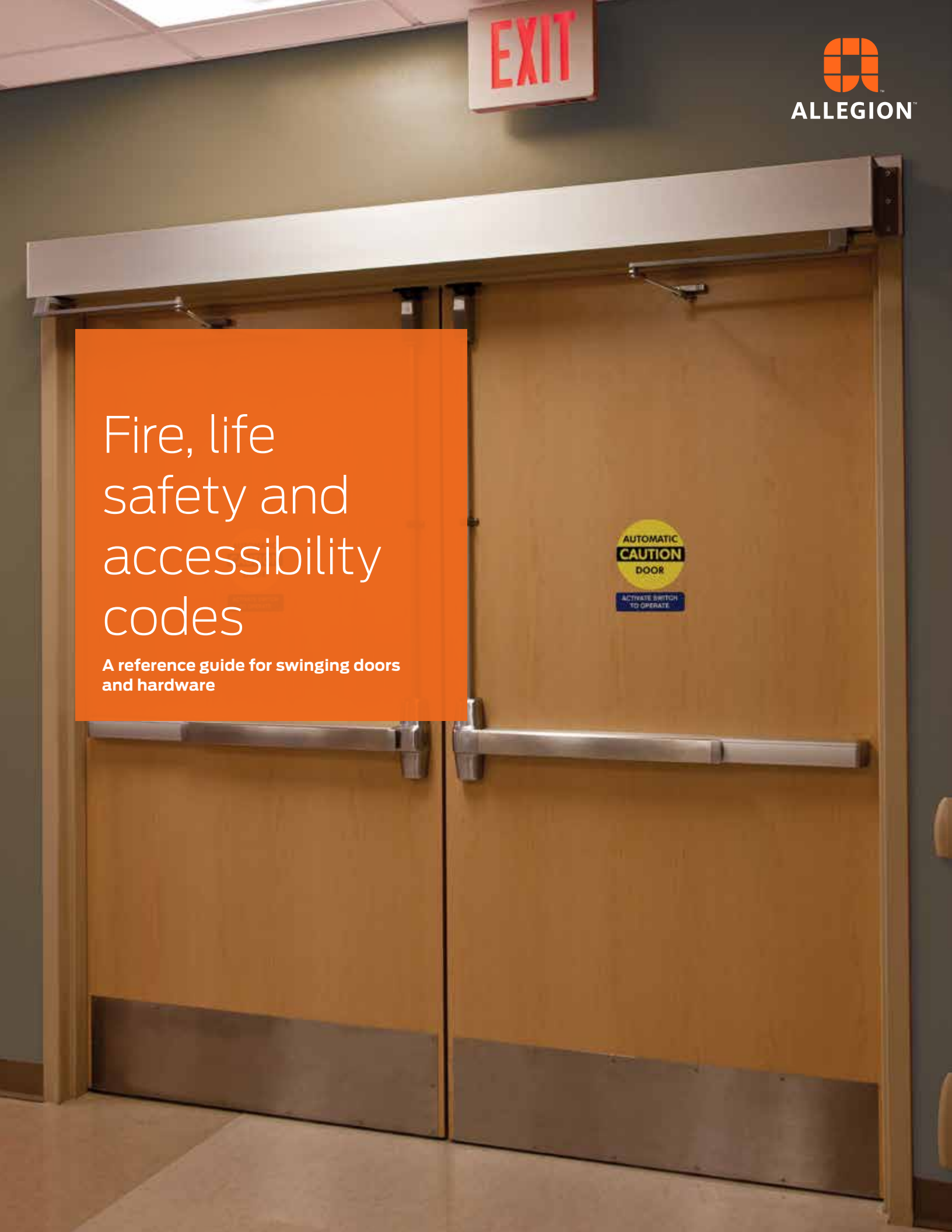


ALLEGION™

Fire, life safety and accessibility codes

A reference guide for swinging doors and hardware

More than a century ago, Von Duprin introduced the first exit device to improve building safety and prevent senseless deaths.

Facility managers are still challenged with the inherent conflict of maintaining a secure building while providing safe emergency egress. Understanding complex fire codes, changing building uses and ADA laws can be difficult, yet is critical to life safety. No one understands these issues like Allegion. Our network of Security and Safety Consultant℠ offices and security centers throughout the world provide needs assessments and offer code-compliant integrated solutions. These include biometric, electronic and mechanical security, as well as software network integration, all designed to ensure your building is safe and secure.

To find out more about Allegion life safety solutions, visit www.allegion.com/us or call 1.877.671.7011, to contact one of our security and safety consultants.

You can trace Von Duprin's genesis to the early 1900s when hundreds of people lost their lives in burning buildings. Carl Prinzler, a salesman for Vonnegut Hardware in Indianapolis, Indiana, felt "something MUST be done." Working with his friend Henry Dupont and using the resources of Vonnegut Hardware, Carl Prinzler introduced the Von Duprin "Self-Releasing Fire and Panic Exit Device."

Since that time, many innovations and building code changes have been successful in reducing senseless deaths, but there have been recent reminders there is more work to be done. Today, Allegion remains an active participant in the process for development of model building and life safety codes. We are strong advocates of the principle of balanced construction, providing life safety through the application of both passive and active fire protection features.

The material enclosed within this guide is intended as a resource and educational piece for those who have chosen a profession of improving the safety and well being of others. Whether you are an architect, fire or building code official, specifier, supplier, or building owner, we hope this guide is a valuable resource to help you understand the inherent complexity when providing a secure building with safe egress.

If, after reviewing this guide, you would like more assistance, please feel free to contact one of our local security and safety consultants who can answer your questions. In addition to answering your code questions, our consultants offer site assessments, on-site training programs and specification services to help you untangle the issues of complying with accessibility requirements and providing adequate building security, while meeting ever changing fire and life safety codes. No one understands these issues like Allegion.

iDigHardware.com

Get answers to your door, hardware and code questions and join the conversation.

Learn about:

- Fire, life safety, accessibility, and building code compliance related to door openings
- Door hardware applications and security solutions, including "creative" installations
- Historic and current events and how they shape today's code requirements
- How to get assistance and training from our network of hardware consultants

Table of contents

Sources for code information

There is more information about many of the topics covered in this publication on our website – iDigHardware.com. You can also submit a specific question from that site by pressing the Help button.

ADA - Americans With Disabilities Act
www.ada.gov

ANSI - American National Standards Institute
www.ansi.org

BHMA - Builders Hardware Manufacturers Association
www.buildershardware.com

Building Code Forum / Doors & Hardware
www.thebuildingcodeforum.com/forum

CCBFC - Canadian Commission on Building and Fire Codes
www.nationalcodes.ca

ICC - International Code Council
www.iccsafe.org

NFPA - National Fire Protection Association
www.nfpa.org

UL - Underwriters Laboratories Inc.
www.ul.com

Warnock Hersey / Intertek Testing Services
www.intertek.com

How to use this resource

We have compiled the following information as a resource on fire, life safety, and accessibility codes as related to swinging doors and hardware. This information is for reference only and is based on our interpretation of the codes. It contains some of the highlights of each code. The actual code publications should be consulted when comprehensive data is required and to ensure compliance with the applicable codes.

Accordingly, Allegion and its related companies, subsidiaries, sectors, divisions, and affiliates, and their respective officers, directors, employees, attorneys, agents, successors, and assigns (hereinafter referred to as "Allegion") make no representations or warranties, express or implied, with respect to the information contained in this resource, nor does it assume any obligation or liability for any advice given by Allegion arising out of or related to this resource.

To use this guide, you must first determine which code has been adopted in your project's location. Your local Security and Safety Consultant℠ offices can provide you with a list of codes in your area. In some cases, there may be more than one code in use for a particular area and sometimes the code requirements differ. In this case, it is safest to follow the most stringent requirement or consult your code officials, as local codes may be more stringent than state or national codes. As always, the Authority Having Jurisdiction (AHJ) has the final say.

Once you have determined which code you want to reference, go to the page(s) in this resource that contain information relative to that code publication. Other things to consider are:

(1) the occupancy classification or use group

(2) occupant load

(3) whether the door in question is a required egress door, a fire door and/or on an accessible route.

The information included in this resource is from past and present publications of each code or standard as of this date. You may need to refer to other editions of the code publications for more information. For your use in referencing the actual code publications, the various sources for purchasing the codes and standards are included at the end of this guide and references to the applicable section numbers are included throughout this resource.

In the last section of this book you will find in-depth code information on topics that we are most often asked about, including panic hardware, door closers, fire doors, and doors with access control / electrified hardware. When you are referring to these articles, you must keep in mind which code is in use for the location in question, as all of the information may not apply to your specific situation. For an additional resource to get answers to your door, hardware and code questions visit iDigHardware.com.

For code questions or to request more copies of this resource, contact your local security and safety consultants.

Classification of occupancy and hazard of contents

As described by *NFPA 101®* - *Life Safety Code®* 2015 Edition

Classification of occupancy (6.1)

The occupancy of a building or structure, or portion of a building or structure, shall be classified as one of the following:

Assembly

An occupancy (1) used for a gathering of 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting transportation, or similar uses; or (2) used as a special amusement building, regardless of occupant load.

Assembly occupancies include the following:

- Armories
- Assembly halls
- Auditoriums
- Bowling lanes
- Club rooms
- College and university classrooms, 50 persons and over
- Conference rooms
- Courtrooms
- Dance halls
- Drinking establishments
- Exhibition halls
- Gymnasiums
- Libraries
- Mortuary chapels
- Motion picture theaters
- Museums
- Passenger stations and terminals of air, surface, underground and marine public transportation facilities
- Places of religious worship
- Pool rooms
- Recreation piers
- Restaurants
- Skating rinks
- Special amusement buildings, regardless of occupant load
- Theaters

Occupancy of any room or space for assembly purposes by fewer than 50 persons in another occupancy and incidental to such other occupancy should be classified as part of the other occupancy and should be subject to the provisions applicable thereto.

Educational

An occupancy used for educational purposes through the twelfth grade by six or more persons for four or more hours per day or more than twelve hours per week.

Educational occupancies include the following:

- Academies
- Kindergartens
- Schools

Other occupancies associated with educational institutions shall be in accordance with the appropriate parts of this code.

In cases where instruction is incidental to some other occupancy, the section of the code governing such other occupancy shall apply.

Day-care

An occupancy in which four or more clients receive care, maintenance and supervision, by other than their relatives or legal guardians for less than 24 hours per day.

Day-care occupancies include the following:

- Adult day-care occupancies, except where part of a health care occupancy
- Child day-care occupancies
- Day-care homes
- Kindergarten classes that are incidental to a child day-care occupancy
- Nursery schools

Health care

An occupancy used to provide medical or other treatment or care simultaneously to four or more patients on an inpatient basis, where such patients are mostly incapable of self-preservation due to age, physical or mental disability or because of security measures not under the occupants' control.

Health care occupancies include the following:

- Hospitals
- Limited care facilities
- Nursing homes

Ambulatory health care

An occupancy used to provide services or treatment simultaneously to four or more patients that provides, on an outpatient basis, one or more of the following:

1) Treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

2) Anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

3) Emergency or urgent care for patients who, due to the nature of their injury or illness are incapable of taking action for self-preservation under emergency conditions without the assistance of others.

Detention and correctional

An occupancy used to house one or more persons under varied degrees of restraint or security where such occupants are mostly incapable of self-preservation because of security measures not under the occupants' control. Within detention and correctional facilities, uses other than residential housing shall be in accordance with the appropriate chapter of the code.

Detention and correctional occupancies include the following:

- Adult and juvenile substance abuse centers
- Adult and juvenile work camps
- Adult community residential centers
- Adult correctional institutions
- Adult local detention facilities
- Juvenile community residential centers
- Juvenile detention facilities
- Juvenile training schools

Residential

An occupancy that provides sleeping accommodations for purposes other than health care or detention and correctional.

Residential occupancies are treated separately in the code in the following groups:

- One-and two-family dwelling units
- Lodging or rooming houses
- Hotels and dormitories
- Apartment buildings

Residential board and care

An occupancy that is used for lodging and boarding of four or more residents, not related by blood or marriage to the owners or operators, for the purpose of providing personal care services.

Mercantile

An occupancy used for the display and sale of merchandise.

Mercantile occupancies include the following:

- Auction rooms
- Department stores
- Drugstores
- Restaurants with fewer than 50 persons
- Shopping centers
- Supermarkets

Business

An occupancy used for the transaction of business other than mercantile.

Business occupancies include the following:

- Air traffic control towers (ATCTs)
- City halls
- College and university instructional buildings, classrooms under 50 persons and instructional laboratories
- Courthouses
- Dentists' offices
- Doctors' offices
- General offices
- Outpatient clinics (ambulatory)
- Town halls

Industrial

An occupancy in which products are manufactured or in which processing, assembling, mixing, packaging, finishing or decorating or repair operations are conducted.

