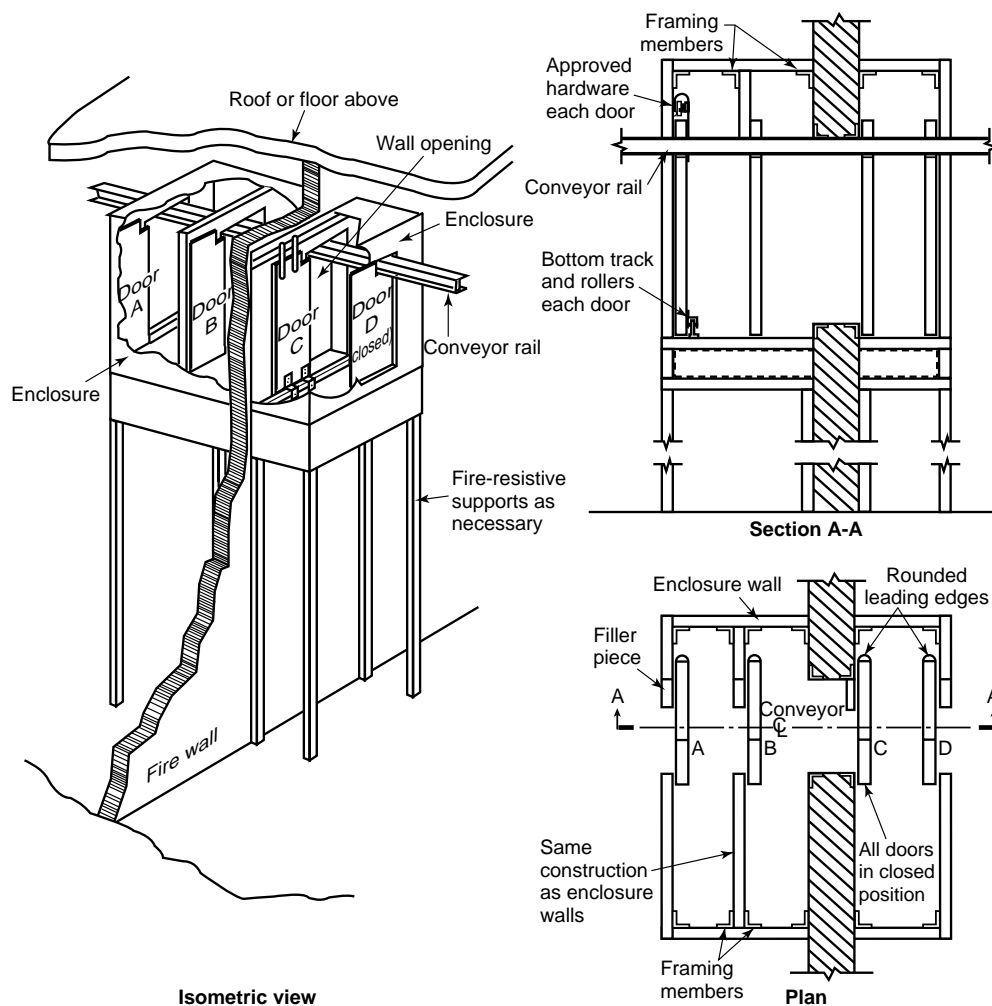


Figure C-6 Door pack installation.

C-5 Figures C-1 through C-6 illustrate only the basic concepts. Proper performance depends equally on conservative design, good workmanship in installation, the operating inspection, and maintenance. Section C-6 outlines a number of important criteria that should be incorporated in planning the suggested arrangements or modifications or in using other concepts developed for specific applications.

C-6 Parameters for Operation and Design.

C-6.1 The selected design should be as simple and direct in operation as possible and should provide reliable performance. Emphasis should be on fail-safe operation.

C-6.2 The sequence of operating steps and interlock should be programmed such that obstruction (e.g., conveyor, conveyed material) to the door closure is positively and permanently (until manually reset) removed from the door's path before the door is released to close.

C-6.3 Structural and mechanical design of items, such as components, linkages, and clearances, should be conservative. Counterweights, springs, and other operating forces (uninterruptable by initial fire stages) should have an ample reserve of strength to handle overload introduced by a reasonable anticipated minor change in factors such as the configuration and

weight of conveyed material, normal wear, and friction. Major changes necessitate complete reengineering to ascertain the adequacy of the design with reinforcement as necessary.

