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ALLEGIONTM

Program Name: Decoded 2 – Fire Door Assemblies

Program Number: CDW406

Learning Units: One CEH (HSW)

Provider Number: J247

Provider Name: Allegion

Description:

Decoded 2 – Fire Door Assemblies: The second class of this 4-part webinar series covers the requirements of NFPA 80 – Standard for Fire Doors and Other Opening Protectives, which ensure that fire doors perform as designed if there is a fire. Requirements for fire door assemblies include positive-latching, door operation, minimal clearances for smoke control, and testing of the various components. The criteria and procedures for annual inspection of fire doors will also be discussed.

Decoded 2 – Fire Door Assemblies

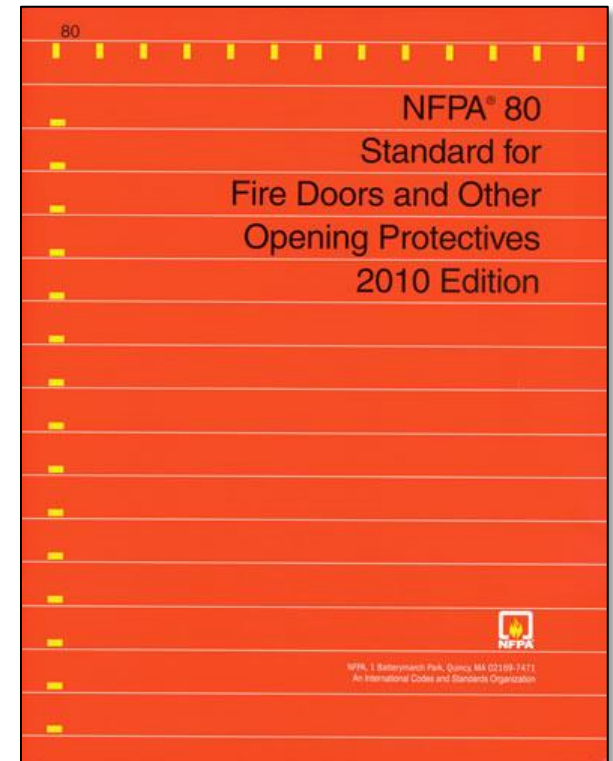
Learning Objectives

Upon successful completion of this program participants should be able to:

1. Discuss the standard for fire door assemblies – NFPA 80, and the sections which apply to swinging doors with builders hardware.
2. State when and where fire rated assemblies would be used, and describe the purpose of fire doors.
3. List basic rules for fire doors which ensure that fire doors will be closed and latched if there is a fire, with minimal smoke infiltration.
4. Review the requirements for annual inspection of fire doors, including inspection criteria and procedures.

Session 2 – Fire Doors

- NFPA 80 – format and organization
- Purpose of fire doors
- Fire ratings and testing
- Basic fire door requirements
- Fire Door Assembly Inspection



80

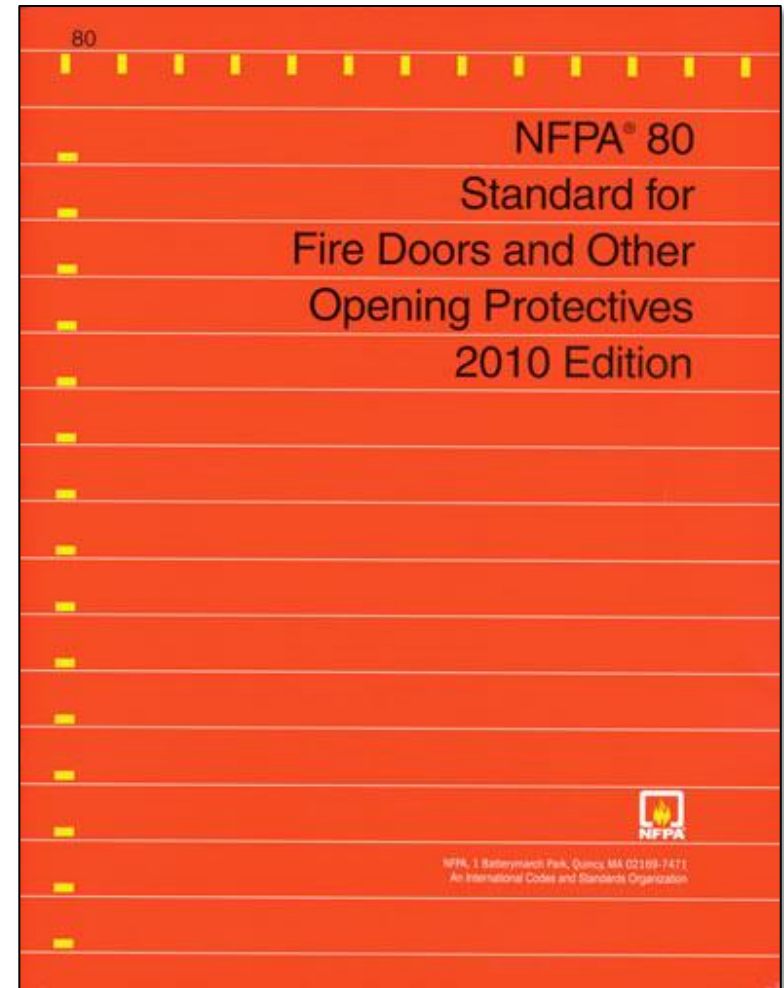
NFPA® 80
Standard for
Fire Doors and Other
Opening Protectives
2010 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02269-7471
An International Codes and Standards Organization

NFPA 80

- NFPA 80 details the requirements for fire doors.
- NFPA 80 does not state where fire doors are required.
- Referenced by the IBC, NFPA 101, and other codes.
- **Recent Editions: 1999, 2007, 2010, 2013**
- COR140 exam uses the 2007 edition



NFPA 80

- * = More information in Annex A – Explanatory Material
- | = Revised in the last code change cycle.

Chapter 1 Administration

1.1* **Scope.** This standard regulates the installation and maintenance of assemblies and devices used to protect openings in walls, floors, and ceilings against the spread of fire and smoke within, into, or out of buildings.

1.1.1* With the exception of fabric fire safety curtain assemblies, this standard addresses assemblies that have been subjected to standardized fire tests. *(See Chapter 20.)*

1.1.2* Incinerator doors, record room doors, and vault doors are not covered in this standard.

1.1.3* Requirements for horizontally sliding, vertically sliding, and swinging doors as used in this standard do not apply to hoistway doors for elevators and dumbwaiters.