Industrial occupancies include the following:
- Dry cleaning plants
- Factories of all kinds
- Food processing plants
- Gas plants
- Hangars (for servicing/maintenance)
- Laundries
- Power plants
- Pumping stations
- Refineries
- Sawmills
- Telephone exchanges

Storage
An occupancy used primarily for the storage or sheltering of goods, merchandise, products or vehicles.

Storage occupancies include the following:
- Barns
- Bulk oil storage
- Cold storage
- Freight terminals
- Grain elevators
- Hangars (for storage only)
- Parking structures
- Truck and marine terminals
- Warehouses

Multiple occupancies
A building or structure in which two or more classes of occupancy exist.

A mixed occupancy is a multiple occupancy where the occupancies are intermingled. The building shall comply with the most restrictive requirements of the occupancies involved, unless separate safeguards are approved.

A separated occupancy is a multiple occupancy where the occupancies are separated by fire resistance-rated assemblies.

Hazard of contents (6.2)

Hazard of contents of any building or structure shall be classified as one of the following:

Low hazard
Contents are of such low combustibility that no self-propagating fire therein can occur.

Ordinary hazard
Contents are likely to burn with moderate rapidity or to give off a considerable volume of smoke.

High hazard
Contents are likely to burn with extreme rapidity or from which explosions are likely.

Highlights of the ICC International Building Code®[1] (IBC)

Notes: In this code reference guide, "fire protection system" means an approved sprinkler system, approved fire alarm system or both. Numbers in brackets ( ) refer to applicable sections of the code publication.

The use groups for the International Building Code (IBC) include the following (consult the code for complete descriptions):

A – Assembly
B – Business
E – Educational
F – Factory
H – High-hazard
I – Institutional
M – Mercantile
R – Residential
S – Storage
U – Utility and miscellaneous

Doors (2015: 1010.1; 2012 and prior: 1008.1)

- Section applies to means of egress doors and additional doors provided for egress
- Must be readily distinguishable from surrounding finishes and easily recognizable as doors
- No mirrors or reflective materials on egress doors
- No curtains or decorations concealing egress doors

Size of doors (2015: 1010.1.1; 2012 and prior: 1008.1.1)

- Minimum clear width 32 inches (813 mm) and sufficient for occupant load
- Measured between the face of the door and the stop on the frame, with door open 90 degrees
- At least one leaf of pairs of doors must provide 32 inches (813 mm) clear width
- Maximum width of a swinging door – 48 inches (1219 mm) nominal
- Egress doors in I-2 occupancies used for movement of beds – minimum of 41 ½ inches (1054 mm) clear width
- Minimum height – 80 inches (2032 mm), or 78 inches (1980 mm) to door closers and stops
- Consult code for exceptions

Projections Into clear width (2015: 1010.1.1.1; 2012 and prior: 1008.1.1.1)

- No projections into required clear width lower than 34 inches (864 mm) above the floor or ground
- Projections into clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) – not more than four inches (102 mm)
- Door closers and door stops – 78 inches (1980 mm) minimum above the floor

Door swing (2015: 1010.1.2; 2012 and prior: 1008.1.2)

- Typically, egress doors must be swinging doors hung on pivots or hinges – consult code for exceptions
- Doors must swing in the direction of egress when serving a room with an occupant load of 50 or more or a group H occupancy (any load)

Door opening force (2015: 1010.1.3; 2012, 2009: 1008.1.3; 2006, 2003: 1008.1.2)

- Interior swinging egress doors other than fire doors – maximum opening force five pounds (22 N)
- Other swinging doors and sliding/folding doors:
  - Latch must release with 15 pound (67 N) force, maximum
  - Door set in motion with 30 pound (133 N) force, maximum
  - Door swings to a full-open position with 15-pound (67 N) force, maximum
- Forces applied at latch side of door

Power operated doors (2015: 1010.1.4.2; 2012, 2009: 1008.1.4.2; 2006, 2003: 1008.1.3.2)

- In power failure, egress doors must be capable of being opened manually, or closed where necessary to safeguard means of egress
- Forces to operate manually must not exceed those specified in "Door opening force" section, except the force to set the door in motion must not exceed 50 pounds and door must swing to full width of opening

[1] 2015, 2012, 2009, 2006, and 2003 editions

- Full-power-operated doors must comply with Builders Hardware Manufacturers Association (BHMA) A156.10, power-assisted and low-energy operators shall comply with BHMA A156.19
- Consult code for exceptions for group I-3, horizontal sliding doors and bi-parting doors

Thresholds (2015: 1010.1.7; 2012, 2009: 1008.1.7; 2006, 2003: 1008.1.6)

- ½ inch (13 mm) maximum height for doors other than sliding doors in dwelling units
- ¾ inch (19 mm) maximum height for sliding doors in dwelling units
- Changes in height of ¼ inch (6 mm) or less may be vertical
- Changes over ¼ inch (6 mm) must be beveled with a slope of 1:2 maximum

Door operations (2015: 1010.1.9; 2012, 2009: 1008.1.9; 2006, 2003: 1008.1.8)

- Unless otherwise allowed within this section, egress doors must always be openable from the egress side without using a key, special knowledge or effort
- Operating devices on doors required to be accessible shall not require tight grasping, tight pinching or twisting of the wrist to operate
- Door handles, pulls, latches, locks and other operating devices shall be installed 34 inches (864 mm) minimum and 48 inches (1219 mm) maximum above the floor
- Locks used for security purposes and not used for normal operation are permitted at any height
- Locks used on access doors protecting pools, spas and hot tubs can have operable parts up to 54 inches (1370 mm) above the finished floor

Locks and latches (2015: 1010.1.9.3; 2012, 2009: 1008.1.9.3; 2006, 2003: 1008.1.8.3)

- Locks and latches are permitted to prevent operation of doors in the following conditions:
  - places of detention or restraint
  - in group A with an occupant load of 300 or less, groups B, F, M and S, and in churches, the main door may have a key operated lock on the egress side as long as:
    - lock is a type which can be readily distinguishable as locked
    - on or adjacent to the door on the egress side there is a sign (THIS DOOR TO REMAIN UNLOCKED WHEN BUILDING IS OCCUPIED) in 1" (25 mm) high letters on a contrasting background
    - use of key-operated locking device may be revoked by the building official for due cause
- Where automatic flush bolts are used, the door leaf equipped with automatic flush bolts must not have a door knob or surface mounted hardware and the unlatching of any leaf must not require more than one operation
- In group R, egress doors from individual dwelling units or sleeping units having an occupant load of 10 or less may have a night latch, dead bolt or security chain - devices must be openable from the inside without the use of a key or tool
- On fire doors where the elevated temperature has disabled the unlatching device in accordance with the listed fire test procedures (ex.: less-bottom-rod fire exit hardware or other hardware that incorporates a fusible link)

Bolt locks (flush and surface bolts) (2015: 1010.1.9.4; 2012, 2009: 1008.1.9.4; 2006, 2003: 1008.1.8.4)

- Manually operated flush bolts and surface bolts are not permitted anywhere other than the following:
  - doors not required for egress in individual sleeping/ dwelling units
  - on a pair of doors serving a storage or mechanical room
  - on a pair of doors in a group B, F, or S occupancy, that serves fewer than 50 occupants, where the inactive leaf has no surface trim such as knobs, levers, panic bars, or similar hardware
  - on a pair of doors in a group B, F, or S occupancy, that serves any number of occupants if building has an approved fire sprinkler system and the inactive leaf has no surface trim such as knobs, levers, panic bars or similar hardware and is not required for egress width.
  - on a pair of doors serving patient rooms in group I-2 occupancy when the inactive leaf is not required for egress width – self-latching bolts are acceptable (not manual flush bolts)

Unlatching (2015: 1010.1.9.5; 2012, 2009: 1008.1.9.5; 2006, 2003: 1008.1.8.5)

Any egress door leaf shall be able to be unlatched with one operation

- Exceptions:
  - places of detention or restraint
  - where manual bolts are permitted by section on "Bolt locks"
  - doors with automatic flush bolts
  - doors from individual dwelling units and guest rooms in group R occupancies as permitted by section on "Locks and latches"

Controlled egress doors in groups I-1 and I-2 (2015: 1010.1.9.6; 2012, 2009: 1008.1.9.6; 2006, 2003: n/a)

- Approved controlled egress locks may be used in group I-1 and I-2 occupancies where necessary for patients' clinical needs
- Building must be equipped throughout with an automatic sprinkler or automatic smoke or heat detection system
- Doors must unlock upon actuation of the fire alarm or sprinkler system (not applicable to psychiatric facilities)
- Doors must unlock upon loss of power to the lock (not applicable to psychiatric facilities)
- Locks must be able to be unlocked by a signal from the fire command center, nurses station or other approved location (not applicable to psychiatric facilities)
- Occupant must not encounter more than one door with a special egress lock before entering an exit (not applicable to psychiatric facilities)
- The emergency plan (see chapter 4 of the International Fire Code) contains procedures for the operation of the unlocking system
- All clinical staff has keys, codes or other means to operate the locks
- Emergency lighting must be provided at the door
- Door locking system must be listed in accordance with UL 294.

Delayed egress locks (2015: 1010.1.9.7; 2012, 2009: 1008.1.9.7; 2006, 2003: 1008.1.8.6)

- Approved, listed or delayed egress locks may be used in any occupancy except group A, E and H, in buildings equipped throughout with an automatic sprinkler or automatic smoke or heat detection system, as long as all of the following requirements are met:
  - There is no delay upon actuation of the fire alarm or sprinkler system
  - There is no delay upon loss of power to the lock
  - Lock has the capability of being unlocked manually by a signal from the fire command center
  - Lock allows egress within 15 seconds (or 30 seconds when approved by AHJ) when a force of 15 pounds (67 N) maximum is applied for three seconds. Prior to the 2015 edition, activation time was 1 second, maximum.
  - Lock may only be rearmed manually
  - Initiation of cycle shall activate audible alarm in vicinity of door
  - Sign meeting the visual character requirements in ICC A117.1, mounted on the door within 12 inches (305 mm) of the release device states: "Push [pull] until alarm sounds. Doors can be opened in 15 [30] seconds." Refer to the 2015 IBC for an exception for Group I occupancies.
  - Emergency lighting must be provided on the egress side of the door
  - A building occupant must not encounter more than one delay before entering an exit. Refer to the 2015 IBC for an exception for I-2 or I-3 occupancies
  - Door locking system must be listed in accordance with UL 294.

Sensor release of electrically locked egress doors (prior to the 2015 edition this section was called Access controlled egress doors) (2015: 1010.1.9.8; 2012: 1008.1.9.8; 2009: 1008.1.4.4; 2006, 2003: 1008.1.3.4)

- Entrance doors and entrance doors to tenant spaces in groups A, B, E, I-1, I-2, I-4, M, R-1 or R-2 may be equipped with an approved entrance and egress access control system installed in accordance with all of the following:
  - Sensor on egress side must detect an occupant approaching the door and door must unlock by a signal from or loss of power to the sensor
  - Loss of power to locking device must unlock the door
  - Door shall unlock by a readily-accessible manual unlocking device (push button) marked "Push to exit", located 40 inches (1016 mm) to 48 inches (1219 mm) above the floor within 5 feet (1524 mm) of the door
  - Manual unlocking device must interrupt power to the lock, independent of the access control system, door must unlock for 30 seconds
  - Fire alarm and/or sprinkler system must unlock the door until system is reset
  - Entrance doors in groups A, B, E and M must not be secured from the egress side when the building is open to the general public
  - System must be listed per UL 294

Electromagnetically locked egress doors (2015: 1010.1.9.9; 2012: 1008.1.9.9; 2009: 1008.1.9.8, 2006, 2003: n/a)

- Egress doors in Group A, B, E, I-1, I-2, I-4, M, R-1 or R-2 occupancies may have electromagnetic locks in addition to listed hardware that has a built-in switch and meets the following requirements:
  - The listed hardware which releases the electromagnetic lock is mounted on the door leaf
  - The operation of the listed hardware is simple and obvious
- The listed hardware can be operated with one hand in all lighting conditions
- When the listed hardware is operated, the power to the lock is directly interrupted, and the electromagnetic lock releases, unlocking the door

- Loss of power to the locking system automatically releases the electromagnetic lock, unlocking the door
- When panic hardware is installed on a door with an electromagnetic lock, operation of the panic hardware releases the electromagnetic lock, unlocking the door (Note: The 2009 edition of the IBC states that this section may be used for doors that are not required to have panic hardware, but this was not the intent and the code has since been changed.)
- Door locking system must be listed in accordance with UL 294.