C-6.4 The design of conveyor components (e.g., trolley track, chain, supports) that pass through the opening should incorporate self-releasing features.

C-6.5 The clearance between the door and the sill should not exceed $\frac{3}{8}$ in. (9.53 mm).

C-6.6 In some instances, it might be advisable to provide another fire door on the opposite side of the opening to increase the reliability of the protection of the wall opening in the event of a fire. Similarly, if the property is sprinklered, consideration should be given to the advisability of reinforcing the protection of the opening by a water curtain of automatic sprinklers.

C-6.7 Following installation, a number of operating tests should be conducted to reflect the range of adverse conditions that should be anticipated in order to ascertain that all components operate smoothly, in proper sequence, within a specified time interval, and with adequate clearances and tolerances.

C-6.8 It is customary good practice to close all fire doors during inoperative periods, and it is even more important in the case of these specialized arrangements. Routine closure should simulate emergency operation, which then results in a regular inspection of the continued adequacy of the protection of the opening.

Appendix D Illustration of Types of Fire Window Components

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

D-1 Figure D-1 illustrates the various installation arrangements for fire windows.

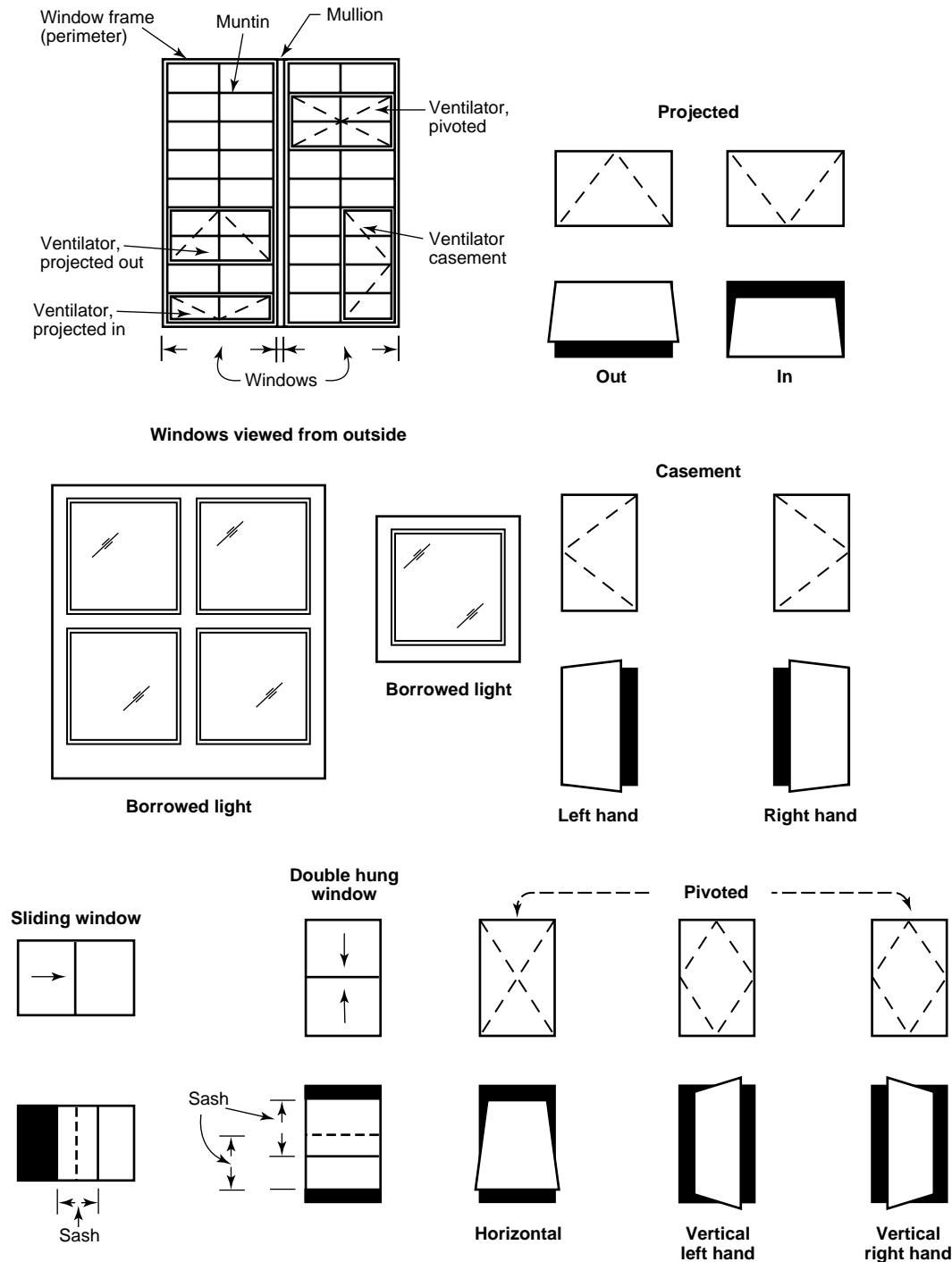


Figure D-1 Types of fire window components.

Appendix E Fire Door and Fire Window Classifications

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

E-1 New and existing fire doors are classified by one of the following designation systems:

- (a) Hourly rating designation
- (b) Alphabetical letter designation
- (c) A combination of both (a) and (b)
- (d) For horizontal access doors, a special listing indicating the fire-rated floor or floor-ceiling or roof-ceiling assemblies for which the door may be permitted to be used

E-2 The hourly designation indicates the duration of the fire test exposure and is known as the fire protection rating. Fire protection ratings of fire doors meeting this standard should be as determined and reported by a testing agency in accordance with NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*. (See ASTM E 152, *Standard Methods of Fire Tests of Door Assemblies*; UL 10B, *Standard for Safety Fire Tests of Door Assemblies*; and ULC-S104, *Standard Method for Fire Test of Door Assemblies*.)

E-3 The alphabetical letter designation was one method employed to classify the opening for which the fire door is considered suitable. Traditionally, the relationship between the alphabetical designation and its use was as follows:

- (a) Class A — Openings in fire walls and in walls that divide a single building into fire areas