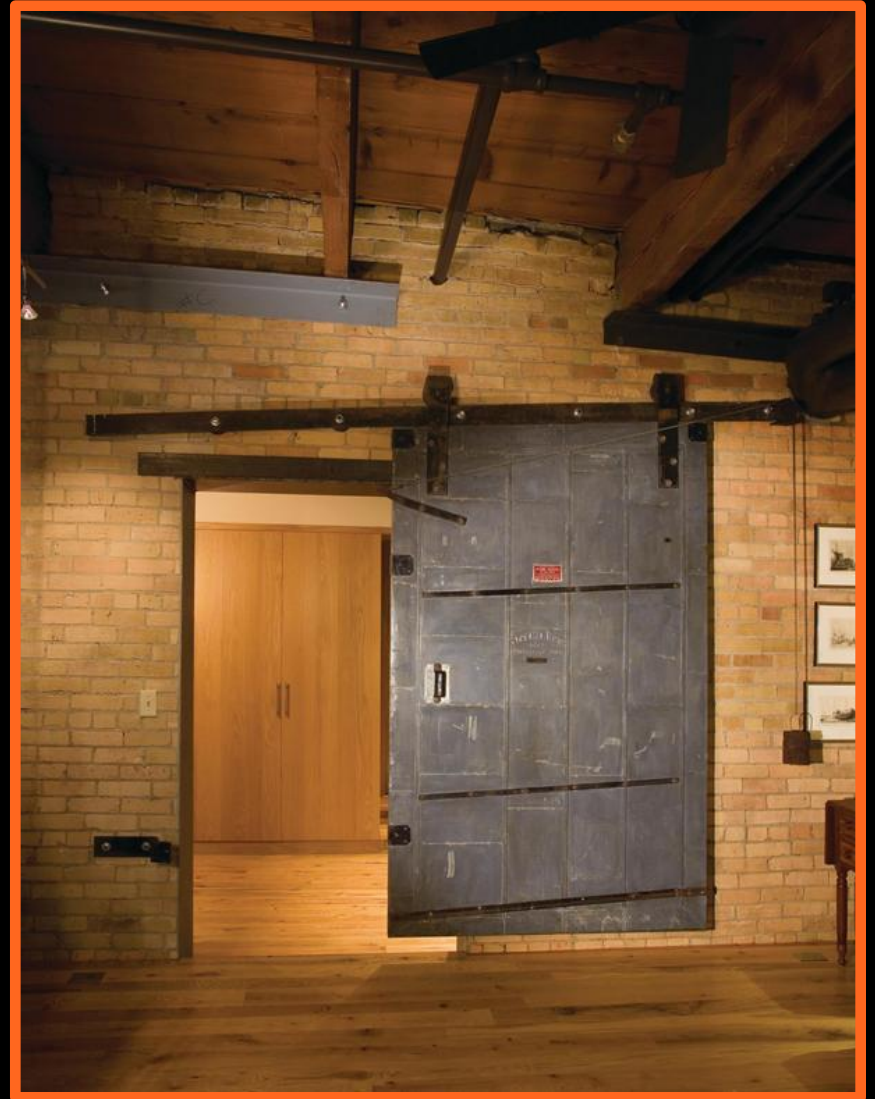
1.1.4* This standard does not cover fire resistance glazing materials and horizontally sliding accordion or folding assemblies fabricated for use as walls and tested as wall assemblies in accordance with NFPA 251, *Standard Methods of Tests of Fire Resistance of Building Construction and Materials*.

NFPA 80 – Standard for Fire Doors and Other Opening Protectives

- Chapter 1 – Administration
- Chapter 2 – Referenced Publications
- Chapter 3 – Definitions
- Chapter 4 – General Requirements
- Chapter 5 – Care and Maintenance
- **Chapter 6 – Swinging Doors with Builders Hardware**
- **Chapter 7 – Swinging Doors with Fire Door Hardware**
- Chapters 8-20 – Other Types of Doors, Glass Block, Dampers, Curtains
- Annexes



Swinging Doors with Builders Hardware



Swinging and Sliding Doors with Fire Door Hardware

Classification of Openings

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

Fire Door Ratings

- Common Ratings
 - A – 3 hours
 - B – 90 minutes or 60 minutes
 - C – 45 minutes
 - 20 minutes



**TABLE 716.5
OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS**

| TYPE OF ASSEMBLY | REQUIRED WALL ASSEMBLY RATING (hours) | MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours) | DOOR VISION PANEL SIZE | FIRE RATED GLAZING MARKING DOOR VISION PANEL* | MINIMUM SIDELIGHT/TRANSOM ASSEMBLY RATING (hours) | | FIRE-RATED GLAZING MARKING SIDELITE/TRANSOM PANEL | |
|--|---------------------------------------|--|----------------------------|---|---|-----------------|---|-----------------|
| | | | | | Fire protection | Fire resistance | Fire protection | Fire resistance |
| Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour | 4 | 3 | Not Permitted | Not Permitted | Not Permitted | 4 | Not Permitted | W-240 |
| | 3 | 3 ^a | Not Permitted | Not Permitted | Not Permitted | 3 | Not Permitted | W-180 |
| | 2 | 1½ | 100 sq. in. ^c | ≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90 | Not Permitted | 2 | Not Permitted | W-120 |
| | 1½ | 1½ | 100 sq. in. ^c | ≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90 | Not Permitted | 1½ | Not Permitted | W-90 |
| Shaft, exit enclosures and exit passageway walls | 2 | 1½ | 100 sq. in. ^{c,d} | ≤100 sq.in. = D-H-90 > 100 sq.in.= D-H-T-or D-H-T-W-90 | Not Permitted | 2 | Not Permitted | W-120 |
| Fire barriers having a required fire-resistance rating of 1 hour: Enclosures for shafts, exit access stairways, exit access ramps, interior exit stairways, interior exit ramps and exit passageway walls | 1 | 1 | 100 sq. in. ^{c,d} | ≤100 sq.in. = D-H-60 >100 sq.in.= D-H-T-60 or D-H-T-W-60 | Not Permitted | 1 | Not Permitted | W-60 |

| | | | | | Fire protection | |
|------------------------------------|-----|-----------------|---------------------|-----------|-----------------|-----------|
| Other fire barriers | 1 | $\frac{3}{4}$ | Maximum size tested | D-H-NT-45 | $\frac{3}{4}$ | D-H-NT-45 |
| Fire partitions: Corridor walls | 1 | $\frac{1}{3}^b$ | Maximum size tested | D-20 | $\frac{3}{4}^b$ | D-H-OH-45 |
| | 0.5 | $\frac{1}{3}^b$ | Maximum size tested | D-20 | $\frac{1}{3}$ | D-H-OH-20 |
| Other fire partitions | 1 | $\frac{3}{4}$ | Maximum size tested | D-H-45 | $\frac{3}{4}$ | D-H-45 |
| | 0.5 | $\frac{1}{3}$ | Maximum size tested | D-H-20 | $\frac{1}{3}$ | D-H-20 |

| TYPE OF ASSEMBLY | REQUIRED WALL ASSEMBLY RATING (hours) | MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours) | DOOR VISION PANEL SIZE | FIRE RATED GLAZING MARKING DOOR VISION PANEL ^a | MINIMUM SIDELIGHT/TRANSOM ASSEMBLY RATING (hours) | | FIRE-RATED GLAZING MARKING SIDELITE/TRANSOM PANEL | |
|------------------|---------------------------------------|--|--------------------------|---|---|-----------------|---|-----------------|
| | | | | | Fire protection | Fire resistance | Fire protection | Fire resistance |
| Exterior walls | 3 | $1\frac{1}{2}$ | 100 sq. in. ^c | ≤100 sq.in. = D-H-90 | Not Permitted | 3 | Not Permitted | W-180 |
| | | | | >100 sq.in = D-H-W-90 | | | | |
| | 2 | $1\frac{1}{2}$ | 100 sq. in. ^c | ≤100 sq.in. = D-H-90 | Not Permitted | 2 | Not Permitted | W-120 |
| | | | | >100 sq.in.= D-H-W-90 | | | | |
| | | | | | Fire Protection | | | |
| | 1 | $\frac{3}{4}$ | Maximum size tested | D-H-45 | $\frac{3}{4}$ | | D-H-45 | |
| Smoke barriers | | | | | Fire protection | | | |
| | 1 | $\frac{1}{3}^b$ | Maximum size tested | D-20 | $\frac{3}{4}$ | | D-H-OH-45 | |