Stairway doors (2015: 1010.1.9.11; 2012: 1008.1.9.11; 2009: 1008.1.9.10; 2006, 2003: 1008.1.8.7)

- Interior stairway means of egress doors shall be openable from both sides without the use of a key or special knowledge or effort.
  Exceptions:
  - stairway discharge doors shall be openable from the egress side and shall only be locked from the opposite side
  - high-rise buildings (over 75 feet (23 M) in height) may have stair doors which are locked on the stair side but must unlock simultaneously without unlatching upon a signal from the fire command center - and a telephone or other two-way communication device connected to a constantly attended station must be provided at every fifth floor if the stair doors are locked
  - in stairways serving not more than four stories, doors may be locked on the stair side as long as they are capable of being unlocked simultaneously without unlatching upon a signal from the fire command center or a single location inside the building's main entrance (Note: The 2003 IBC did allow doors on stairs serving four stories to be mechanically locked on the stair side but the code has since changed.)
  - consult code for exceptions related to facilities with single exit stairs

Panic and fire exit hardware (2015: 1010.1.10; 2012, 2009: 1008.1.10; 2006, 2003: 1008.1.9)

- Panic hardware is required for doors equipped with latches which serve rooms or spaces with 50 occupants or more in groups A or E, and in group H occupancies of any occupant load (Note: Prior to the 2006 IBC, panic hardware was required for groups A and E, 100 occupants or more.)
  - Exception: entrances described in section on locks and latches
  - Exception (new in 2015): Doors serving Group A or E occupancies may have electromagnetic locks complying with section 1010.1.9.9
- Actuating portion of device must extend at least half the width of the door leaf
- Maximum force to unlatch is 15 pounds (67 N)
- Balanced doors with panic hardware must have pushpad type panics and the pad shall not extend more than one-half the width of the door measured from the latch side
- Panic hardware must be listed per UL 305
- Panic hardware used on fire doors is fire exit hardware and must be listed per UL 305 and UL 10C
- Electric rooms with equipment rated 1200 amperes or more, and over 6 feet wide, that contain overcurrent devices, switching devices or control devices with exit access doors must be equipped with panic hardware (Note: 2014 National Electrical Code requires panic hardware for doors within 25 feet of the required working space, serving rooms housing equipment with >600 volts, >800 amps (previously >1200 amps) and battery rooms)

Positive pressure (2015, 2012: 716.5.1; 2009, 2006, 2003: 715.4.1)

- Fire doors must be tested in accordance with NFPA 252 or UL10C
- After 5 minutes into the NFPA 252 test, the neutral pressure level in the furnace shall be 40 inches (1016 mm) or less above the sill

Temperature rise doors (2015, 2012: 716.5.5; 2009, 2006, 2003: 715.4.4)

- Fire doors in vertical exit enclosures and exit passageways shall have a maximum transmitted temperature end point of not more than 450°F above ambient after 30 minutes of fire test exposure
- Exception: not required in buildings equipped throughout with an automatic sprinkler system

Highlights of the National Building Code of Canada[1]

Notes: In this Code Reference Guide, "fire protection system" means an approved sprinkler system, approved fire alarm system, or both. Numbers in brackets ( ) refer to applicable sections of the code publication.

Use Groups (consult code for complete descriptions):

A – Assembly
B – Care, Treatment, or Detention
C – Residential
D – Business and Personal Service
E – Mercantile
F – Industrial (divided into Divisions 1, 2, and 3 to indicate level of hazard)

Doors and Door Hardware (3.3.1.13)

- a door that opens into or is located within a public corridor and provides access to an exit shall provide a clear opening of 800 mm minimum for a single door or active leaf of a pair (1050 mm minimum for doors required to accommodate moving patients in beds per 3.3.3.4)
- exit access doors shall be readily openable in the direction of exit travel, requiring no keys, special devices, or specialized knowledge (exception for contained use area or impeded egress zone)
- exit access doors shall be operable with one hand and one releasing operation (exception for dwelling unit/ suite)
- dwelling unit doors may have on additional releasing operation, with no keys, special devices or knowledge
- door release hardware must be installed 1200 mm maximum above the finished floor
- except for hotels and motels, doors opening onto a public exit access corridor must not relock automatically (3.3.4.5)

Door Swing - Exits (2010: 3.4.6.12; 2005: 3.4.6.11)

- except where sliding doors are permitted (2010: 3.4.6.14; 2005: 3.4.6.13), every exit door shall open in the direction of exit travel and swing on a vertical axis

Self-Closing Devices - Exits (2010: 3.4.6.13; 2005: 3.4.6.12)

- exit doors normally required to be kept closed shall be self-closing and shall not be secured in the open position except as allowed by section 3.1.8.12(1)

Door Release Hardware (2010: 3.4.6.16; 2005: 3.4.6.15)

- locking, latching, and other fastening devices on the principal entrance door and all exit doors shall permit the door to be readily opened from the egress side with one operation and without the use of keys, special devices, or specialized knowledge (exceptions for contained use area, impeded egress zone, electromagnetic locks and security doors on banks and mercantile facilities)
- if the door is equipped with a latch, a device which will release the latch and allow the door to swing wide open when a force of not more than 90 N is applied in the direction of travel to the exit shall be installed on:
  - every exit door from a floor area of an Assembly Occupancy with an occupant load of more than 100,
  - every door leading to an exit lobby from an exit stair shaft and every exterior door leading from an exit stair shaft in a building having an occupant load of more than 100,
  - every exit door from a floor area containing a High Hazard Industrial occupancy
- except where required by section 3.8.3.3 (Barrier-Free Doorways and Doors), every exit door shall open with a force of not more than 90 N after the latch is released, force applied at the releasing device
- electromagnetic locks without latches, pins, or other devices to keep the door closed may be installed on exit doors except doors leading directly from high hazard industrial occupancies, provided:
  - building is equipped with a fire alarm system, and
  - locking device and all similar devices in the exit access leading to the exit unlock upon fire alarm, and
  - locking device releases upon loss of power to the lock and associated auxiliary controls, and
  - device releases upon operation of a manually operated switch accessible only to authorized personnel, and
  - a force of 90 N applied to the door opening hardware initiates an irreversible process that releases the locking device within 15 seconds and device shall not relock until the door has been opened, and

[1] 2010 and 2005 editions

  - upon release, the locking device must be manually reset by the switch referred to above, and
  - if more than one locking device of this type is used in a building, the switch must release and reset all locking devices simultaneously (appendix), and
  - a legible sign must be permanently mounted on the exit door to indicate that the locking device will release 15 seconds after the application of force to the door opening hardware
- operating hardware for the doors to in this section shall be installed 1200 mm maximum above the finished floor

Security for Banks and Mercantile Floor Areas (2010: 3.4.6.17; 2005: 3.4.6.16)

- requirements of this section may be waived for bank and mercantile occupancies due to security concerns
- buildings must be sprinklered throughout
- consult section for specific requirements

Emergency Access to Floor Areas (2010: 3.4.6.18; 2005: 3.4.6.17)

In a building more than 6 stories high,

- doors providing access to floor areas from exit stairs shall not have locking devices to prevent access to the floor area from which the travel distance up or down to an unlocked door is more than 2 stories
- doors that provide access to the floor area (as required above) shall have signage on the stair side to indicate that they are openable from the stair side
- a master key for all locked doors in a stairwell shall be provided in a designated location accessible to fire-fighters, or the locked door shall have a wire glass panel not less than 0.0645 m^2 in area and located not more than 300 mm from the door opening hardware
- if access to floor areas through unlocked doors is required by this section, an occupant entering the floor area must have access, through unlocked doors within the floor area, to at least one other exit

Barrier-Free Doorways and Doors (3.8.3.3)

- every doorway in a barrier-free path of travel shall have a clear width of at least 800 mm when the door is in the open position (measured from the face of the door at 90 degrees to the outside edge of the frame stop, the projection of exit devices are taken into account - appendix)
- the doorway of at least one bathroom within a residential suite must have a clear width of at least 800 mm when the door is in the open position
- door operating devices shall not require tight grasping or twisting of the wrist to operate
- thresholds shall be a maximum of 13 mm above the floor surface and shall be beveled
- doors that provide a barrier-free path of travel at an entrance referred to in Article 3.8.1.2 shall be equipped with a power operator in a hotel, a building of Group B, Division 2 major occupancy, and a building of Group A, B-Division 3, D, or E major occupancy more than 500 m^2 in building area (exception - individual suite having an area less than 500 m^2 in a building having only suites of assembly, care, business and personal services or mercantile occupancy if the suite is completely separated from the remainder of the building so that there is no access to the remainder of the building
- door closers used in a barrier-free path of travel shall require a maximum force applied at the handle, push plate, or latch releasing device of no more than 38 N to operate an exterior door and 22 N to operate an interior door (exception - entrance to a dwelling unit, or where greater forces are required to close the door against prevailing difference in air pressure)
- door closers used on interior doors in a barrier-free path of travel shall have a closing period of not less than 3 seconds from the open position of 70 degrees to a point 75 mm from the closed position, measured from the leading edge of the latch side of the door (exception - dwelling unit entrance doors), delayed action not required (appendix)
- only the active leaf in a multiple leaf door in a barrier free path of travel need to conform to the requirements

Highlights of *NFPA 101 - The Life Safety Code*[1]

Notes: In this code reference guide, "fire protection system" means an approved sprinkler system, approved fire alarm system or both. Numbers in brackets ( ) refer to applicable sections of the code publication. Refer to Classification of Occupancy section at the front of this guide for descriptions of occupancy types.

Locks, latches and alarm devices (7.2.1.5)

- Locks, if provided, shall not require the use of a key, tool or special knowledge or effort for operation from the egress side (does not apply to fire doors after exposure to elevated temperatures)
- Exception: as specifically allowed by the occupancy chapters, exterior doors shall be permitted to have key-operated locks from the egress side as long as:
  - exception is permitted in the occupancy chapters for the specific occupancy
  - on or adjacent to the door there is a sign (THIS DOOR TO REMAIN UNLOCKED WHEN THE BUILDING IS OCCUPIED)
  - locking device is of a type that is readily distinguishable as locked
  - key is immediately available to any occupant inside the building when door is locked
  - provisions may be revoked by the AHJ (Authority Having Jurisdiction) for cause where permitted by the occupancy chapters

Electrically controlled egress door assemblies (2015, 2012: 7.2.1.5.6; 2009: 7.2.1.5.5; 2006, 2003: n/a)

- Electric locks in the means of egress may be released by approved, listed hardware with a built-in request-to-exit switch as long as:
  - Hardware releasing the lock is mounted on the locked door leaf
  - Hardware operation is obvious and readily operated for egress
  - Hardware requires the use of only one hand to egress
  - Power to the electronic lock is interrupted upon activation of the door-mounted hardware
  - Loss of power to the hardware unlocks the electric lock
  - Hardware for new installations listed per ANSI/UL 294

Stairwell re-entry (2015, 2012: 7.2.1.5.8; 2009, 2006, 2003: 7.2.1.5.7)

- Doors in stair enclosures serving more than four stories shall meet one of the following criteria:
  - Re-entry from the stair enclosure to the interior of the building shall be provided (passage sets)
  - An automatic release actuated by the fire alarm system shall unlock all stair enclosure doors to provide reentry (fail-safe locks or fail-safe trim for fire exit hardware)
  - Selected re-entry - selected doors may have locking hardware, provided that at least two levels are unlocked, there aren't more than four stories between unlocked floors, and the top or next to the top floor is unlocked, signage on the stair side identifies unlocked doors, and signage on the stair side of locked doors indicates the location of the nearest unlocked door in each direction (Note: Selected re-entry is included in NFPA 101, but not the IBC.)
- The following applications are not required to comply:
  - Existing installations in buildings that are not high-rise buildings, as permitted in the occupancy chapters
  - Stairs serving a building permitted to have a single exit, in accordance with the occupancy chapters
  - Existing installations in sprinklered high-rise buildings, as permitted in the occupancy chapters
  - Stairs in health care occupancies, where otherwise provided in the occupancy chapter
  - Stairs in detention and correctional occupancies, where otherwise provided in the occupancy chapter

Stair to roof (2015, 2012: 7.2.1.5.9; 2009, 2006, 2003: 7.2.1.5.8)

If stair enclosure allows access to the roof, door to the roof must be kept locked or must allow re-entry from the roof.