- (b) Class B — Openings in enclosures of vertical communications through buildings and in 2-hour rated partitions providing horizontal fire separations
- (c) Class C — Openings in walls or partitions between rooms and corridors having a fire resistance rating of 1 hour or less
- (d) Class D — Openings in exterior walls subject to severe fire exposure from outside of the building
- (e) Class E — Openings in exterior walls subject to moderate or light fire exposure from outside of the building

E-4 Special listings are provided for horizontal access doors that are installed in fire-rated floors or floor-ceiling or roof-ceiling assemblies that have been tested in accordance with the methods described in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*. The listing indicates the fire-rated assembly and the hourly rating (3 hours, 2 hours, 1½ hours, 1 hour, ¾ hour, or ½ hour) for which the door may be permitted to be used so that access to the space above the ceiling or to the floor above can be provided without adversely affecting the fire resistance rating of the entire assembly. The listing provides limitations on the maximum size of an individual door opening and the total area of all door openings permitted for each 100 ft² (9.3 m²) of floor or ceiling.

E-5 One-half-hour (30-minute) and ⅓-hour (20-minute) fire doors are for use where smoke control is a primary consideration and are for the protection of openings in partitions between a habitable room and a corridor where the wall is constructed to have a fire resistance rating of not more than 1 hour or across corridors where a smoke partition is required.

E-6 Labels attached to each door provide evidence that the size of the door and the exposed glass area are permitted under this standard. In addition, where the temperature rise is

shown, it indicates the temperature increase above ambient that has developed on the unexposed face of the door at the end of 30 minutes of exposure to the standard fire test. If the temperature rise is not indicated, the rise for the door is in excess of 650°F (343°C). The temperature rise through the glazing material used for glass lights is not measured.

E-7 Where fire doors are used in stairway enclosures, such doors should be constructed so that the maximum transmitted temperature end point should not exceed 450°F (232°C) above ambient at the end of 30 minutes of the standard fire exposure test.

E-8 Fire windows are classified by an hourly rating designation.

E-9 Fire windows generally are considered suitable for protecting window openings in corridors, smoke barriers, or room partitions inside buildings, or in exterior walls for exterior exposures where such partitions or walls are required to have a fire resistance rating by the authority having jurisdiction. Generally, such fire resistance ratings are not greater than 1 hour for interior partitions. However, exterior walls can have fire resistance ratings as high as 4 hours.