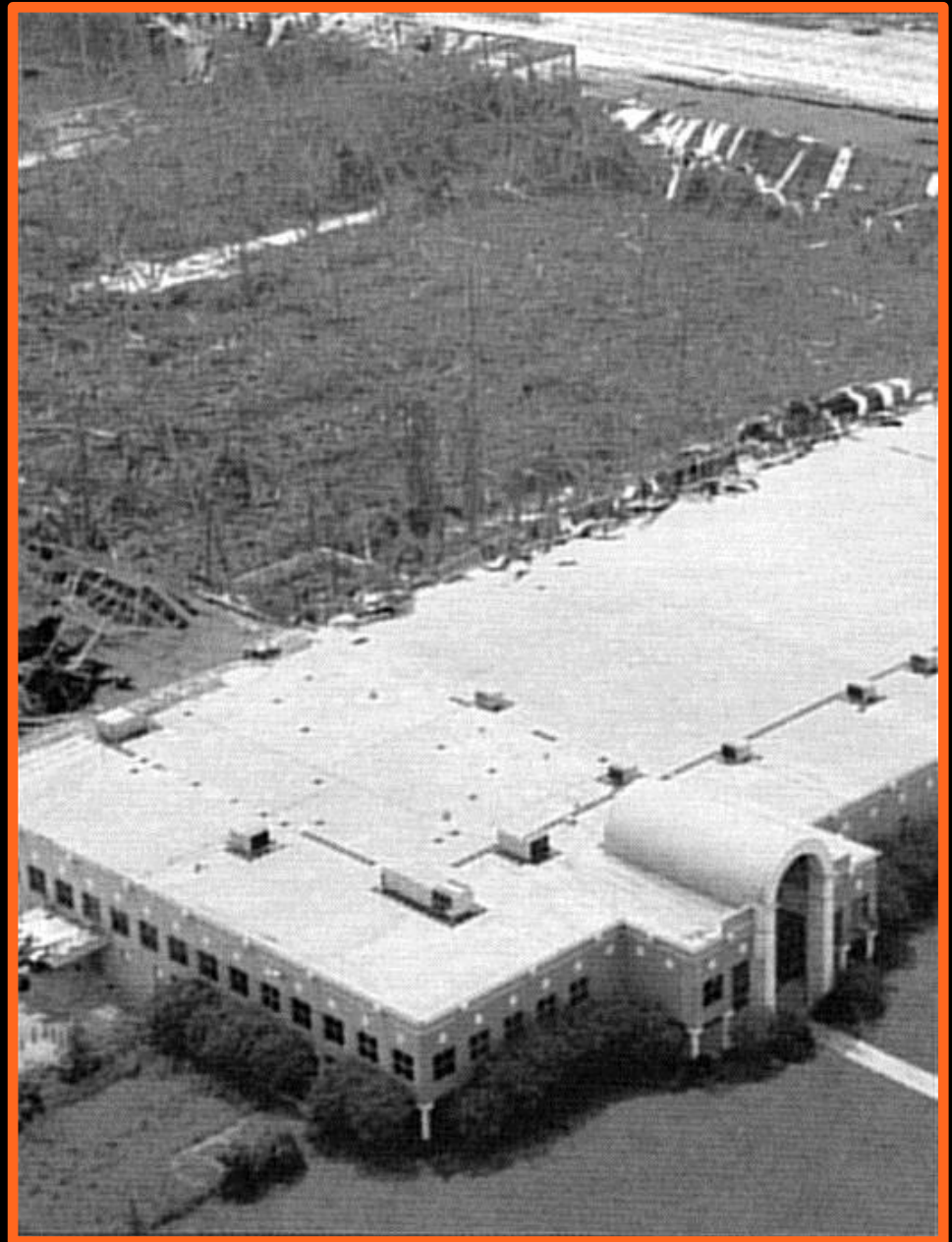
What's the point?



History has shown us the importance of operational fire and egress doors.

A warehouse fire in 1996 left only the part of the building protected by fire doors intact.

Source: NFPA Journal



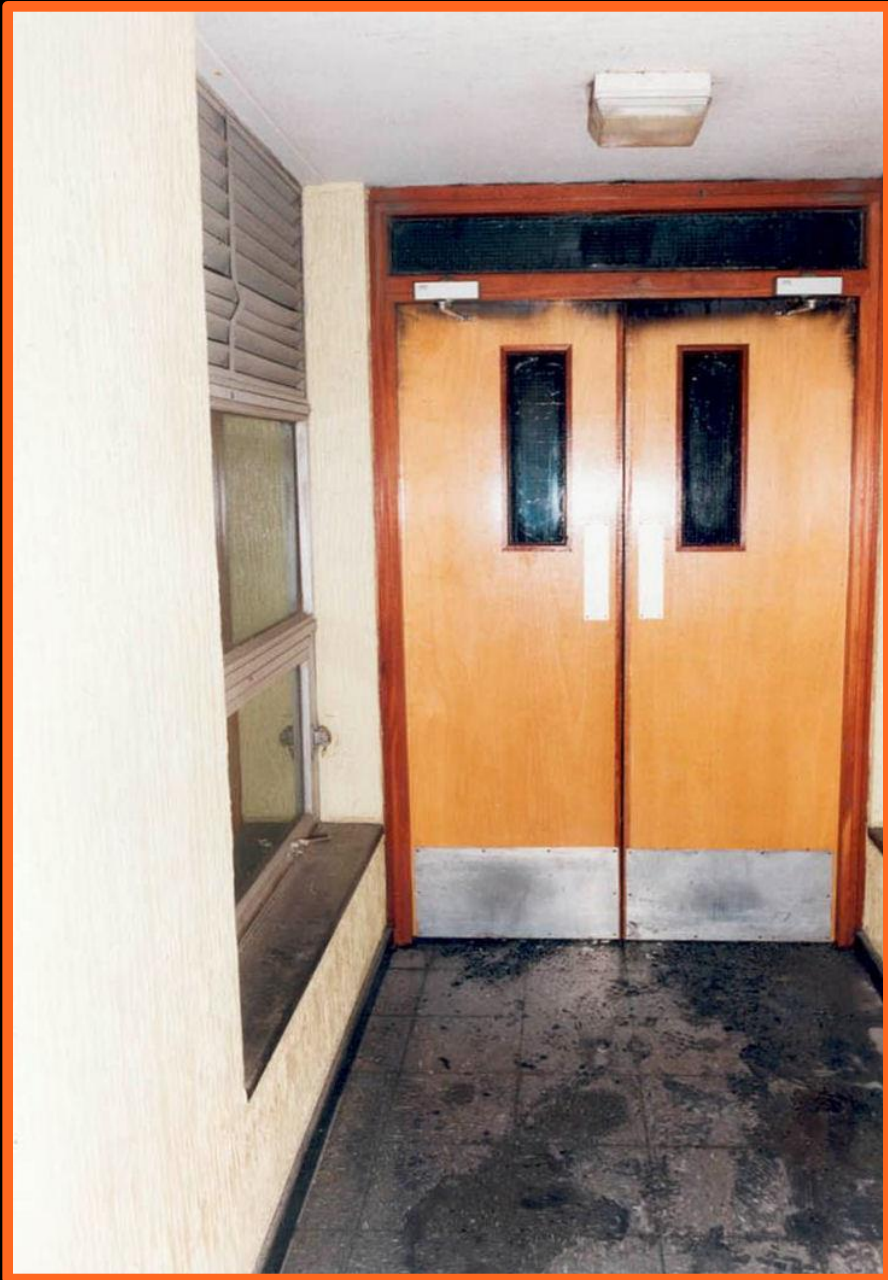
The Robert Moses Nature Center was protected by this fire door.





Properly Closed
Fire Door
Prevented Fire
Damage To This
Entire Section of
The Building











@ Juan Guerra



Fire doors must be closed and latched at the time of a fire.



Operation of Doors

- **Self-Closing** = standard door closer without a hold-open mechanism
- **Automatic-Closing** = door closer with electric or battery-operated hold-open mechanism actuated by the fire protection system or a smoke detector
- **Power-Operated Fire Doors** = door with an automatic operator – must be deactivated upon fire alarm

Exception

- Fire doors in common walls between R-1 sleeping units
- AKA communicating doors between hotel rooms



Exception

- Inactive leaf of rated pair to unoccupied room
 - Boiler room
 - Electric room
 - Mechanical room



Acceptable Ways to Hold Open a Fire Door

- Non-detected electronic hold-open unit released by fire alarm.
- Electronic hold-open unit with on-board detector.