Releasing devices (2015, 2012: 7.2.1.5.10-12; 2009, 2006, 2003: 7.2.1.5.9 -7.2.1.5.11)

- Latch or other fastening device on a door shall be provided with a releasing device having an obvious method of operation under all lighting conditions
- Releasing mechanism (except existing installations) shall be located between 34 inches (864 mm) and 48 inches (1219 mm) above the finished floor

[1] 2015, 2012, 2009, 2006, and 2003 editions

- Doors shall be openable with not more than one releasing operation
- Exceptions:
  - egress doors from individual living units and guest rooms of residential occupancies may require two releasing operations, as long as no key is required for egress and both mechanisms are less than 48 inches (1219 mm) AFF (existing security devices complying with this exception may have three releasing operations - devices that are not automatic latching may be located up to 60 inches (1524 mm) AFF)
  - two releasing operations permitted for existing hardware when door serves an occupant load of three or less, as long as simultaneous retraction is not required
- Where a pair of doors is required in a means of egress, each leaf shall have its own releasing device, and each device must operate independently (can't require one device to be released before the other), except where automatic flush bolts are used. The door leaf with the flush bolts shall have no doorknob or surface-mounted hardware - unlatching any leaf shall not require more than one operation
- No additional locking device (padlock, hasp, chain, deadbolt, etc.) shall be installed on a door which is required to have panic hardware

Delayed egress locks (7.2.1.6.1)

- Approved, listed and delayed egress locks are permitted on doors serving low and ordinary hazard contents in buildings protected throughout by an approved, supervised automatic fire detection system or sprinkler system, where permitted by chapters 12-42, provided that:
  - Doors unlock upon actuation of the sprinkler system, any heat detector or up to two smoke detectors
  - Doors unlock upon loss of power controlling the lock mechanism
  - An irreversible process (such as pushing the door or touchpad) releases the lock within 15 seconds (AHJ (Authority Having Jurisdiction) can approve a delay of up to 30 seconds) upon application of force to the release device (15 lbs (67 N) for not more than three seconds)
  - Initiation of the release process activates an audible signal in the vicinity of the door
  - After release, re-locking shall be by manual means only
  - Signage on egress side of door (PUSH [PULL] UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS.)
  - New installations must have emergency lighting on the egress side.

Access controlled egress doors (7.2.1.6.2)

- Where permitted in the occupancy chapters, doors in the means of egress may have an approved entrance and egress access control system, provided that:
  - A sensor on the egress side unlocks the door upon detection of an occupant approaching the door
  - Loss of power to the sensor unlocks the door
  - Loss of power to the lock unlocks the door
  - Manual release device (push button) adjacent to the door unlocks the door - must have signage (PUSH TO EXIT), and must result in direct interruption of power to the lock, and door remains unlocked for at least 30 seconds
  - If the building has a fire protection system, actuation of the fire protection system automatically unlocks the door and the door remains unlocked until the fire protection system is manually reset
  - New installations must have emergency lighting on the egress side

Elevator lobby exit access door locking (2015, 2012, 2009: 7.2.1.6.3; 2006, 2003: n/a)

- Except for newly-constructed high-rise buildings, doors that separate the elevator lobby from the exit access are permitted to be locked electronically, if the following criteria are met:
  - This type of locking must be allowed by the occupancy chapter. In the 2015 edition of NFPA 101, it is allowed in new and existing assembly, educational, day-care, health care, ambulatory health care, hotels and dormitories, apartment buildings, mercantile, business, industrial, and storage occupancies.
  - Lock is listed per ANSI/UL 294
  - Building is protected throughout with a fire alarm and sprinkler system and movement of water through the system actuates the fire alarm system
  - Elevator lobby is protected by an approved smoke detection system that, upon detection of smoke, activates the fire alarm system
  - Activation of fire alarm by means other than manual pull stations unlocks the elevator lobby door(s).
  - Loss of power to the elevator lobby lock system unlocks the assembly - once unlocked, the door(s) will not relock until the fire alarm has been manually reset
  - Where elevator lobby doors remain latched after unlocking, latch-releasing hardware is mounted on the door and has an obvious method of operation
  - A two-way communication system allows communication between the elevator lobby and A constantly staffed control point
  - Control point staff is trained and capable of providing emergency assistance

- Doors are not required to comply with requirements pertaining to delayed egress locks or access controlled egress doors
- Note: The International Building Code does not currently contain a section specific to locking of elevator lobby doors, but some states have modified the code to include a similar section.

Panic hardware and fire exit hardware (7.2.1.7)

- Actuating portion of device must extend at least half the width of the door leaf
- Device must be mounted between 34 inches (865 mm) and 48 inches (1220 mm) above finished floor (30 inches (762 mm) to 48 inches (1220 mm) for existing applications)
- Door locations requiring panic hardware are listed within the individual occupancy chapters: means of egress doors in assembly, day-care, and educational occupancies with an occupant load of 100 or more persons shall be permitted to have a latch or lock only if it is panic hardware
- Doors serving high hazard contents areas with occupant load of more than five shall be permitted to have a latch or lock, only if it is panic hardware
- Required panic hardware (except as allowed for detention and correctional occupancies), shall not be equipped with any locking device, set screw or other arrangement that prevents the release of the latch when pressure is applied to the releasing device
- Fire exit hardware may not be equipped with devices to hold the latch retracted, unless the devices are listed and approved for such purposes (i.e. electric latch retraction)

Self-closing devices (7.2.1.8)

- Doors designed to normally be kept closed in a means of egress shall be a self-closing door and shall not be secured in the open position,
- Exception: doors can be automatic closing, if
  - upon release of the hold-open mechanism, the door becomes self-closing
  - door can be easily released manually
  - releasing mechanism is activated by approved smoke detectors installed per NFPA 72
  - upon loss of power to the hold-open device the door becomes self-closing
  - release of one door in a stair enclosure results in closing of all doors in that stairway
- Note: A standard door closer without a hold-open mechanism is self-closing. A door with a closer and an electric or battery-operated hold-open mechanism actuated by smoke detectors is automatic-closing.

Inspection of door openings (2015, 2012, 2009: 7.2.1.15; 2006, 2003: n/a)

- In new and existing assembly, educational, day-care, hotels and dormitories, apartment buildings, mercantile, business, industrial, storage, and residential board and care occupancies, the following doors must be inspected and tested annually:
  - doors with panic hardware or fire exit hardware
  - door assemblies in exit enclosures
  - electrically controlled egress doors
  - door assemblies with special locking arrangements (delayed egress, access controlled egress doors and elevator lobby doors)
- Written record of inspections and testing must be signed and retained for review by AHJ
- Functional testing must be performed by individuals with knowledge and understanding of the type of door being tested
- Visual inspection must be performed from both sides of the assembly
- Minimum inspection criteria:
  - floor space on both sides of opening clear of obstructions, door leaves open fully and close freely
  - forces to set door in motion and move to the fully open position within limits of this code
  - latching and locking devices do not require keys, tools, or special knowledge or effort – one releasing operation per door leaf
  - releasing hardware installed between 34 inches (865 mm) and 48 inches (1220 mm) above the floor
  - releasing devices on pairs do not require more than one operation, except the inactive leaf may have automatic flush bolts as long as the inactive leaf does not have a doorknob or dummy hardware
  - door closers properly adjusted to meet closing speed requirements for accessibility
  - projection of door into path of egress is within limits for encroachment
  - powered doors operate within stated opening force limitations and other requirements of this code
  - required signage is intact and legible
  - doors with special locking arrangements function as required
  - security devices impeding egress are not present
  - luminous door hardware marking, if required, is present
  - emergency lighting for access-controlled egress doors and delayed egress locks is present and functioning
- Deficiencies must be repaired or replaced without delay
- Note: Fire door assemblies in all occupancy types are required to be inspected after installation, upon completion of maintenance work, and also annually.

Highlights of NFPA 80 – Standard for Fire Doors and Other Opening Protectives[1]

Note: Numbers in brackets ( ) refer to applicable sections of the publication.

Equivalency (1.4)

- Standard does not prohibit the development of new products that meet the intent of the requirements
- It is the responsibility of the manufacturer to provide enough information to allow the AHJ (Authority Having Jurisdiction) to make a determination
- Devices not described in standard – manufacturers must provide descriptive information provided by a testing laboratory regarding acceptable installation methods

Appurtenances / Job-site hardware preparation (4.1.3)

- Job-site prep for surface-applied hardware, function holes for mortise locks and holes for labeled viewers:
  - Maximum one inch (25.4 mm) diameter holes permitted, except cylinder holes may be any size
  - Maximum 3/4 inch (19 mm) undercutting for wood and composite doors allowed
  - Any preparations other than noted above must be done under label service. Note: The 2016 edition of NFPA 80 allows job-site preparations of holes larger than 1 inch diameter for surface-mounted hardware if allowed by the door manufacturer's listing and the hardware manufacturer's listing. The 2016 edition also allows raceways for wires to be field drilled in accordance with the door manufacturer's listing and when permitted by the listing laboratory.
  - Plant-ons as allowed per the manufacturer's listing

Signage (4.1.4)

- Signs shall not exceed 5% of the area of the face of the door
- Attached to fire door with adhesive – no mechanical attachments such as screws or nails
- Signs must not be attached to fire-protection-rated glazing

Listed and labeled products (4.2)

- Listed items are required to bear a label
- Labels applied in locations that are readily visible after installation
- Generic items such as hinges are not labeled but must comply with the standard
- Fire door assembly may consist of listed, labeled, or classified products from different organizations that are acceptable to the AHJ, unless restricted by published listings
- Note: The 2016 edition of NFPA 80 includes a list of information that must be included on the label, and states that frames in certain locations are not required to have a fire protection rating. Glazing must be permanently labeled as identified in Table 4.2.2.

Classification and types of doors (4.3)

- Fire doors must be labeled
- Swinging fire doors permitted to be supplied separately with individually labeled frames and hardware
- Fire doors used with fire exit hardware shall be specifically labeled as such - label shall address necessary reinforcements and the assembly shall have been tested for egress panic load requirements
- AHJ shall be consulted for oversized doors

Glazing material in fire doors (4.4)

- Only labeled fire-resistance rated or fire-protection rated glazing material and labeled light kits may be used, when permitted by the door listing
- Allowable size of light depends on type of glazing and specific listings
- Glazing in fire doors must meet impact safety standards – there is no longer an exemption in the International Building Code for impact- resistance of glazing in fire doors
- New wood doors – glazing materials installed in labeled glass kits or in accordance with fire door listing and installed under label service
- Fire protection glazing 100 square inches (0.065 m^2) maximum, in 3-hour fire doors or 1 1/2 -hour doors used in severe exterior fire exposure locations – glazing tested per NFPA 252
- Consult standard for other glazing limitations and testing requirements
- Each glazing unit must have a label visible after installation
- Viewers in fire doors must be labeled

[1] 2016, 2013, 2010, and 2007 editions

Fire-resistance-rated glazing in doors and windows (4.5)

- This glazing limits the temperature rise on the unexposed surface and must withstand the hose stream test
- Tested in accordance with ASTM E119 or UL 263
- Subsequently tested in accordance with NFPA 252 or NFPA 257
- Allowed in fire doors listed up to 3 hours, in maximum size tested

Classification of hardware for fire doors (4.6)

- Builders hardware includes hinges, locks and latches, bolts and closers
  - builders hardware is applied to swinging fire doors
  - builders hardware shall not be required to be shipped from the factory with the fire doors
- Fire exit hardware is an exit device that is labeled for both panic and fire protection
- Fire door hardware includes surface-mounted strap hinges, surface-applied latches and closing devices
  - fire door hardware is applied to swinging and sliding doors
  - in NFPA 80, hardware for sliding doors shall be fire door hardware
  - fire door hardware must be shipped from the factory with the fire door
  - typical of tin-clad type doors

Clearance at bottom of door (4.8.4)

- Clearance under the bottom of a fire door – 3/4 inches (19 mm) maximum
- If bottom of door is more than 38 inches (965 mm) above the floor (for example, a counter shutter or chute door), maximum clearance is 3/8 inch (9.5 mm) or as specified by manufacturer's label service procedure
- Note: The 2016 edition of NFPA 80 references products which are listed to address clearances in excess of 3/4 inch (19 mm)

Inspection and Testing (5.2)

- Fire door assemblies inspected and tested at least annually – consult standard for details of performance-based option
- Upon completion of installation and maintenance work – fire door assemblies must be inspected and tested (added in 2013 edition)
- Written record of inspection signed and kept for AHJ review
- Inspection performed by qualified individual with knowledge of the type of assembly being inspected
- Fire door assemblies – visually inspected from both sides to assess overall condition
- Inspect per the following criteria:
  - labels must be visible and legible
  - no open holes or breaks in surface of door or frame
  - glazing, light frames, glazing beads (if present) intact and securely fastened
  - door, frame, hinges and hardware are in the noncombustible threshold – secure, aligned, in working order, with no damage
  - no parts missing or broken
  - clearances between door edge and frame, measured on the pull side, within allowable limits per NFPA 80
  - self-closing device operational, and active door closes when operated from the full open position
  - coordinator (if present) facilitates inactive leaf closing before active leaf
  - latching hardware operates and securely latches door in closed position
  - auxiliary hardware items that interfere with operation must not be installed on door or frame
  - no field modifications performed that void the label
  - gasketing, where required, is present and intact
  - signage on door meets requirements of NFPA 80

Operation of doors (2016, 2013: 6.1.3; 2010, 2007: 6.1.4)

- All swinging fire doors must be closed and latched at the time of fire
- Door operation classified as:
  - self-closing door – equipped with a closing device, closes each time it is opened (no hold-open)
  - automatic-closing door – closes and latches automatically when released by an automatic fire detector
  - power-operated fire door – automatic operator is automatically disconnected during an alarm condition, allowing the door to close and latch

Clearances at perimeter and meeting stiles (6.3.1.7)

- Clearances between the door and frame and at meeting stiles, measured on the pull side of the door:
  - Steel doors – 1/16 inch (1.16 mm) to 3/16 inch (4.8 mm)
  - Wood doors – 1/8 inch (3.2 mm) maximum
  - Note: The 2016 edition of NFPA 80 allows a clearance of 1/16 inch to 3/16 inch for HPDL-faced doors, wood doors, and stile and rail doors with a rating up to 1/3-hour installed in a hollow metal frame. For these door types with a rating over 1/3-hour, the clearance is limited to 1/8 inch maximum.