E-10 The hourly designation indicates the duration of the fire test exposure and is known as the fire protection rating. Fire protection ratings of windows meeting this standard should be as determined and reported by a testing agency in accordance with NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*. (See ASTM E 163, *Standard Methods of Fire Tests of Window Assemblies*; UL 9, *Standard for Safety Fire Tests of Window Assemblies*; and ULC-S106, *Standard Method for Fire Test of Window and Glass Block Assemblies*.)

E-11 Assemblies constructed with fire-resistant glazing materials that have been tested as fire-resistive walls or partitions in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, are not considered fire windows. However, they may be permitted to be used in applications where fire windows are required, since they exceed the fire performance criteria for fire windows having a fire protection rating of the same duration.

Appendix F Surface Attachments to Swinging Door Faces

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

F-1 Surface attachments to swinging door faces generally fall into the following two categories:

- (a) Plant-ons
- (b) Protective plates

F-2 Plant-ons are usually decorative in nature and are used to impart a specific design or style. Plant-ons can be of various designs of flat material or can have a contoured shape, such as molding. Plant-ons project from the face surface of the door and are made of different materials including wood, metals, and plastics. Plant-ons are attached to the door by a variety of methods such as adhesive, screws, nails, or other mechanical means that might penetrate the door face to achieve holding strength. Although there is no limit to the size or frequency of plant-ons on a door, they usually are located at random on one or both sides. The use of plant-ons should not prohibit the installation of small signs indicating the function, use, or location of doors.

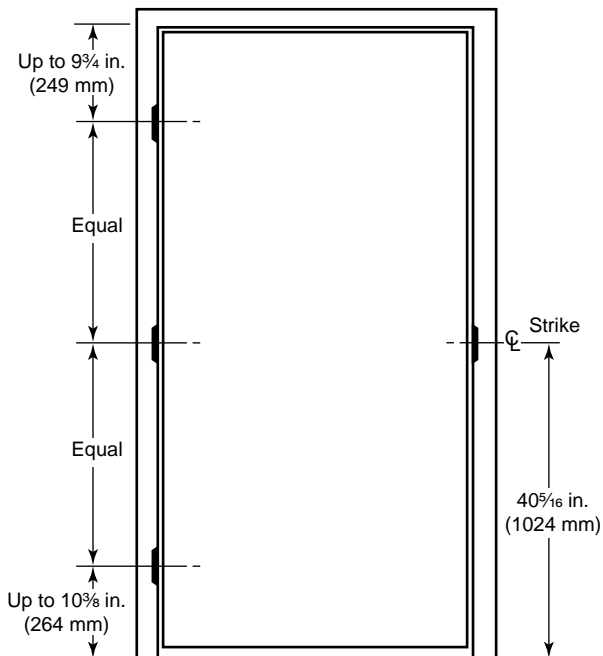
F-3 Protective plates are usually utilitarian in nature and are used to provide additional resistance to wear or impact. Protective plates are usually flat sheets of metal or plastic applied on one or both door faces and located within the lower 16 in. (406 mm) of the door. Plates above this height could affect the fire performance of the door but may be permitted to be used if tested and approved. Attachment of protective plates to the door faces is achieved by a variety of methods such as adhesives, screws, or other mechanical means that might penetrate the door face to achieve holding strength.

Appendix G Door Hardware Locations

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

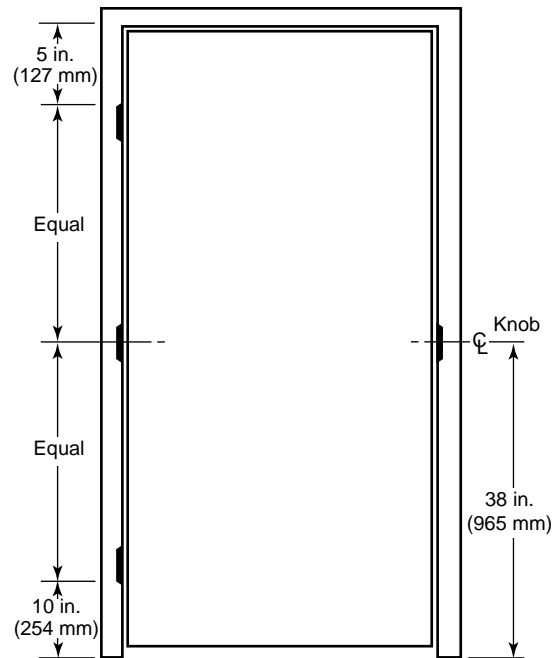
NOTE: Doors not meeting the hardware location standard may be permitted to be labeled if covered in individual listings.