Not OK



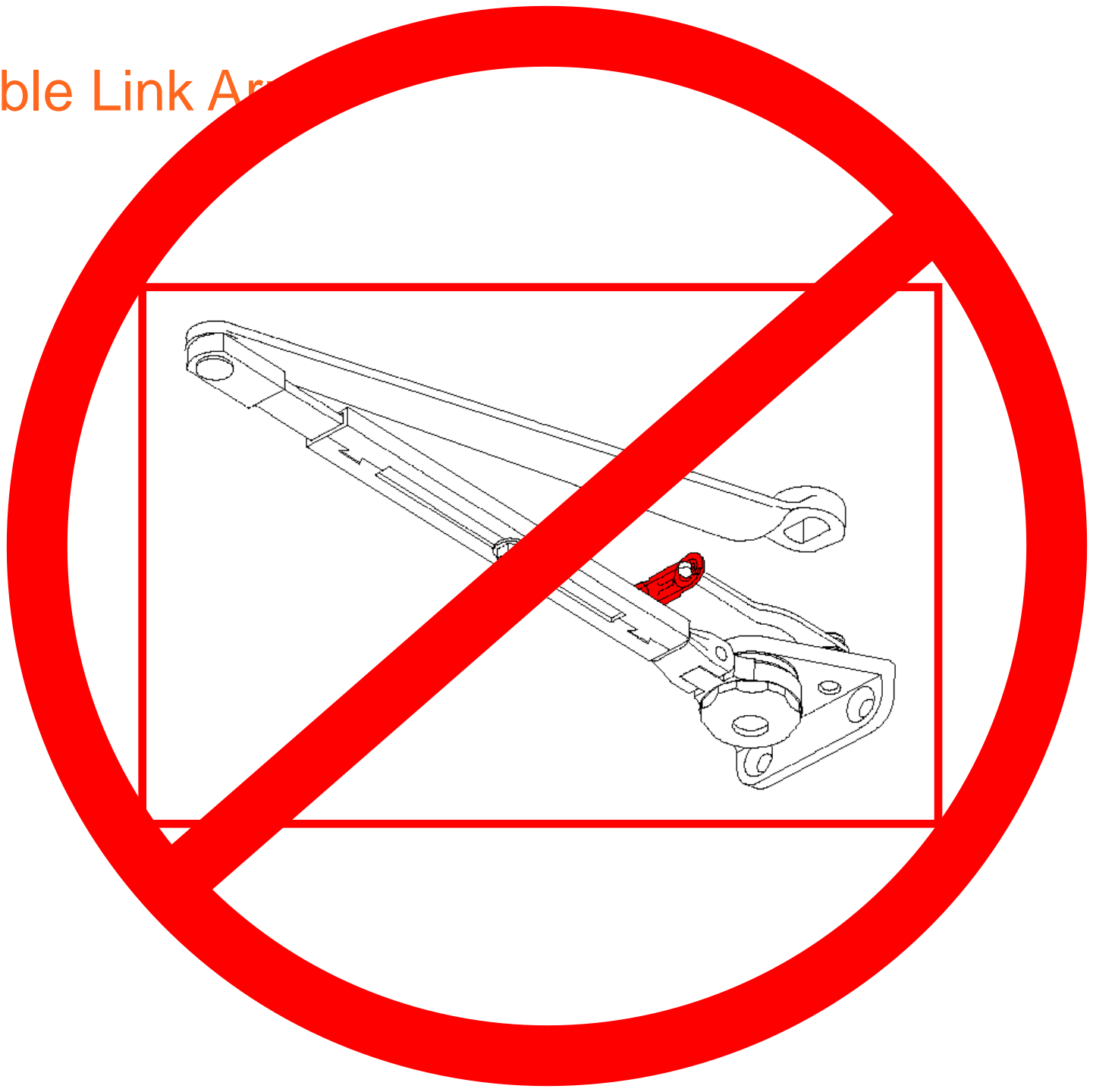
Not OK



Not OK



Fusible Link Assembly



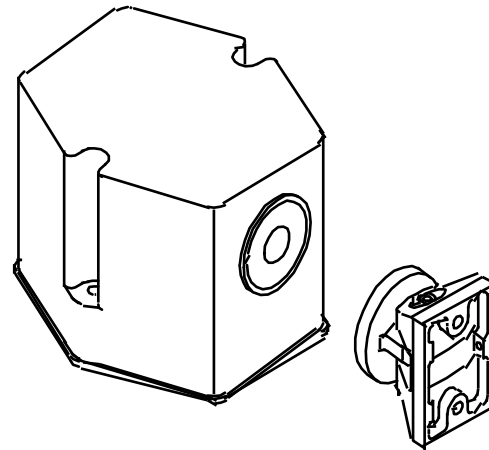
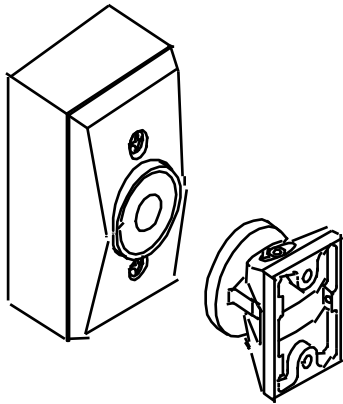
Fusible Link Arm

- Current codes require smoke-actuated hold-opens for almost all fire door locations.



Acceptable Ways to Hold Open a Fire Door

- wall or floor magnet with closer



Not OK

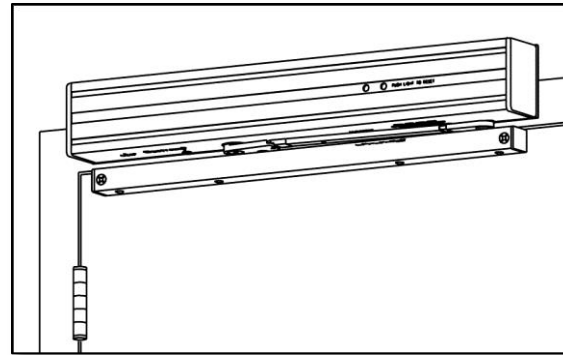
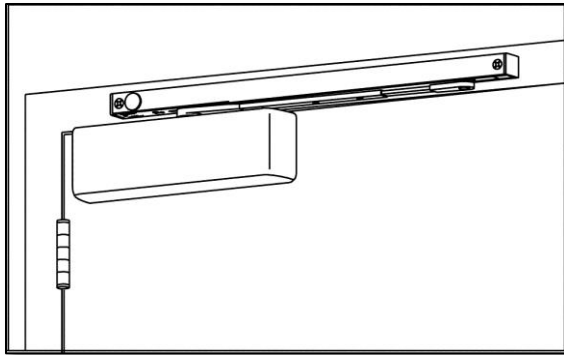