Assembly components (6.4)

- Closing device required on every fire door - adjusted to ensure positive latching on each door operation
- Coordinator required if a latch bolt or astragal can prevent the inactive door from closing and latching – coordinator not required if doors latch independently of each other
- Hinges shall be
  - steel, ball-bearing hinges, or meeting the requirements of ANSI/BHMA A156.1

  - doors up to 60 inches (1.52 m) in height – two hinges
  - one additional hinge for each 30 inches (0.76 m) of door height (or fraction)
  - if spring hinges are used – two minimum, labeled, and meeting the requirements of ANSI/BHMA A156.17, Grade 1
  - heavyweight hinges 4 ½ inches (114 mm) high and 0.180 inches (4.57 mm) thick permitted on doors that are wide or heavy or subject to heavy use or stress
  - pivot sets (top and bottom) – one intermediate pivot for doors up to 90 inches (2.29 m) in height, and one additional inter-mediate pivot for each 30 inches (0.76 m) of door height over 90 inches (2.29 m)
  - if only intermediate pivots are used – two intermediate pivots for doors up to 60 inches (1.52 m) in height, one additional intermediate pivot for each additional 30 inches (0.76 m) of door height (or fraction)
  - length of continuous hinges – within one inch of door height
- Consult code for hinge specifics and fastening requirements

Shimming (6.4.3.4)

- Shimming with steel shims permitted when required to meet acceptable clearances

Locks or latches (6.4.4)

- Any lock, latch, or fire exit hardware shall meet both life safety and fire protection requirements
- Fire exit hardware to be installed only on doors labeled "Fire Door to be Equipped with Fire Exit Hardware"
- Fire exit hardware must be labeled for both fire and panic – label must be permanently attached and must include serial number and manufacturer's name and type of approval
- All single doors and active leaves of pairs shall have an active latch bolt that cannot be held retracted – except doors not in a means of egress may have dead bolts in addition to the active latch bolts or as permitted by the AHJ
- Locks with interconnected dead bolts which are retracted when the latch bolt is retracted are permitted
- Automatic devices which are activated by the fire protection system and become positively latched upon activation are permitted (i.e. electric latch retraction fire exit hardware)
- Pairs may have fire exit hardware and an open back strike (no astragal) where allowed by the AHJ – latch must be released by one obvious operation
- Where pairs are needed for movement of equipment and inactive leaf is not for exit purposes – labeled top and bottom self-latching or automatic flush bolts or labeled two-point latches are permitted
- Labeled manual flush bolts or surface-bolts permitted when acceptable to the AHJ, where they do not pose a hazard to safety to life (i.e. rooms not normally occupied by humans, like transformer vaults and storage rooms)
- Latch throw – minimum shown on fire door label and as specified in manufacturer's installation instructions
- Electric strikes may be used where allowed by published listings (fail-secure only)
- Consult standard for requirements for attaching hardware to fire doors

Protection plates (6.4.5)

- Factory-installed protection plates – installed per door listings. Note: The 2016 edition of NFPA 80 requires factory-installed protection plates to be labeled and installed per door listings.
- Field-installed protection plates – labeled and installed per their listing
- Label not required where top of plate is not more than 16 inches (406 mm) above the bottom of the door

Astragals (6.4.7)

- Astragals may not inhibit the free use of either leaf when located in a means of egress
- If astragal is required, it must project approximately ¾ inch (19 mm) or as indicated in published listings

Gasketing (6.4.8)

- Gasketing used on fire doors must be in accordance with published listings of the door, frame or gasketing manufacturer

Thresholds (6.4.9)

- If thresholds are used, they must be noncombustible or listed (added in the 2016 edition)

Application, Installation, and Adjustment (6.5)

- Installation of all fire door assembly components must be in accordance with each component's listing
- All components must be installed per the manufacturer's installation instructions and adjusted to function per the listing
- All components must be firmly attached to walls, doors and frames as acceptable to the AHJ
- Mounting screws, bolts or shields must be steel except where permitted by the standard
- Attachment to doors with composite cores must provide firm anchorage

Temperature rise (Annex D.7)

- Fire doors used in stairway enclosures shall be constructed so that the maximum transmitted temperature end point shall not exceed 450° F above ambient temperature at the end of 30 minutes of the standard fire exposure test (Note: This may not be required by the applicable building code; buildings equipped throughout with sprinkler systems are often exempt.)

Highlights of the 2010 ADA Standards for Accessible Design, and 2009 ICC A117.1 Accessible and Usable Buildings and Facilities

Note: Numbers in brackets ( ) refer to applicable sections of the publication.

With the recent updates to the ADA Standards, the requirements of these two standards have now become very similar. Section 404 addresses doors on accessible routes. Manual doors and gates intended for user passage must meet the following requirements (consult the standards or maneuvering clearance requirements):

Clear opening width (ADA: 404.2.2, 404.2.3; A117.1: 404.2.1, 404.2.2)

- 32 inches (815 mm) minimum, clear opening width required for swinging doors
  - measured with door open 90 degrees, face of door to stop on strike jamb (figure 1)
  - openings more than 24 inches (610 mm) deep, minimum 36 inch (915 mm) clear opening width required
  - for pairs of doors, at least one leaf of the pair must comply (the active leaf)
  - projections into the required clear opening width are not allowed below 34 inches (865 mm) above the floor or ground
  - between 34 inches (865 mm) and 80 inches (2030 mm) above the floor or ground, projections into the clear width are limited to four inches (100 mm)
  - projections into the required clear width are not limited if more than 80 inches (2030 mm) above the floor or ground
  - in alterations, the latch side stop may project a maximum of 5/8 inch (16 mm) into the required clear opening width
- Door closers and stops permitted to be 78 inches (1980 mm) minimum above the floor or ground – minimum clear opening height is typically 80 inches (2030 mm) nominal

Thresholds (ADA: 404.2.5, 303; A117.1: 404.2.4, 303)

- Total threshold height - 1/2 inch (13 mm) high maximum (figure 2)
- Change in level of 1/4 inch (6.4 mm) maximum in height may be vertical
- Change in level of 1/4 inch (6.4 mm) to 1/2 inch (13 mm) must be beveled with a slope not steeper than 1:2
- Change in level over 1/2 inch (6.4 mm) must be a ramp sloped 1:12
- Existing or altered thresholds 3/4 inch (19 mm) high maximum, that have a beveled edge on each side with a slope not steeper than 1:2 are acceptable

Figure 1

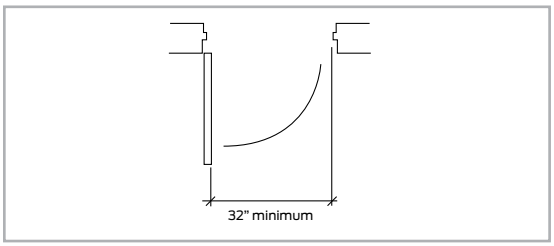
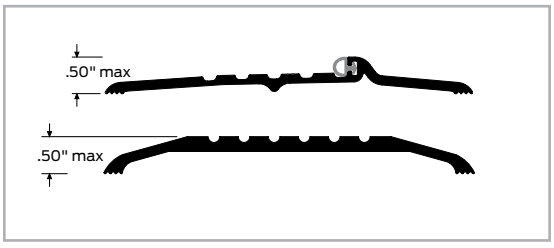


Figure 2



Threshold image courtesy of Zero International

Highlights of the 2010 ADA Standards for accessible design, and 2009 ICC A117.1 accessible and usable buildings and facilities

Door hardware (ADA: 404.2.7; A117.1: 404.2.6)

Note: The 2010 ADA standards refers to section 309.4 regarding operation of door hardware. This section requires operable parts to be operable with one hand and no tight grasping, pinching or twisting of the wrist, similar to the requirements of A117.1. However, section 309.4 also limits the force to activate operable parts to five pounds (22.2 N) maximum. ICC A117.1 does not include this limitation on operational force.

- Handles, pulls, latches, locks, and other operable parts – shape that is easy to grasp with one hand - no tight grasping, tight pinching, or twisting of the wrist to operate (figure 3)
- A117.1 exempts locks used only for security purposes and not for normal operation
- ADA refers to section 309.4 which requires a maximum of five pounds (22.2 N) to operate
- ADA notes that door hardware operated with a closed fist or loose grip accommodates the greatest range of users – hardware requiring simultaneous hand and finger movements is not recommended
- Operable hardware must be mounted 34 inches (865 mm) to 48 inches (1220 mm) above the floor or ground (except locks used only for security purposes)
- ADA allows existing locks in any location at existing glazed doors without stiles, existing rolling grilles or similar doors with locks at the top or bottom rail
- ADA allows access gates in pool, spa, and hot tub enclosures to have hardware mounted at 54 inches (1370 mm) maximum above the floor or ground – latches may not be self-locking devices operated by key, combination or electronic function
- Operating hardware for sliding doors must be exposed and usable from both sides when doors are fully open (pocket doors must project from the pocket when fully open, to allow access to hardware)

Closing speed (ADA: 404.2.8; A117.1: 404.2.7)

- Door and gate closers - five seconds minimum to close from open position of 90 degrees to 12 degrees from the latch
- Delayed action closers are not required by these standards
- Spring hinges - 1.5 seconds minimum to close from open position of 70 degrees to closed position

Opening force (ADA: 404.2.9; A117.1: 404.2.8)

- Interior hinged doors and gates which are not fire doors - five pounds (22.2N) maximum
- Fire doors - minimum allowed by the appropriate administrative authority (size 3 closer recommended per NFPA 80 for interior doors 3 feet wide)
- Sliding or folding doors - five pounds (22.2N) maximum

Figure 3

- A maximum opening force for exterior doors is not established by these standards – refer to state and local requirements (the IBC does include opening force requirements that would apply to exterior egress doors)
- Maximum force pertains to the continuous application of force necessary to fully open a door, not the initial force required to overcome the inertia of the door
- Force limits do not apply to the force required to retract bolts or to disengage other devices used to keep the door in a closed position

Door surface (ADA: 404.2.10; A117.1: 404.2.9)

- Bottom 10 inches (255 mm) of swinging doors and gates must have a smooth surface on the push side extending full width of door – no projecting hardware in this area
- Parts creating horizontal or vertical joints must be within 1/16 inch (1.6 mm) of the same plane as the other
- Cavities created by added kick plates shall be capped
- Exceptions:
  - sliding doors are exempt from this section
  - tempered glass doors without stiles, where top edge of bottom rail tapers to the glass at 60 degrees minimum from horizontal are exempt from the 10 inch (255 mm) height requirement (no projecting hardware allowed)
  - doors that do not extend to within 10 inches (255 mm) of the ground are exempt from this section
  - existing doors and gates may have kick plates installed to provide a 10 inch (255 mm) high smooth surface, as long as the cavity between the top of the kick plate and the recessed glass or panel is capped

Vision lights (ADA: 404.2.11; A117.1: 404.2.10)

- Vision lights in doors and sidelights adjacent to doors - bottom of at least one light must be 43 inches (1090 mm) maximum above the floor or ground
- Standard does not require every door to have a vision light, but mandates height where lights for viewing are present

- Exception: lights with the lowest part more than 66 inches (1675 mm) above the floor or ground (these lights are not intended for viewing)

Automatic doors (ADA: 404.3; A117.1: 404.3)

- Must comply with ANSI/BHMA A156.10 (full powered) or ANSI/BHMA A156.19 (low energy/ power assist)
- Clear opening width – 32 inches (815 mm) minimum in power-on and power-off mode –based on clear opening provided by all leafs in the open position
- Doors with power assist (reduced opening force, not completely automatic) – must meet maneuvering clearance requirements for manual doors
- ADA requirement – automatic doors and gates which serve an accessible means of egress must meet the maneuvering clearance requirements for manual doors or standby power must be provided for the operator (Exception: where door remains open in the power-off condition)
- Thresholds on automatic doors – same requirements as manual doors (figure 3)
- ANSI/BHMA A156.19 includes requirements for actuators:
  - requires low energy operators to be initiated by a knowing act
  - including wall- or jamb-mounted contact switches such as push plates; fixed non-contact switches (maximum 12-inch detection range); the action of manually opening (pushing or pulling) a door; and access control devices such as keypads, card readers, and keyswitches
  - if a low energy operator is actuated by a motion sensor instead of a knowing act, the requirements of ANSI/BHMA A156.10 must be followed, which may include safety mats and guide rails
  - mount actuators between 36 inches (915 mm) and 48 inches (1219 mm) above the floor or ground
  - mount actuators between one foot (305 mm) and five feet (1524 mm) from the door when possible – no more than 12 feet (3.7 m) from the center of the door (provide additional time delay – one second for each foot of distance over five feet (1524 mm)
  - actuators shall be accessible when door is open – mounted where user is not in path of moving door and user can see the door when activating switch

Decoded: Panic hardware

Panic hardware, also known as an exit device (or fire exit hardware when used on fire doors), is designed to provide fast and easy egress to allow building occupants to exit safely in an emergency.