G-1 Figures G-1, G-2, and G-3 represent the locations of hardware on fire doors.



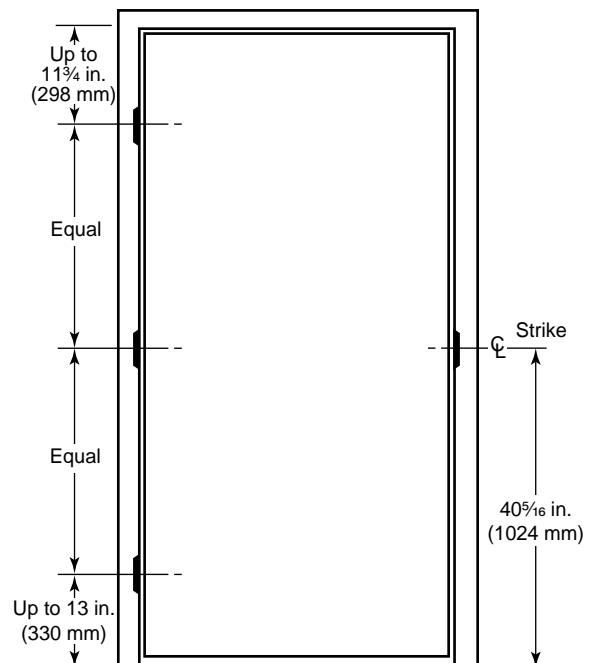
Note: On doors over 7 ft 6 in. (2.3 m), two equally spaced intermediate hinges are required.

Figure G-1 Swinging wood composite fire doors equipped with builders hardware.



Note: On doors over 7 ft 6 in. (2.3 m), two equally spaced intermediate hinges are required.

Figure G-2 Custom steel hollow metal and composite fire doors equipped with builders hardware.



Note: On doors over 7 ft 6 in. (2.3 m), two equally spaced intermediate hinges are required.

Figure G-3 Standard steel hollow metal and composite fire doors equipped with builders hardware.

Appendix H Types of Door Construction

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

H-1 General. The following types of door construction generally are described using the terminology of the industry and testing laboratory classification and are provided for identification of available doors.

H-2 Composite Doors. Composite fire doors consist of wood, steel, or plastic sheets bonded to and supported by a solid core material.

H-3 Hollow Metal Doors. Hollow metal fire doors are of flush or panel design with not less than 20-gauge steel faces. Flush door designs include steel stiffeners or honeycomb core material to support the faces. The voids between stiffeners can be filled with insulating material. Panel door designs are of stile and rail construction with insulated panels.

H-4 Metal Clad (Kalamein) Doors. Metal clad fire doors are of flush or panel design consisting of metal-covered wood cores or stiles and rails and insulated panels covered with steel of 24 gauge or lighter.

H-5 Sheet Metal Doors. Sheet metal fire doors are formed of 22-gauge or lighter steel and are of corrugated, flush sheet, or panel design.

H-6 Rolling Steel Door. A rolling steel fire door consists of a steel curtain that travels using guides and is attached to an overhead barrel. The barrel is enclosed in a hood and is supported by wall-mounted or jamb-mounted brackets. This door type should incorporate an automatic-closing mechanism.

H-7 Tin Clad Doors. Tin clad fire doors are of two- or three-ply wooden core construction, covered with 30-gauge galvanized steel or terne plate [maximum size 14 in. \times 20 in. (0.36 m \times 0.51 m)] or 24-gauge galvanized steel sheets not more than 48 in. (1.22 m) wide. Face sheets shall be vented.

H-8 Curtain-Type Doors. Curtain-type doors consist of interlocking steel blades or a continuous, formed, spring steel curtain installed in a steel frame.