Not OK



Acceptable Ways to Hold Open a Fire Door

- electro-magnetic hold-open closer

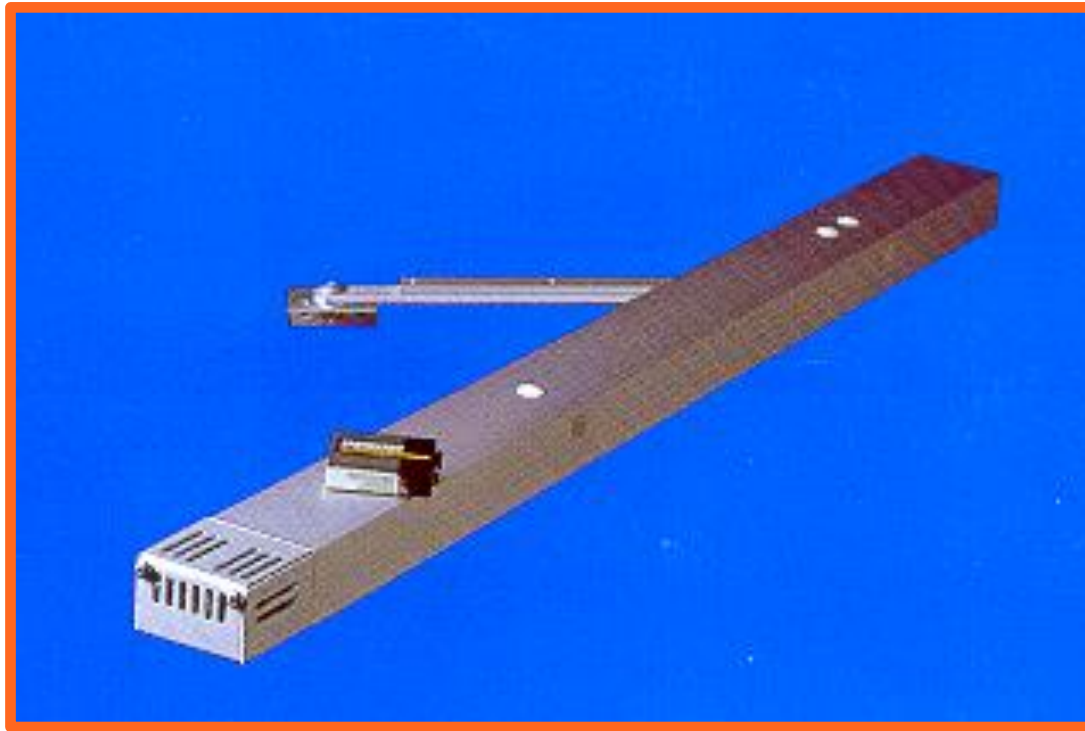


A positive stop MUST be used with closer/holders.



Acceptable Ways to Hold Open a Fire Door

- battery-operated detected holder with closer



Stair Enclosures



- “The release by means of smoke detection of one door in a stair enclosure results in closing all doors serving that stair.”

Self Latching Positive Latching

- Must have an active latch bolt



Not OK



Latch Throw



NFPA 80 – 2007:

6.4.4.6 Throw.

6.4.4.6.1 The throw of single-point latch bolts shall not be less than the minimum shown on the fire door label.

6.4.4.6.2 The minimum throw shall be as specified in the manufacturer's installation instructions.

In previous editions, a minimum latch throw was spelled out in NFPA 80.

Self Latching Positive Latching

- No Mechanical Dogging



Self Latching Positive Latching

- No Mechanical Dogging



Latch may be held back electrically (EL/QEL)
and release on fire alarm.

Not OKI



Not OKI



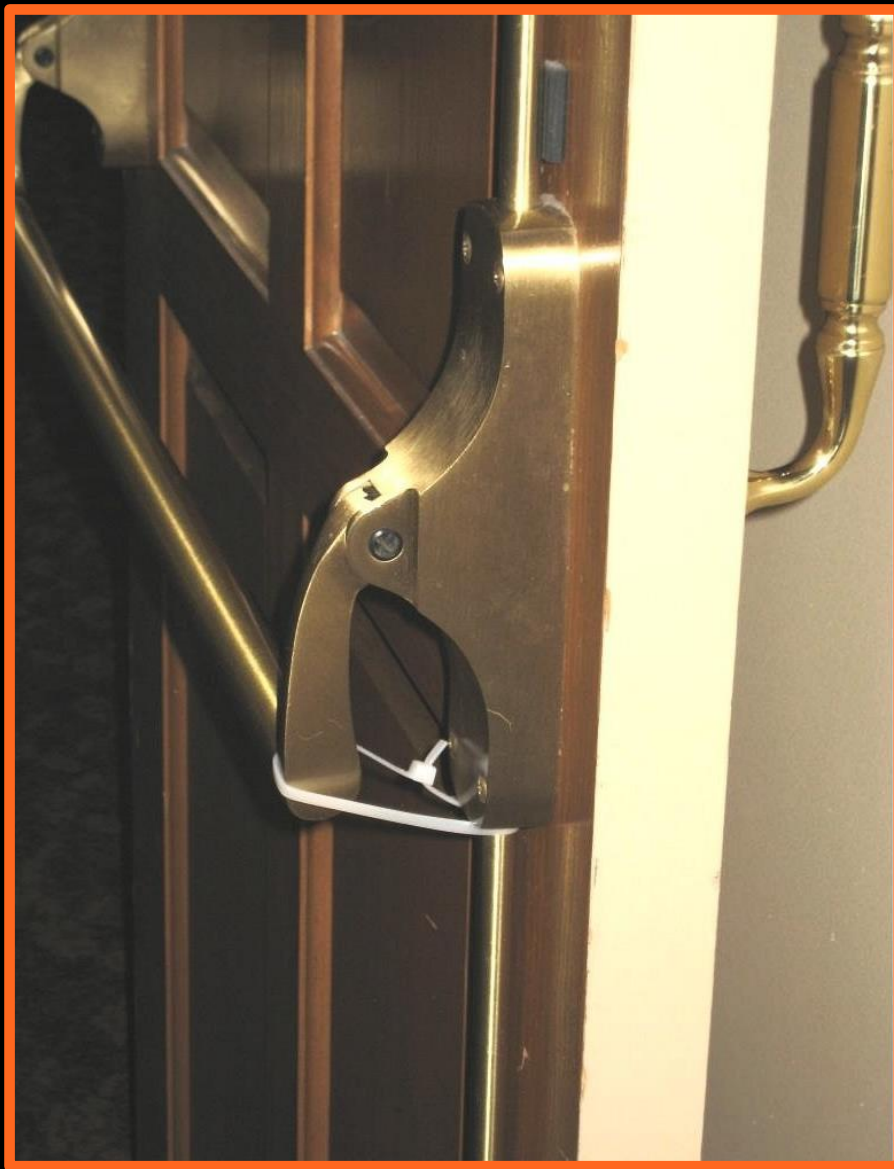
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Self Latching

Positive Latching

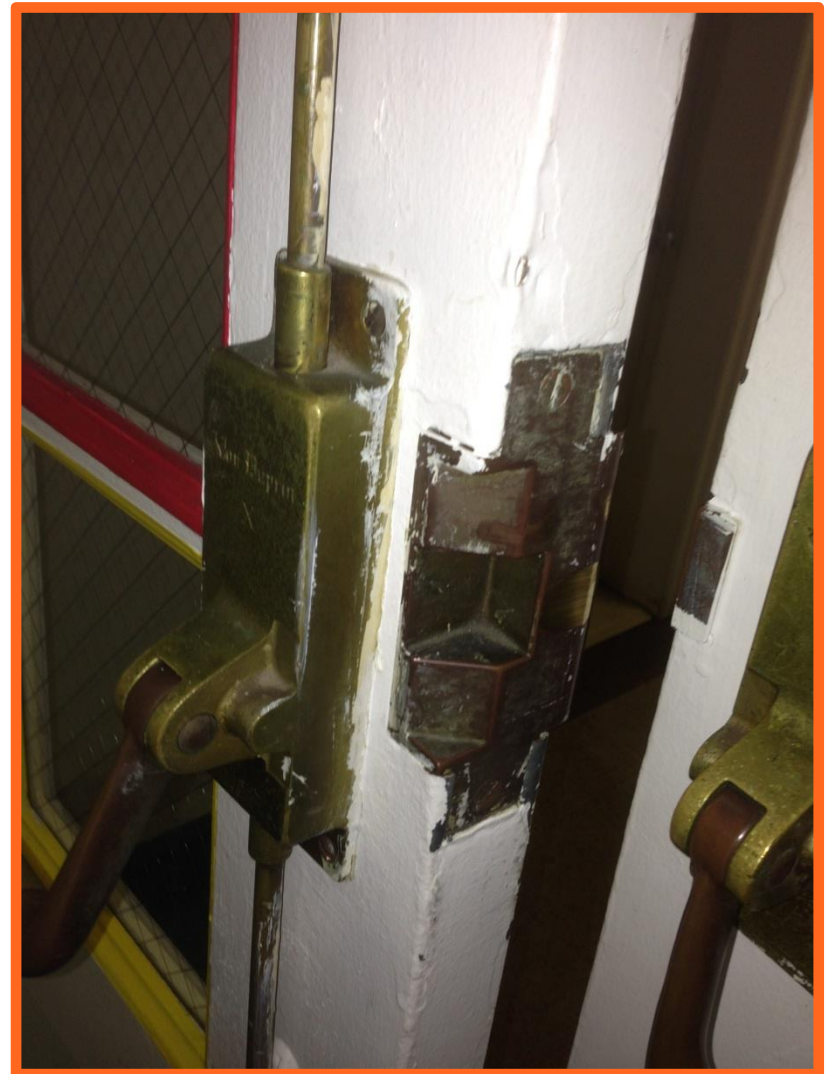
- Electric Strikes – must be Fail Secure
 - Fail Secure – When power fails, keeper is secure
 - Fail Safe – When power fails, keeper is free