The majority of the codes researched for this article define panic hardware as "a door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel." Panic hardware can be classified as either a touchpad or pushpad type device, a crossbar device style or recessed panic hardware.

Where panic hardware is required by code:

- **International Building Code (2006, 2009, 2012, 2015):** Each door in a means of egress equipped with latches or locks serving assembly or educational occupancies with an occupant load of 50 people or more. High hazard occupancies (any occupant load).
- **International Building Code (2003):** Each door in a means of egress equipped with latches or locks serving assembly or educational occupancies with an occupant load of 100 people or more. High hazard (H-1, H-2, H-3, or H-5) occupancies (any occupant load).
- ***NFPA 101*® (2003, 2006, 2009, 2012, 2015):** Required means of egress doors equipped with latches or locks serving assembly, educational or day-care occupancies with an occupant load of 100 people or more. High hazard contents areas with an occupant load in excess of five.

Panic hardware is only required by code if both criteria are met; the occupancy type must be one of those listed above and the occupant load must be more than 50 people or 100 people depending on the code referenced. Although *NFPA 101*® is the only code discussed in this article that has a separate classification for day-care occupancies, all of the other referenced codes consider children's day-care facilities of a certain size as educational occupancies. Therefore, the requirement for panic hardware would apply if the day-care facility had the referenced occupant load. In some cases, panic hardware may not be required on the main exit door serving certain occupancies or on stadium gates. Consult the applicable code for these exceptions.

Beginning with the 2002 edition, *NFPA 70*®, the *National Electrical Code*® required certain rooms housing electrical equipment to have doors that open in the direction of egress and were "equipped with panic bars, pressure plates or other devices that are normally latched but open under simple pressure." Technically, a hospital latch or paddle-type release would meet this requirement, but the fact that the words "panic bar" were used in the code has prompted many code officials to require panic hardware. The 2008 edition of *NFPA 70* added language to require these outswinging doors with devices that open under simple pressure when the door is within 25 feet of the required working space. The 2014 edition of *NFPA 70* further clarifies the requirement by mandating "listed panic hardware" on these rooms, rather than devices that open under simple pressure.

According to article 110 of *NFPA 70*, personnel doors serving the following types of rooms, within 25 feet of the working space, must comply:

- Rooms housing large equipment - 600 volts, nominal or less, 1200 amps or more (changed to 600 volts or less, 800 amps or more in the 2014 edition)
- Rooms housing conductors and equipment used on circuits of over 600 volts, nominal
- Transformer vaults (2002, 2005, 2008, 2011 editions)
- Battery rooms (2014 edition)

The IBC also refers to panic hardware for electrical rooms:

> Electrical rooms with equipment rated 1200 amps or more and over 6 feet (1829 mm) wide that contain over-current devices, switching devices or control devices with exit or exit access doors shall be equipped with panic hardware or fire exit hardware. Doors shall swing in the direction of egress travel.

Because the *NFPA 70* requirements are more stringent and most jurisdictions use the National Electrical Code,

those requirements would typically take precedence.

The AHJ may request panic hardware in other instances if he or she believes that panic hardware is required for life safety. Of course, panic hardware may also be used in locations where it is not required by code, for ease of use or ability to withstand abuse. If a door is not equipped with a latch or lock (push/pull application), the door is not required to have panic hardware. Keep in mind that when an application requires panic hardware, all of the doors in the means of egress from that room or area will typically require panic hardware, including the exit access, the exit and the exit discharge. The exception to this rule is the code requirement for panic hardware on electrical rooms, which includes only the personnel doors within 25 feet of the required working space.

Other code considerations

- Where panic hardware is required, the actuating portion of the device (touchpad or crossbar) must be at least half the width of the door leaf.
- Current codes require panic hardware to be mounted between 34 inches and 48 inches above the floor. Existing panic hardware may have been installed in accordance with previous code requirements.
- A force of 15 pounds applied to the touchpad or crossbar must release the latch. Some codes have recently been modified to require door hardware to operate with five pounds of force, which has created a conflict between the code requirements.
- No additional locking device (deadlock, chain, padlock and hasp, etc.) may be installed on a door required to have panic hardware, and panic hardware may not be equipped with any device that prevents the release of the latch when the touchpad or crossbar is pressed. The exception to this is a delayed egress device.
- When panic hardware is used on fire doors, fire exit hardware must be used and the door must be equipped with a label stating "Fire Door to be Equipped with Fire Exit Hardware." Fire exit hardware is labeled for panic and fire and is not equipped with a mechanical "dogging" mechanism. Electric latch retraction may be used to provide dogging for fire exit hardware, as long as the latch projects automatically upon actuation of the smoke detection system.
- If panic hardware is used on balanced doors (doors where the pivot point is located several inches in from the hinge edge of the door) a pushpad/touchpad device must be used and the actuating portion of the device must not extend more than half the width of the door. Crossbar style devices may not be used on balanced doors. The reason for this is that if the actuating portion extended all the way over to the hinge edge of the door, a building occupant could push on the wrong end of the panic device and the door would not open.
- In some jurisdictions, doors and hardware must meet testing requirements for hurricane and tornado protection. Consult the applicable codes and manufacturers' certifications for compliance information.

The requirements for panic hardware vary by code. However, as more jurisdictions have adopted the International Building Code®, it has become less complicated to decide when and where to specify and supply panic hardware. The following codes were researched for this article. For more information, determine the code that is being enforced and refer to the appropriate edition of that code.

International Building Code® (IBC) – 2003, 2006, 2009, 2012, 2015

NFPA 101® Life Safety Code® (*NFPA 101®*) – 2003, 2006, 2009, 2012, 2015

NFPA 70 National Electrical Code - 2002, 2005, 2008, 2011, 2014

Decoded: Door closers

A door closer is used to control a door and may be affected by several different codes and standards, including limitations on opening force, closing speed, and hold-open methods.

Accessibility, fire and life safety requirements all have an effect on door closers, but if the product is selected and installed properly, these requirements may not be difficult to meet.

Accessibility

In the 1980s when the hardware industry began to focus more on standards for accessibility, many people assumed that door closers on an accessible route were required to have the delayed action feature. This feature holds the door open for up to a minute or two when the door is opened to 90 degrees, and although it may be convenient for certain locations, it is not a code requirement. In fact, many closers can meet the accessibility guidelines simply by proper adjustment. The two prevalent accessibility standards in the United States are ICC A117.1 – Accessible and Usable Buildings and Facilities and the 2010 ADA Standards for Accessible Design.

Closing speed

(See figure 5): Door closers must be adjusted so that it takes at least five seconds for the door to move from an open position of 90 degrees to 12 degrees from the latch. (ADA: 404.2.8.1; A117.1: 404.2.7.1)

Figure 5

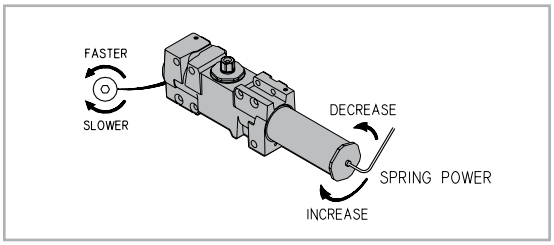
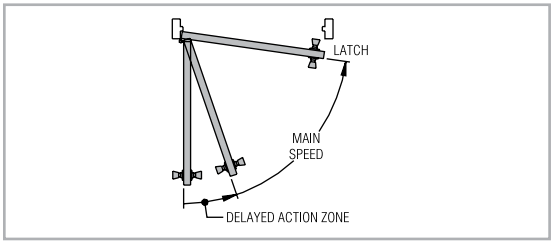


Figure 6



Opening force

The accessibility standards require interior hinged, sliding, or folding doors, other than fire doors, to be opened with five pounds maximum. This limitation applies to the force required to open the door, not the force required to release the latch. Fire doors are limited to the minimum opening force allowed by the AHJ – typically a size 3 closer is recommended by NFPA 80 for interior doors. Exterior doors are not addressed by the accessibility standards, but may be addressed by state or local accessibility requirements. The International Building Code limits the amount of opening force for accessible swinging doors to five pounds, and other egress doors to 15 pounds to release the latch, 30 pounds to set the door in motion and 15 pounds to open the door to the fully-open position. (ADA: 404.2.9; A117.1: 404.2.8; IBC 2015: 1010.1.3, IBC 2012, 2009: 1008.1.3)

Fire doors

One of the cardinal rules of fire-rated doors is that they must be self-closing, but there are many ways to hold open a fire door (see figure 7). A wall-or floor-mounted magnetic holder and a separate mechanical closer may

Figure 7

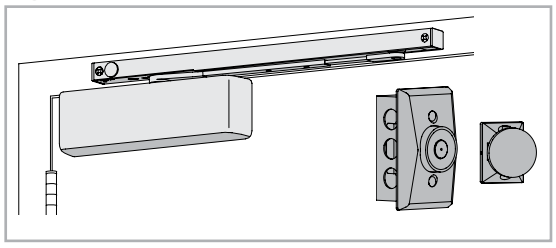
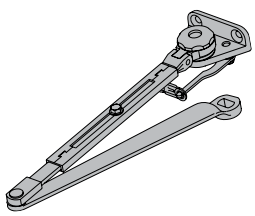


Figure 8



Note: Fusible link hold-open arms for door closers do not meet the requirements of IBC or NFPA 101" because they are not smoke-activated.

be used if the holder releases upon fire alarm/smoke detection. A closer with an integral electronic holder may either release upon fire alarm or may contain an integral smoke detector. For some retrofit applications, a battery-operated holder with an integral smoke detector may be used in conjunction with a separate mechanical closer. According to NFPA 80, Standard for Fire Doors and Other Opening Protectives (6.4.1), a closing device must be installed on every fire door. A couple of exceptions to that requirement are communicating doors between hotel rooms and the inactive leaf of pairs leading to rooms not normally occupied by humans, like a mechanical room (where acceptable to the AHJ). Closers must be securely attached with steel screws or through-bolts, and the closer must be adjusted so the door latches each time it closes.

NFPA 80 divides the operation of fire doors into three categories (2016, 2013: 6.1.3; 2010, 2007: 6.1.4):

- Self-closing door – the door is equipped with a closing device, and closes each time it is opened (no hold-open).
- Automatic-closing door – the door closes and latches automatically when released by an automatic fire detector.
- Power-operated fire door – the automatic operator is automatically disconnected during an alarm condition, allowing the door to close and latch.

Life safety

The International Building Code (IBC) and *NFPA 101 – The Life Safety Code* contain similar requirements for holding open fire doors, although they are more specific with regard to locations where automatic-closing doors are allowed, and how they are released. Automatic-closing doors must have the capability of manual release, and be automatically released by smoke detectors meeting the requirements of NFPA 72 – National Fire Alarm Code. When automatic-closing doors are used on stairs, they must be wired so all doors close when one door closes, protecting the exit enclosure. (*NFPA 101*: 7.2.1.8; 2015, 2012 IBC: 716.5.9; 2009 IBC: 715.4.8)
The following codes and standards were researched for this article. For more information, determine the code that is being enforced and refer to the appropriate edition of that code.

ADA Standards for Accessible Design - 2010

ICC/ANSI A117.1 – Accessible and Usable Buildings and Facilities – 2009

NFPA 80 – Fire Doors and Other Opening Protectives – 2007, 2010, 2013, 2016

NFPA 101® Life Safety Code® (*NFPA 101®*) – 2006, 2009, 2012, 2015

International Building Code (IBC) – 2009, 2012, 2015

Decoded: Fire door assembly inspection (FDIA) - Top 10 deficiencies

More attention is being focused on fire doors and egress doors as jurisdictions adopt editions of the International Fire Code (IFC) and NFPA 101 - The Life Safety Code dated 2009 or later. These recent codes reference editions of NFPA 80 - Standard for Fire Doors and Other Opening Protectives dated 2007, 2010, or 2013. Fire door assemblies and certain egress doors must be inspected annually per these publications and any deficiencies found must be corrected without delay.