H-9 Wood Core-Type Doors. Wood core-type doors consist of wood, hardboard, or plastic face sheets bonded to a wood block or wood particle board core material with untreated wood edges.

H-10 Special Purpose Doors. See Appendix I.

H-11 Classification of Labeled Door Frames.

H-11.1 Single Unit-Type Door Frame.

H-11.1.1 Aluminum. These frames consist of head and jamb members with or without solid transom panels. These frames might consist of one or more units that might be factory or field assembled. They might be designed for erection before or after walls are built.

H-11.1.2 Pressed Steel. These frames consist of head and jamb members with or without solid or glazed transom panels, glazed side lights, solid side panels, transom bars, mullions, or a combination thereof. These frames might consist of one or more units that might be factory or field assembled. They might be designed for erection before or after walls are built.

H-11.1.3 Steel Channel. These frames consist of head and jamb members of structural steel channels, either shop or

field assembled, that are to be erected before masonry walls are built. The design and construction shall meet the requirements of 2-3.1.

H-11.1.4 Wood. These frames consist of head and jamb members with or without solid transom panels, glazed side lights, and solid side panels. These frames might consist of one or more units that might be factory or field assembled. They might be designed for erection before or after walls are built.

H-11.2 Two Section-Type Door Frame. These frames consist of a rough buck of either pressed steel or steel channels designed to be erected before masonry walls are built or installed in finished masonry wall openings. The finished head and jamb members are secured to rough bucks.

Appendix I Special Purpose Doors

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

I-1 Acoustical fire doors and frame assemblies are available in single swings and pairs and are furnished complete with sound seals. These doors are tested in accordance with the standard fire test of door assemblies and also with the ASTM E 90, *Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions*, test for airborne sound transmission loss with an STC rating determined by the procedures in ASTM E 413, *Classification for Rating Sound Insulation*.

I-2 Security fire door and frame assemblies are available in two types of security applications. There is an institutional type for use in prisons and other building types where a high degree of security is needed. A commercial type is used primarily to protect the rear entrances of commercial establishments, interior secure areas, electric-generating stations, data processing centers and security control areas of office buildings, and other building types where a lower degree of security is needed. Security doors are available with bullet-resistant capabilities. These doors are tested in accordance with the standard fire test of door assemblies and additionally might be tested in accordance with UL 752, *Standard for Safety Bullet-Resisting Equipment*, which specifies bullet-resistant ratings for medium power small arms, high power small arms, super power small arms, and high power rifles. Hardware is provided with the door assembly in the case of doors tested in accordance with UL 752.

I-3 Armored attack-resistant fire doors and frame assemblies are available in single swing design. These doors are tested in accordance with the standard fire test of door assemblies. This special type of security door assembly also has ballistic resistance, including resistance to small arms multiple impact threat, armor piercing, and projectiles, and is resistant to attack by tools that can impact the door.

I-4 Radiation-shielding fire doors and frame assemblies are available in single swing and pairs. These doors are tested in accordance with the standard fire test of door assemblies. Doors and frames are lined with lead and are designed to provide shielding against specific types and intensities of radiation.

I-5 Pressure-resistant fire door and frame assemblies are available in single swing and pairs. These doors are tested in accordance with the standard fire test of door assemblies. These doors also are designed to resist blasts from explosions, wind forces, and pressure differences between spaces.

Appendix J Radiant Heat Transfer

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

J-1 Fire windows were originally designed for protecting openings in exterior walls. In such applications, radiant heat transfer was not a significant consideration, since the main function of fire windows was to contain the flames within the building. However, where fire windows are used in interior partitions as borrowed lights and side lights, the user of this standard might need to consider radiant heat transfer during fire. Exiting through corridors and past fire windows could be compromised, and combustible materials on the unexposed side of fire windows could be ignited. The information that follows is a guide to the evaluation of radiant heat transfer through fire windows.

Recent revisions to this standard have permitted very large areas of fire protection-rated glazing materials to be used in interior partitions, limited only by the size of the test furnace. Also, recent technological advances in the glazing industry have compounded the problem of radiant heat transfer by making it possible to provide glazing materials with fire protection ratings of 60 minutes and 90 minutes. Historically, fire windows including glass block have been limited to a 45-minute rating by the standard fire test, NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*. This time limit was predicated on the failure of wired glass at approximately 1600°F (870°C). [1] Some European manufacturers also have developed fire-resistant glazing assemblies that meet the requirements of a fire resistant-rated wall assembly (currently up to 2 hours). These glazing materials, however, do not transmit excessive radiant heat, since they are required to limit the temperature rise on the unexposed face to 250°F (121°C).