Open Back Strikes

NFPA 80 – 2007:

6.4.4.10* Open back strikes shall be permitted to be used in lieu of conventional strikes only where specifically provided for in the published listings.



Self Latching Positive Latching

- Automatic Flush Bolts
 - No “Dummy” Trim on Egress Side
 - Coordinator Required



Flush Bolts



manual



automatic

Door Coordinators

- Pairs of doors with automatic flush bolts or astragals
- Coordinates closing of doors so correct door closes first
- Bar type and gravity type
 - Bar type installs under frame head
 - Gravity type installs on frame face

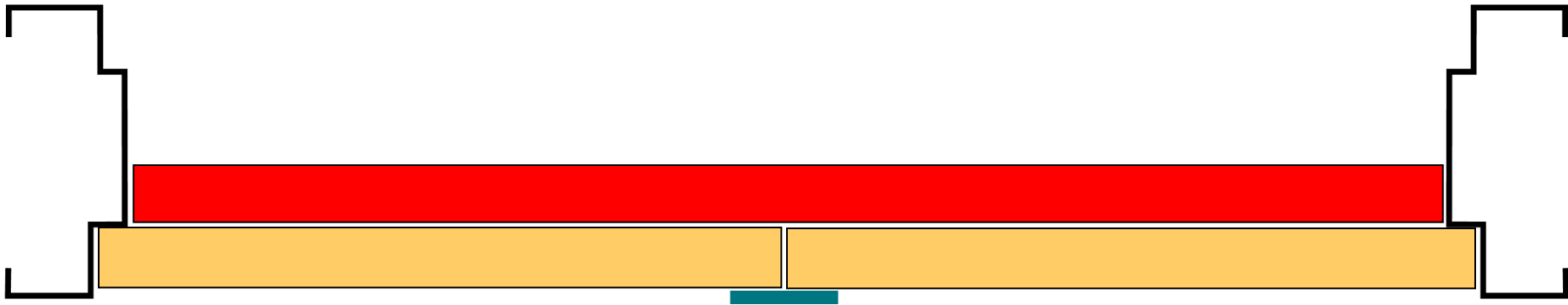




Door Coordinator

inactive

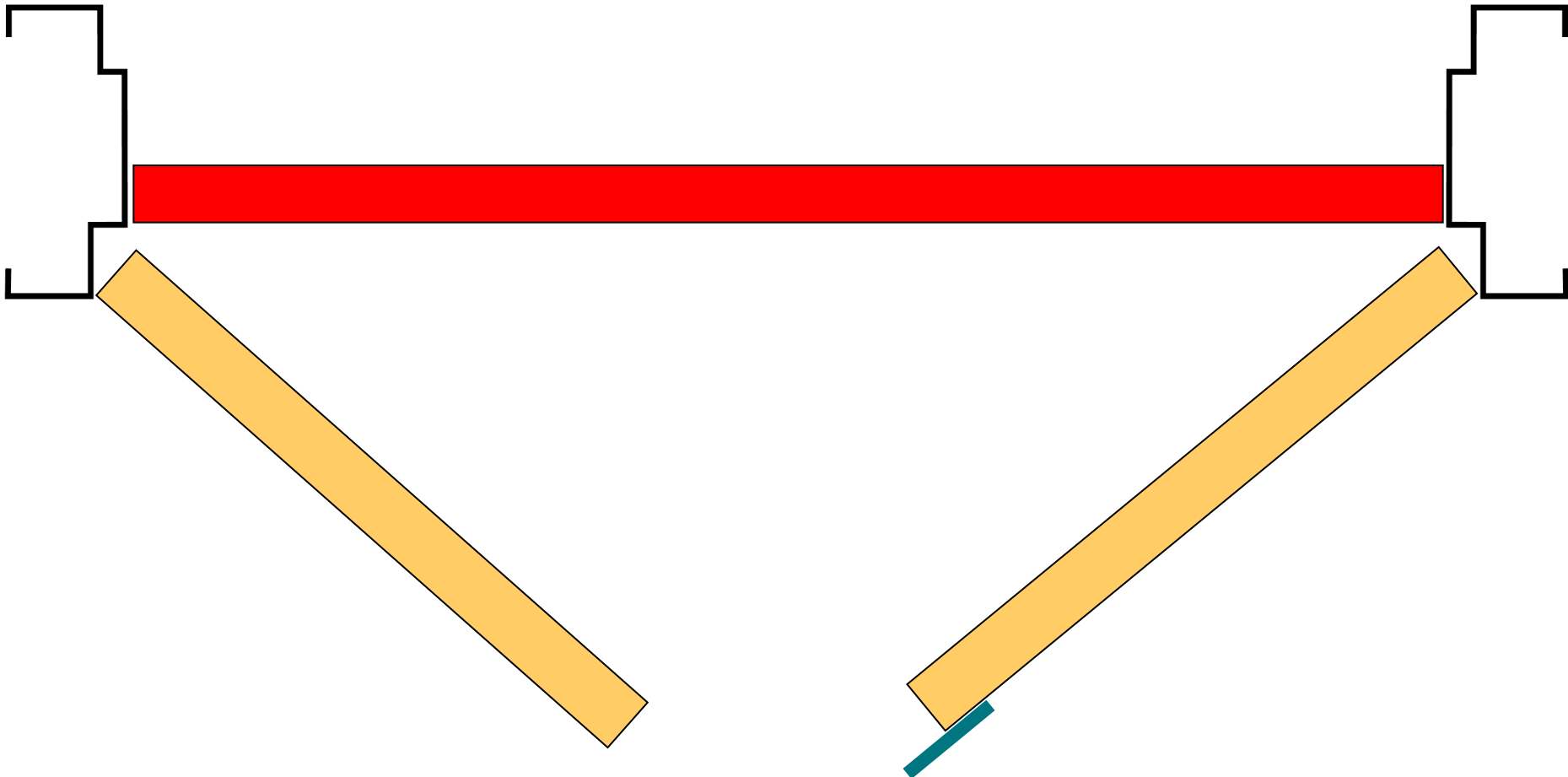
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Door Coordinator