The Door Security and Safety Foundation is an organization which exists to promote secure and safe openings that enhance life safety, through education and partnerships with like-minded organizations. The foundation's research has identified the top ten deficiencies on swinging doors with builders hardware:

1

Painted or missing fire door labels

The label found on the edge or top of a fire door and in the rabbet of a fire-rated frame may be made of metal, paper or plastic, or may be stamped or diecast into the door or frame. Labels must be visible and legible. Some embossed labels can still be read if they are painted, but if a painted label is illegible, the paint must be removed. If labels are missing or can't be made legible, the authority having jurisdiction may require the doors or frames to be re-labeled by a listing agency.

2

Poor clearance dimensions around the perimeter of the door in the closed position

The maximum clearance allowed by NFPA 80 between a fire door and the frame at the head, jambs, and meeting stiles of pairs is $^{1}/_{8}$ inch for wood doors, and $^{3}/_{16}$ inch for hollow metal doors (Note: The 2016 edition of NFPA 80 includes a change regarding perimeter clearance. Refer to page 19 of this guide.). The maximum clearance at the bottom of the door is $^{3}/_{4}$ inch. Prior to the 2007 edition, NFPA 80 included a variable requirement for the undercut, depending on the type of flooring.

New products have been successfully tested and listed for use on a fire door assembly where clearances are larger than what is allowed by NFPA 80. These products may be approved as an alternative to replacing the door. For clearances larger than those allowed by NFPA 80, listed gasketing products may be allowed as an alternative to replacing the door. Shimming the hinges with metal shims may help to correct the problem, and there are metal edges available which are listed for use when a door needs to be increased in width to reduce the clearance. Products are now available which have been tested and listed to address excessive clearance at the bottom of a fire door, or which extend the thickness of the frame stop when there are perimeter clearance problems.

3 Kick-down door holder

A kick-down door holder is a simple mechanical device which is mounted on the bottom corner of the door and flips down to hold the door open. Because fire doors must be self-closing or automatic-closing (there are a few exceptions), a kick-down holder is not an acceptable way of holding open a fire door. A mechanical hold-open feature in a door closer and other types of hold-opens such as wedges, hooks, and overhead holders are not allowed on fire doors either.

An automatic-closing fire door is held open electronically, and closes upon fire alarm. This may be accomplished with a wall- or floor-mounted magnetic holder, a closer-holder unit which receives a signal from the fire alarm system or incorporates its own smoke detector, or a separate hold-open unit which is paired with a standard door closer. There is also a battery-operated hold-open available which can be used in some retrofit applications.

Existing fire doors are sometimes equipped with fusible link closer arms, which incorporate a fusible link that is intended to melt during a fire and release the hold-open. Current building and life safety codes do not allow fusible link arms on doors in a means of egress, because they do not allow the doors to control the spread of smoke. Automatic-closing doors must be initiated by the fire alarm system or smoke detection.

4 Auxiliary hardware items that interfere with the intended function of the door

These auxiliary items may include creative ways of holding open the door or providing additional security. In many cases the auxiliary items create an egress problem, for example, additional locks or surface bolts (most egress doors must unlatch with one operation), chains or creative devices used with panic hardware, or electronic access control products that have not been installed with the required release devices for code compliance. Hardware used on fire doors must be listed for that use, and items not listed for use on a fire door must be removed. Holes left by the removal of auxiliary items must be filled in accordance with NFPA 80, typically either with steel fasteners, or with the same material as the door or frame.

Field preparation for these auxiliary items may also create a problem on fire doors. NFPA 80 limits job site preparation of fire doors to holes for surface-applied hardware, function holes for mortise locks, and holes for labeled viewers. The maximum hole diameter is 1 inch (25 mm), except holes for cylinders which may be any diameter (Note: The 2016 edition of NFPA 80 includes several changes with regard to job-site preparations. Refer to page 18.). Protection plates may be field-installed, and wood and composite doors may be undercut in the field a maximum of ¾ inch (19 mm) (check with the door manufacturer first). Field modifications beyond what is allowed by NFPA 80 may void the label and require re-labeling of the assembly. New fire door caulk is now available but there are limitations on door material and hole size.

5 Fire doors blocked to stay in the open position

If a fire door is not able to close, it can't compartmentalize the building and prevent the spread of fire and smoke. Fire doors are typically blocked open for the convenience of the building's occupants. Many people don't understand the function of fire doors, and may compromise life safety without realizing the results of their actions. Educating facilities staff and the building's occupants on fire door requirements can help to avoid a problem, and/or a fine from the local fire marshal.

6 Area surrounding the fire door assembly blocked by furniture, equipment and/or boxes

In addition to the annual inspection of fire doors, recent editions of NFPA 101 – *The Life Safety Code* require certain egress doors to be inspected annually as well. The area leading to fire and egress doors must be kept clear for egress purposes, and to provide the required maneuvering clearance for accessible openings.

If a fire door is no longer used as a door, building occupants will sometimes place furniture or stack stored items against the door. NFPA 80 requires fire doors that are no longer in use to be removed and replaced with wall construction matching the adjacent wall. A fire door typically carries a lower hourly rating than the wall, because the fuel load against an operable door is much less than a wall with furniture and other materials against it. If a 20-minute door in a 1-hour wall has an increased fuel load because it is no longer operable, it will not be able to withstand fire for the required amount of time. Check required egress routes before removing any door.

7 Broken, defective or missing hardware items (latch bolts and/or strike plates, closer arms, cover plates, etc.)

Hardware may not perform as designed and tested if it is missing parts or if the hardware has become damaged. Bent closer arms may not close the door properly. Missing cover plates may create a passage for smoke, and a missing strike or latchbolt could mean that the door does not stay positively latched when exposed to the pressures of a fire. When defective hardware is noted, it must be repaired.

8 Fire exit hardware installed on doors that are not labeled for use with fire exit hardware

Fire exit hardware is essentially panic hardware which is listed for use on a fire-rated door. It is not equipped with mechanical dogging (the ability to hold back the latch) since fire doors need to positively latch, although electric dogging may be used as long as the latch projects upon fire alarm.

Fire exit hardware is not required for every fire door. Its use is determined by the occupancy type and the occupant load. The IBC requires panic hardware / fire exit hardware for Assembly and Educational occupancies with an occupant load of 50 people or more (2006 edition and later), 100 people or more (2000 and 2003 editions). NFPA 101 requires panic hardware / fire exit hardware for Assembly, Educational, and Day Care occupancies with an occupant load of 100 people or more.

When fire exit hardware is used, NFPA 80 requires the door to have a label stating, "Fire door to be equipped with fire exit hardware." This ensures that the door is properly reinforced for the fire exit hardware. An existing door which is prepped for a lockset would not typically be reinforced for fire exit hardware or carry the proper label, so fire exit hardware should not be retrofitted to an existing door that was not originally prepped for it.

9 Missing or incorrect fasteners

In most cases, hardware must be installed with the fasteners provided by the manufacturer. Installers sometimes use other fasteners for faster installation or because the original fasteners have been lost. There must be no missing fasteners on hardware installed on fire doors, and some products may require through-bolts if the door does not have adequate blocking or reinforcing.

10 Bottom flush bolts that do not project ½" into the strike

Flush bolts are used on the inactive leaf of pairs of doors when the active leaf has a lockset. There are three types – manual, automatic, and constant-latching. They typically project into the frame head and into the floor, although there are some automatic and constant-latching bolts which have a top bolt only, and incorporate an auxiliary fire pin which projects when a certain temperature is reached and engages into the edge of the other door.

Manual flush bolts are projected and retracted manually, and are only allowed by NFPA 80 on fire doors "where acceptable to the AHJ, provided they do not pose a hazard to safety to life." Annex A – Explanatory Material states, "This provision limits their use to rooms not normally occupied by humans (e.g., transformer vaults and storage rooms)." The use of manual flush bolts is also limited to certain applications by the egress code requirements, because it requires two motions to unlatch the door when manual flush bolts are installed, and they are not within the allowable reach range for accessibility.

Automatic flush bolts project automatically when the active leaf is closed, via a small trigger on each bolt. When the active leaf is opened, the bolts retract automatically, making them acceptable for use on most egress doors which don't require panic hardware as long as the inactive leaf is not equipped with "dummy" hardware (lever or bar) which suggests that the inactive leaf can be operated independently. Automatic flush bolts are considered positive-latching and can be used on fire doors as long as fire exit hardware is not required. A coordinator is also required to ensure that the inactive leaf closes before the active leaf.

Constant latching flush bolts have an automatic flush bolt on the bottom, and the top is a spring-loaded bolt which is retracted manually to open the door. These bolts provide a higher degree of security than the other two because the inactive leaf is more likely to be closed and latched properly. They can be an egress issue for some doors because the top bolt has to be retracted manually, and it is not within the accessible reach range. A coordinator is also required for this application.

When the bottom bolt doesn't engage properly, there is no assurance that the fire door will perform as it was designed and tested during a fire. The undercut of the door must be carefully coordinated to ensure the proper engagement of the bottom bolt. Another issue with flush bolts on fire doors is that the coordinator / auto flush bolt combination can be difficult to keep functional in a high-use opening. If the latches don't retract properly or if the inactive leaf is pulled or pushed without opening the active leaf first, the corners of the door can be susceptible to damage because of the volume of material removed to prepare the door for the flush bolt. This is a particular problem on wood doors.

The new requirements for the annual inspection of fire and egress doors have drawn attention to the condition of existing doors, and the potential failure of these doors to perform in a fire or emergency. If the inspection requirements are not being enforced in your area, fire and egress doors are still required to be properly maintained, so now is the time to make a plan for inspecting the doors in your facility and repairing or replacing deficient components. Written documentation of fire door inspections must be kept for review by the Authority Having Jurisdiction. Inspections may be conducted by an individual who is knowledgeable about the type of doors being inspected, and there are several fire door inspection training programs available.

These photos illustrate the value of a code-compliant fire door. This door prevented the spread of fire from a maintenance area to the rest of the Robert Moses Nature Center. It's easy to imagine what the outcome would have been if the door had been propped open.

Photos courtesy of Fire Protection Specialist Christopher Taylor, NYS Office of Fire Prevention and Control.

Decoded: NFPA 80 – 2013 FDAI changes

The 2013 edition of NFPA 80 – Standard for Fire Doors and Other Opening Protectives includes some important changes in chapter 5, many of them related to fire door assembly inspection.

It will likely be several years before this edition of the standard is referenced in a building code or fire code and adopted by a jurisdiction, but some of the clarifications and best practices can be implemented now.

Field modifications

Previous editions of NFPA 80 contain language supporting laboratory approval of field modifications, but this was further clarified in the 2013 edition. Acceptable field modifications are addressed in chapter 4 – General requirements, in the paragraphs related to appurtenances. But when a field modification is desired that is not covered by that section, chapter 5 states that the listing laboratory shall be contacted through the manufacturer and a written or graphic description of the modification provided. The laboratory may then provide written authorization to perform the work without a field visit from the laboratory or relabeling of the opening. If the manufacturer is no longer available, the laboratory may provide an engineering evaluation to support the field modification.

> From Annex A of NFPA 80 – 2013: A.5.1.4.1 field modifications beyond the scope of the prescriptive allowances permitted by 4.1.3.2 through 4.1.3.4 typically result in voiding the fire rating of the assembly. Paragraph 4.1.4.2.1 provides an alternative method whereby proposed modifications can be documented and presented to the labeling agency prior to work commencing. Where the proposed modifications(s) are within the parameters of the manufacturer's procedures and will not degrade the fire resistance of the assembly, the labeling agency is permitted to authorize such modifications without a requirement for a subsequent field inspection.

Inspection and testing

While the 2007 and 2010 editions of NFPA 80 require documented inspection and testing of fire door assemblies annually, the 2013 edition includes additional requirements for the inspection and testing of door, shutter and window assemblies upon completion of their installation (5.2.1), and also upon completion of maintenance work on fire door assemblies (5.2.2.5).

- When a building code references the 2013 edition of NFPA 80, newly-installed fire door assemblies must be inspected and tested.
- When fire door assemblies are repaired and the governing code references NFPA 80-2013, the assemblies must be inspected and tested immediately upon completion of the work to ensure that they are in compliance with NFPA 80.
- When a fire code references the 2007, 2010 or 2013 editions of NFPA 80 for maintenance of fire doors, all fire door assemblies must be inspected and tested annually.

Records of these inspections must be retained for at least three years and the media used must be able to survive for the required retention period.