Since the present fire test standard, NFPA 257, does not require measuring and reporting temperature rise on the unexposed face of the glazing material or radiant heat transmission, glazing products tested to this standard have not been required to retard heat transfer. However, this data is required in many European fire test standards. [2] As a result, European building codes place limitations on the use of glazing in fire-resistant partitions inside buildings and require the use of insulating glazing in means of egress as well as where combustibles could be in close proximity. Research by Margaret Law, Bsc., Ministry of Technology and Fire Offices Committee, Joint Fire Research Organization, led to the development of such limitations in the *British Building Code*. [3,4] This research provides a methodology for calculating safe distances from wired glass windows used to screen room fires from adjacent spaces.

Mrs. Law's research properly identifies two major concerns for the use of fire protection-rated glazing in interior partitions as follows:

- (a) The impact on occupants exiting past the glazing
- (b) The potential for nonpiloted (auto)ignition of combustibles on the unexposed side of the glazing

Both of these concerns should be considered by the user of this standard when evaluating a specific fire protection-rated glazing material for interior application.

The exiting concern relates mostly to corridor applications where evacuating occupants might pass directly in front of the glazing that screens them from fire. Calculation methods described in references 1 and 5 can be used to determine the

radiant heat flux generated by a fire as well as the incident heat flux on a person located any distance beyond the unexposed face of the glazing. Safe distances for evacuees then can be determined from Figures 3-11.39 and 3-11.40 of the *SFPE Handbook of Fire Protection Engineering*, which provide data useful in estimating the time to reach pain threshold and the time taken for thermal radiation to burn skin. [5]

Traditional glazing materials have been prohibited from being used in fire windows in exit stair enclosures because of the concern of radiant heat transfer. Recently, the model building codes also incorporated requirements for limiting the temperature rise on the unexposed face of fire doors opening into exit stair enclosures in order to address the problem of heat transfer (both conducted and re-radiated) that could expose evacuating occupants passing doors at each floor landing. Therefore, caution should be exercised when considering glazing materials with fire protection ratings of 60 minutes or more in such applications, since they can transmit excessive radiant heat into the exit stair enclosure. However, glazing materials with fire resistance ratings are suitable in such situations, since they have been tested to limit heat transfer.

Addressing the problem of the nonpiloted (auto)ignition of combustibles stored near a fire window demands an understanding of critical irradiation levels. Incident flux levels for autoignition of various combustible materials have been developed. [3,6] Average values of 30 kW/m² to 35 kW/m² normally are used for ordinary (cellulosic) combustibles. Lower values have been identified for some synthetic materials.

The radiant intensity (heat flux) of the exposing fire depends, among other factors, on the type of materials burning (rate of heat release) and the ventilation rate of the enclosing room. For well-ventilated fires in light hazard occupancies, such as offices, schools, institutions, and residences, a peak radiation intensity (output) of 85 kW/m² has been used by Mrs. Law to represent a 1-hour fire exposure. [3] Nelson provides a method for determining safe separation distances based on the radiant heat flux incident on a combustible material screened by wired glass (with a transmissivity of 0.5) from a fire (with an emissivity of 1.0) (blackbody). [6] In general, a fully developed compartment fire is viewed as a blackbody and, therefore, is assigned an emissivity of 1.0. To determine the radiation intensity, the following formula can be used:

$$I = e\sigma T^4$$

where:

I = radiation intensity (kW/m²)

e = emissivity

σ = Stefan-Boltzman constant

$$= 5.67 \times 10^{-11} \text{ kW/m}^2 - ^\circ\text{K}^4$$

T = absolute temperature of the fire (°K)

For most situations, the temperature of the compartment fire is the only unknown variable. NFPA 72, *National Fire Alarm Code*®, provides some guidance for calculating room temperature based on different fire growth rates. Other methods base the temperature on the standard temperature-time curve used in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*. In a fully developed compartment fire assumed to have a temperature of 1600°F (870°C or 1140°K), the radiant heat flux would be approximately 105 kW/m².