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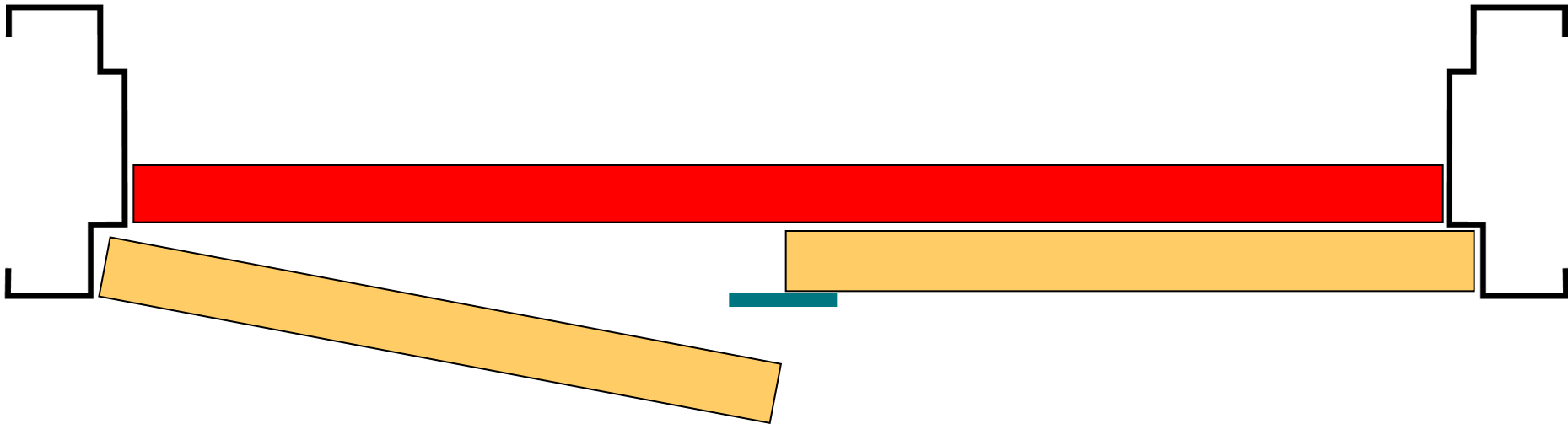
active