> From NFPA 80-2013, the information required to be included in the inspection report:
> 5.2.2.4 A record of all inspections and testing shall be provided that includes, but is not limited to, the following information:
> (1) Date of inspection
> (2) Name of facility
> (3) Address of facility
> (4) Name of person(s) performing inspections and testing
> (5) Company name and address of inspecting company
> (6) Signature of inspector of record
> (7) Individual record of each inspected and tested fire door assembly
> (8) Opening identifier and location of each inspected and tested fire door assembly

(9) Type and description of each inspected and tested fire door assembly
(10) Verification of visual inspection and functional operation
(11) Listing of deficiencies in accordance with 5.2.3, section 5.3 and section 5.4

Acceptance testing

Previous editions of NFPA 80 require inspections to be conducted by individuals with knowledge and understanding of the type of door being tested. The 2013 edition added a requirement for the inspections to be performed by a "qualified person" with this knowledge and understanding. This term was defined in the 2010 edition and is also included in the 2013 edition:

> Qualified person. A person who, by possession of a recognized degree, certificate, professional standing or skill, and who, by knowledge, training and experience has demonstrated the ability to deal with the subject matter, the work or the project.

This person is required to do a visual inspection before testing to identify any damaged or missing parts that could create a hazard or affect operation. The acceptance testing must include closing the door by all means of activation and a record must be kept, documenting the inspections and testing.

Inspection criteria

In addition to the 11 inspection criteria previously included in the standard, two new criteria have been added (#1 and 13):

> 5.2.3.5.2 As a minimum, the following items shall be verified:
> (1) Labels are clearly visible and legible.
> (2) No open holes or breaks exist in surfaces of either the door or frame.
> (3) Glazing, vision light frames and glazing beads are intact and securely fastened in place, if so equipped.
> (4) The door, frame, hinges, hardware, and noncombustible threshold are secured, aligned, and in working order with no visible signs of damage.
> (5) No parts are missing or broken.
> (6) Door clearances do not exceed clearances listed in 4.8.4 and 6.3.1.7.
> (7) The self-closing device is operational; that is, the active door completely closes when operated from the full open position.
> (8) If a coordinator is installed, the inactive leaf closes before the active leaf.
> (9) Latching hardware operates and secures the door when it is in the closed position.
> (10) Auxiliary hardware items that interfere or prohibit operation are not installed on the door or frame.
> (11) No field modifications to the door assembly have been performed that void the label.
> (12) Meeting edge protection, gasketing and edge seals, where required, are inspected to verify their presence and integrity.
> (13) Signage affixed to a door meets the requirements listed in 4.1.4.

As in previous editions of NFPA 80, any deficiencies noted during the inspection process must be repaired "without delay."

These changes to NFPA 80 will complement the previously-included requirements and will go even further to ensure that fire door assemblies are installed properly and remain in accordance with the standard throughout the life of the opening. Code-compliant fire doors which function as designed and tested will compartmentalize the building to protect building occupants and property, and help to provide a safe means of egress if a fire occurs.

Decoded: Electrified hardware refresher

The 2015 International Building Code (IBC) Commentary, available from the International Code Council, includes updated information which helps to clarify the code requirements that pertain to electrified hardware.

Although the code language has been refined over the last few editions of both the IBC and NFPA 101 – The Life Safety Code, the code requirements for electrified hardware continue to be confusing for many, often resulting in inconsistent application and enforcement.

There are 7 basic code categories for electrified hardware used to control access or egress, and this edition of Decoded provides a brief refresher on each as well as some recent code changes. Many of these code applications, but not all, fall into the category commonly called "special locking arrangements." The code references are provided to facilitate further research. Some jurisdictions have modified the national requirements for electrified hardware, so it's very important to check local codes as well.

Controlled access / free egress

The majority of electrified hardware applications fall into this category. An access control reader is typically mounted on the ingress side of the opening, to control access. On the egress side, the door hardware allows free egress – just turn the lever or push the touchpad of the panic hardware. The access control reader does not inhibit egress, it controls access only, and the system typically includes an electrified lockset, electrified lever trim, electric strike, or electric latch retraction device. If electric latch retraction devices or electric strikes are installed on fire doors, they must automatically provide positive latching upon fire alarm.

When a door equipped with an access control reader allows free egress using normal operation of the hardware, it is not typically considered one of the special locking arrangements.

This type of system is not addressed by the codes as a special locking arrangement, because it allows free egress just as a standard mechanical lockset or panic hardware would. These doors are subject to the typical code requirements for operable hardware: doors must be readily openable from the egress side without keys, tools, or special knowledge or effort, and without tight grasping, tight pinching, or twisting of the wrist. One operation must unlatch the door from the egress side, and operable hardware must be mounted between 34 inches and 48 inches above the floor. Applications which do not allow immediate free egress will typically fall into one of the categories outlined below.

Delayed egress

Delayed egress locking systems may include panic hardware or an electromagnetic lock with delayed egress circuitry, or a delayed egress controller used in combination with other listed components. This hardware delays egress for 15 seconds (or 30 seconds when approved by the Authority Having Jurisdiction (AHJ)). The use of these locks is dependent upon the use group or occupancy classification, and the requirements vary between the IBC and NFPA 101. The IBC

does not allow delayed egress locks on Assembly, Educational, or High Hazard occupancies; NFPA 101 includes limitations specific to each occupancy classification.

There are many conditions for the use of delayed egress locks, including a sprinkler / fire alarm system which releases the lock to allow immediate egress upon activation, a local audible alarm, signage, remote release, emergency lighting, release on power failure, and limitations on the number of delays in an egress route. Activation requirements to begin the 15-second timer include a maximum force of 15 pounds applied for no more than 3 seconds. Prior to the 2015 edition of the IBC, activation was required after a 1-second application of force, but this has been changed to 3 seconds which is consistent with the NFPA 101 requirements. The 2015 edition of the IBC also added a requirement for delayed egress locks to be listed in accordance with UL 294 – Access Control System Units. The 2015 requirements apply to jurisdictions where this edition has been adopted.

In the 2015 edition of the IBC, the activation time for delayed egress locks has changed from 1 second to 3 seconds, which is consistent with NFPA 101.

Controlled egress

This application is specific to health care occupancies equipped throughout with an automatic sprinkler system or automatic smoke or heat detection system, and allows certain types of units to have locked doors in a means of egress when this control is needed for the safety or security of the patients. The codes are not specific about the types of units where this locking is allowed – this is left up to the AHJ. A common location would be a memory care unit housing patients with dementia, although areas such as pediatrics, maternity, and emergency rooms may be considered.

Controlled egress locks are allowed in some health care units, but staff must be prepared to facilitate egress if needed.

The most common locks used in a controlled egress system are electromagnetic locks, or delayed egress devices which have been modified to have an “infinite delay” instead of the typical 15-second delay. Both of these products would be fail-safe, allowing free egress when power is removed. When this section was introduced in the 2009 IBC, the locks were incorrectly called “delayed egress locks” even though this section of the code does not require a time delay. This terminology was changed to “special egress” in the 2012 edition, and is now called “controlled egress” in the 2015 edition.

All clinical staff is required to carry the keys, codes, or other credentials required to operate these locks, and the unlocking procedures must be part of the facility’s emergency plan. For most types of units, the locks must automatically unlock to allow immediate egress upon actuation of the fire alarm or sprinkler system and upon power failure. A remote switch located at the fire command center, nurses’ station, or other approved location must directly break power to the lock to unlock the door. Some areas, such as behavioral health units or a location where an infant abduction system is used may be exempt from the automatic unlocking requirements. The IBC states that a building occupant must not be required to pass through more than one door with a controlled egress lock before entering an exit, and emergency lighting is required at the door. The 2015 IBC has added a requirement for the locking system to be listed in accordance with UL 294. The NFPA 101 requirements vary slightly so refer to the referenced section for specifics.

Electromagnetic lock with sensor release

In most recent editions of the IBC and NFPA 101, the section that applies to mag-locks released by a sensor is called Access Controlled Egress Doors. Because of this title, this section was sometimes misapplied to all doors with access control readers, even though those doors typically allow free egress without sensors or other release devices. In the 2015 IBC, the title of the section was changed to Sensor Release of Electrically Locked Egress Doors, to avoid this confusion. Mag-locks that are unlocked by door-mounted hardware are addressed by a different set of code requirements.

When a mag-lock released by a sensor is used, the use group or occupancy type must be one where this application is allowed. In addition to the motion sensor which detects an approaching occupant, the lock must be unlocked by actuation of the fire alarm / sprinkler system (if present), loss of power, and a signal from a push button. The push button must unlock the lock for 30 seconds independent of the access control system, and must be located 40 inches to 48 inches vertically above the floor and within 5 feet of the door. Ready access must be provided to the push button, and it must be marked "Push to Exit."

The section called Access Controlled Egress Doors has been changed to Sensor Release of Electrically Locked Egress Doors in the 2015 IBC.

Electromagnetic lock with door hardware release

A new section was added to the IBC and NFPA 101 in the 2009 editions, which addresses doors with mag-locks that are released by hardware mounted on the door. The door-mounted hardware may include a lever handle, panic hardware, or other device equipped with a request-to-exit (REX or RX) switch or electronic touch sensor. The added section clarifies the code requirements for mag-locks released this way, vs. mag-locks released by a sensor (see above).

When a mag-lock released by door-mounted hardware is used, the use group or occupancy type must be one where this application is allowed. The door must be equipped with listed hardware mounted on the door leaf, which incorporates a built-in switch to directly release the electromagnetic lock and unlock the door immediately. The release device must have an obvious method of operation, and must be readily operated with one hand under all lighting conditions. The code requirements that address this application do not require the lock to unlock upon actuation of the fire alarm or sprinkler system, but the lock must unlock upon loss of power to the switch in the door-mounted hardware.

Mag-locks released by hardware mounted on the door are addressed in a separate code section from mag-locks released by a sensor.

Elevator lobby egress

The IBC does not currently include a section specific to locks on elevator lobby doors; elevator lobbies are required to have a code-compliant means of egress, so methods used to secure the doors would be limited by the IBC to an alarm to deter access, or possibly a delayed egress lock. For facilities where NFPA 101 (2009 edition or later) is enforced, a fail-safe lock may be used if other criteria are met. This lock will allow access through the secured doors during a fire alarm, so building occupants can find another exit. Some jurisdictions have adopted modifications to the IBC which address locks on elevator lobby doors.

NFPA 101 permits electrified locking of elevator lobby doors only where the building has an automatic sprinkler system or a fire alarm system and where this type of locking is allowed by the occupancy chapters. The lock must unlock automatically upon actuation of the sprinkler system or fire alarm system (except when the

Electrified locking of elevator lobby doors is only addressed by NFPA 101, not the IBC, although some jurisdictions have adopted code modifications that allow it.

system is initiated by a manual fire alarm box) and upon loss of power to the lock. When the lock is unlocked, the doors must remain unlocked until the fire alarm system has been manually reset. If the locking hardware has a latch, there must be code-compliant hardware on the door leaf to release the latch. Locking systems used on elevator lobby doors must be listed in accordance with UL 294, and a two-way communication system must be installed in the elevator lobby to allow a building occupant to call for help.

Stairwell reentry

If stair doors are locked on the stair side, they must allow reentry back into the building to ensure the safety of building occupants during a fire. If a stairwell becomes compromised by smoke, occupants are able to leave the stair through remotely-unlocked doors and find another exit. These unlocked stair doors also allow firefighters access to each floor.

A fail-safe lockset or fail-safe lever trim for fire exit hardware is typically used to meet the stairwell reentry requirements; a less common option is a frame-mounted device that controls the locking/unlocking of a modified mechanical mortise lock. Electric strikes may not be used for stairwell reentry, because electric strikes on fire doors must be fail-secure; fail-safe electric strikes are not allowed on fire door assemblies. Electromagnetic locks are occasionally used for stairwell reentry, particularly for retrofit applications. Latching hardware is required in addition to the electromagnetic lock, to provide the positive latching required for fire doors.

The stairwell reentry requirements vary between the IBC and NFPA 101; the IBC requires all stair doors to allow reentry with the exception of the discharge door.

The requirements for stairwell reentry differ from the IBC to NFPA 101. With the exception of the 2003 edition, the IBC requires all stair doors to facilitate re-entry with the capability of remote unlocking from the fire command center. In addition, the IBC requires high-rise buildings to have a stairway communication system.

NFPA 101 allows stairs serving 4 stories or less to have mechanical locks on the stair side, which do not allow reentry. In most facilities, stairs serving more than 4 stories must allow reentry when the fire alarm system is actuated. NFPA 101 also includes an option called “selected reentry” which allows some doors to be mechanically locked, while others allow reentry.

Conclusion

When considering which code requirements to follow, first identify which category the hardware falls into, and refer to the applicable code section. This summary is not intended to provide complete information about each of the types of electrified locks referenced. For more information, refer to the referenced code sections. Keep in mind that state or local requirements could differ from those of the IBC or NFPA 101, so it’s important to be aware of the codes in your facility’s jurisdiction. Refer to the published codes for the detailed code requirements, and consult the Authority Having Jurisdiction for more information about the local requirements.

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