To determine the incident radiant heat flux on the unexposed side of the glazing, the following formula can be used:

$$I_i = FtI$$

where:

I_i = incident radiation intensity (kW/m²)

F = configuration factor for the glazed opening

t = transmissivity of the glazing material

I = radiation intensity of the fire (kW/m²)

Transmissivity of 1/4-in. (6.35-mm) wired glass has been reported in the range of 0.4 to 0.6. Many analyses have used 0.5 transmissivity to account for the effects of re-radiation by the glazing product. Some manufacturers might be able to provide specific heat transfer information relative to their products.

The user should consider the significance of the source radiation, the transmissivity of the glazing material, the time of exposure, the separation distances, and the configuration of the glazed opening in relation to the target.

Continuing with the earlier example of a fire having a temperature of 1600°F (870°C), the incident radiant heat flux (I_i) for a window opening having a configuration factor of 0.35 in relation to a combustible target would be approximately 18.4 kW/m². The footnote documents provide detailed guidance for this analysis.

J-2 References.

1. National Fire Protection Association, *Fire Protection Handbook*, 18th ed., "Protection of Openings," pp. 7-86 to 7-90.
2. ISO 3009-1976/A1-1984, *Fire Resistance Tests — Glazed Elements*, International Organization for Standardization, 1976.
3. Law, Margaret, "Safe Distances from Wired Glass Screening a Fire," *The Institution of Fire Engineers Quarterly*, London, 1969.
4. Law, Margaret, "Heat Radiation from Fires and Building Separation," *Fire Research Technical Paper No. 5*, London, 1963.
5. Society of Fire Protection Engineers, *SFPE Handbook of Fire Protection Engineering*, 2nd ed., "Thermal Radiation Hazards," pp. 3-236 to 3-237, 1988.
6. Nelson, Harold E., "Radiant Energy Transfer in Fire Protection Engineering Problem Solving," *Fire Technology*, Vol. 4, No. 3, pp. 196-205, August 1968.

Appendix K Referenced Publications

K-1 The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not considered part of the requirements of this standard unless also listed in Chapter 16. The edition indicated here for each reference is the current edition as of the date of the NFPA issuance of this standard.

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

NFPA 72, *National Fire Alarm Code*®, 1996 edition.

NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, 1996 edition.

NFPA 101®, *Life Safety Code*®, 1997 edition.

NFPA 105, *Recommended Practice for the Installation of Smoke-Control Door Assemblies*, 1999 edition.

NFPA 220, *Standard on Types of Building Construction*, 1995 edition.

NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, 1995 edition.

NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, 1995 edition.

NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*, 1996 edition.

SFPE Handbook of Fire Protection Engineering, 2nd edition, 1995.

K-1.2 Other Publications.

K-1.2.1 ANSI Publication. American National Standards Institute, Inc., 11 West 42nd Street, 13th floor, New York, NY 10036.

ANSI Z97.1, *Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings*, 1984.

K-1.2.2 ASME Publication. American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

ASME Handbook on A17.1, *Safety Code for Elevators and Escalators*, Edward A. Donoghue, Editor, 1993.

K-1.2.3 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 90, *Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions*, 1990.

ASTM E 152, *Standard Methods of Fire Tests of Door Assemblies*, 1981.

ASTM E 163, *Standard Methods of Fire Tests of Window Assemblies*, 1984.

ASTM E 413, *Classification for Rating Sound Insulation*, 1987.

K-1.2.4 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 9, *Standard for Safety Fire Tests of Window Assemblies*, 1994.

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

UL 752, *Standard for Safety Bullet-Resisting Equipment*, 1991.

K-1.2.5 ULC Publications. Underwriters Laboratories of Canada, 7 Crouse Road, Scarborough, Ontario M1R 3A9.

ULC-S104-M80, *Standard Method for Fire Test of Door Assemblies*, 1980.

ULC-S106-M80, *Standard Method for Fire Test of Window and Glass Block Assemblies*, 1980.

K-1.2.6 U.S. Government Publication. U.S. Government Printing Office, Washington, DC 20402.

Title 16, *Code of Federal Regulations*, Part 1201, "Standard for Architectural Glazing," January 6, 1977.

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