Door Coordinator

inactive

active



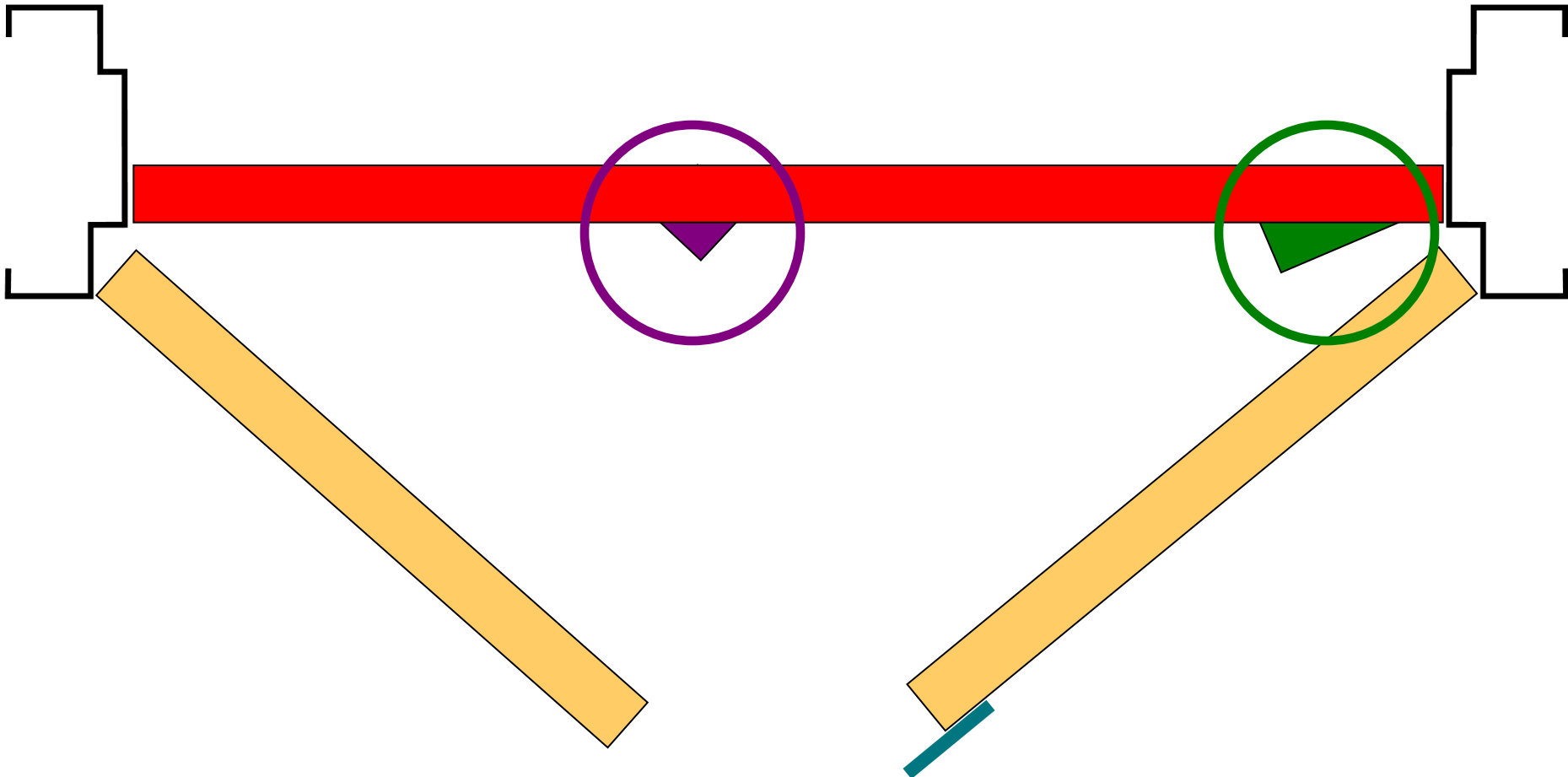
Door Coordinators



Door Coordinator

inactive

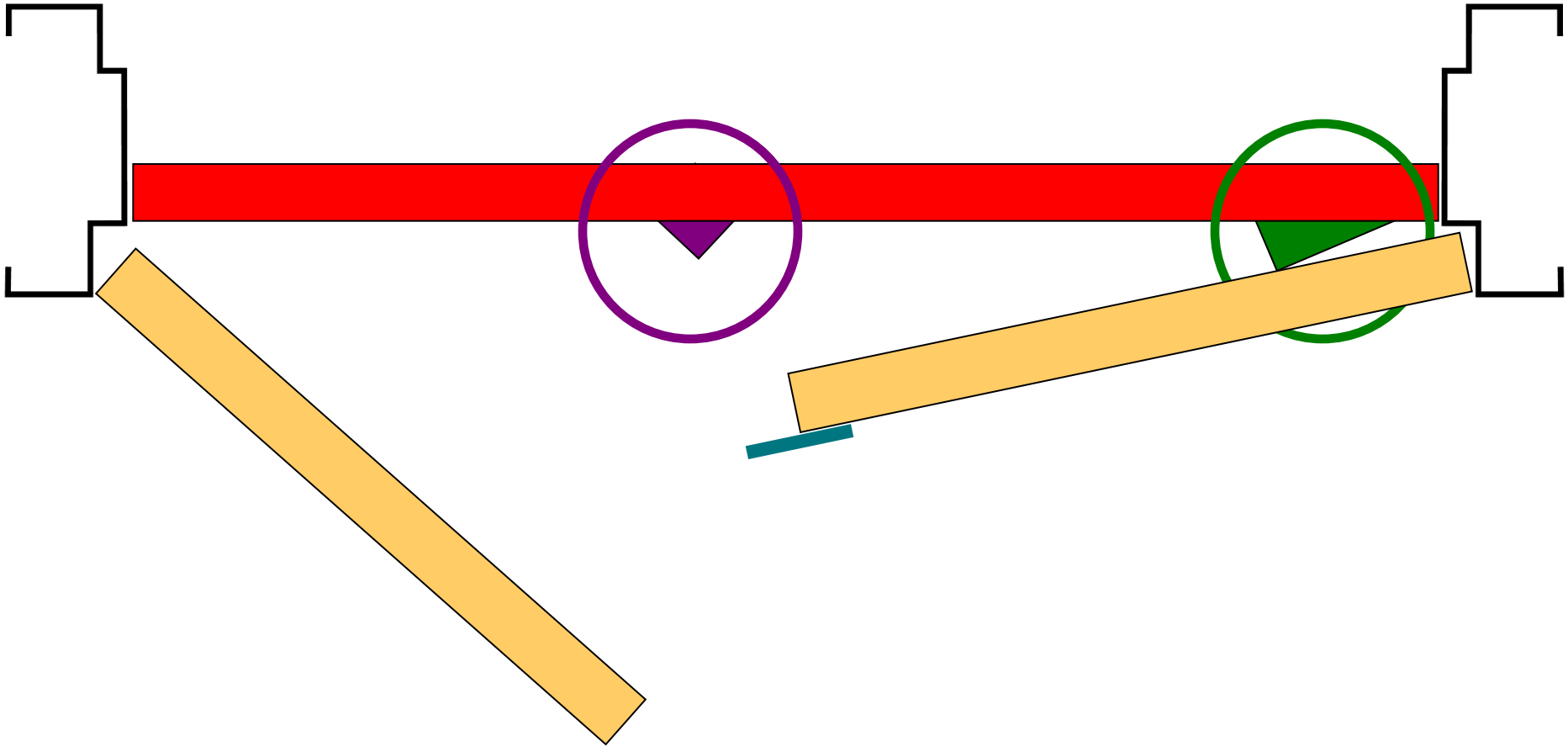
active



Door Coordinator

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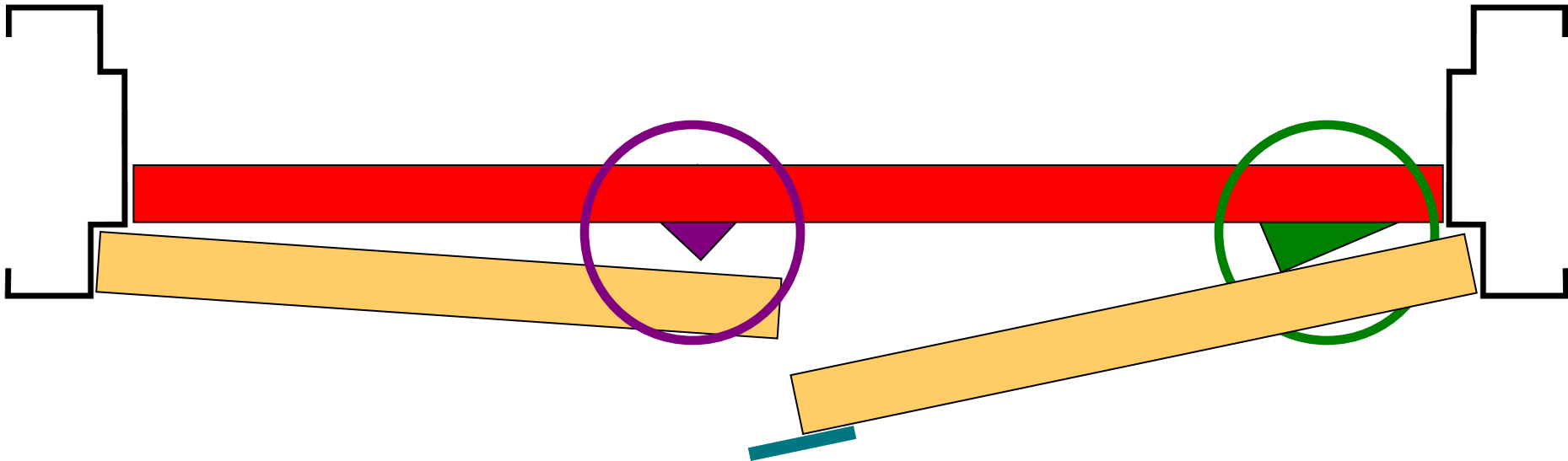
active



Door Coordinator

inactive

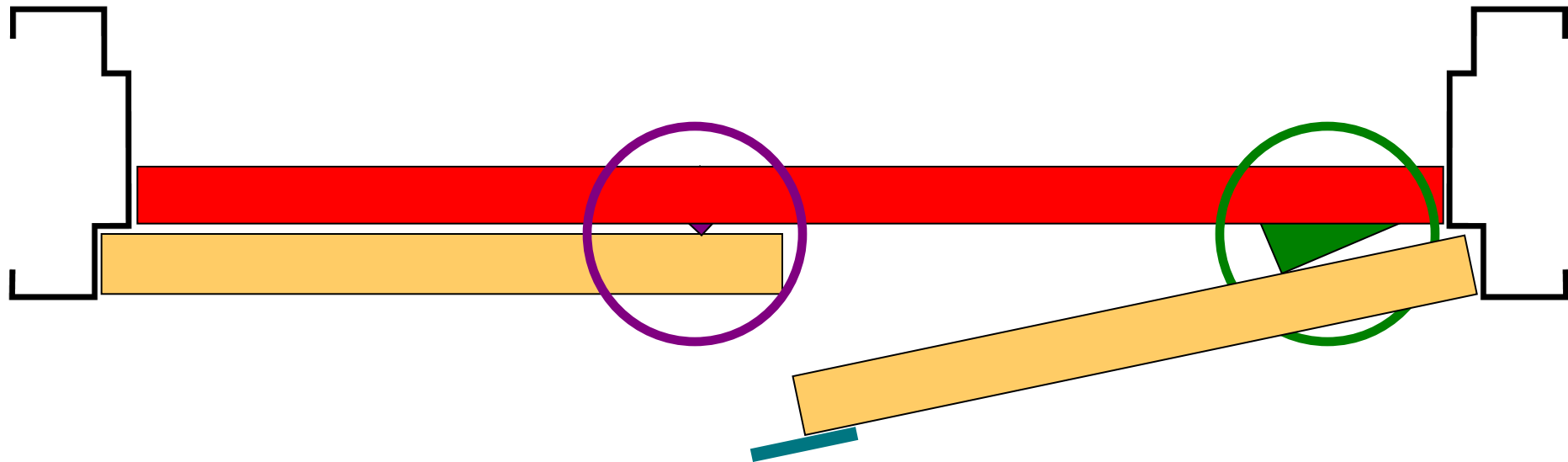
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Door Coordinator

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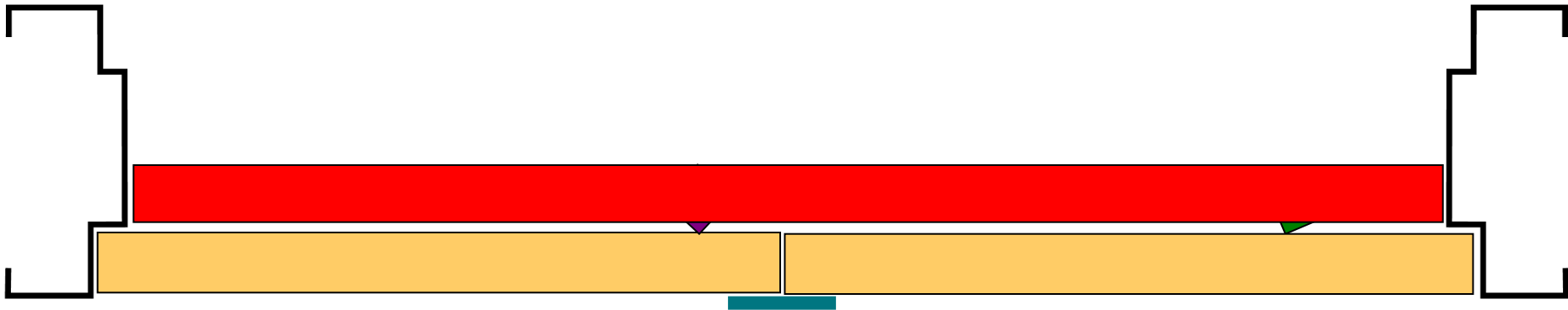
active



Door Coordinator

inactive

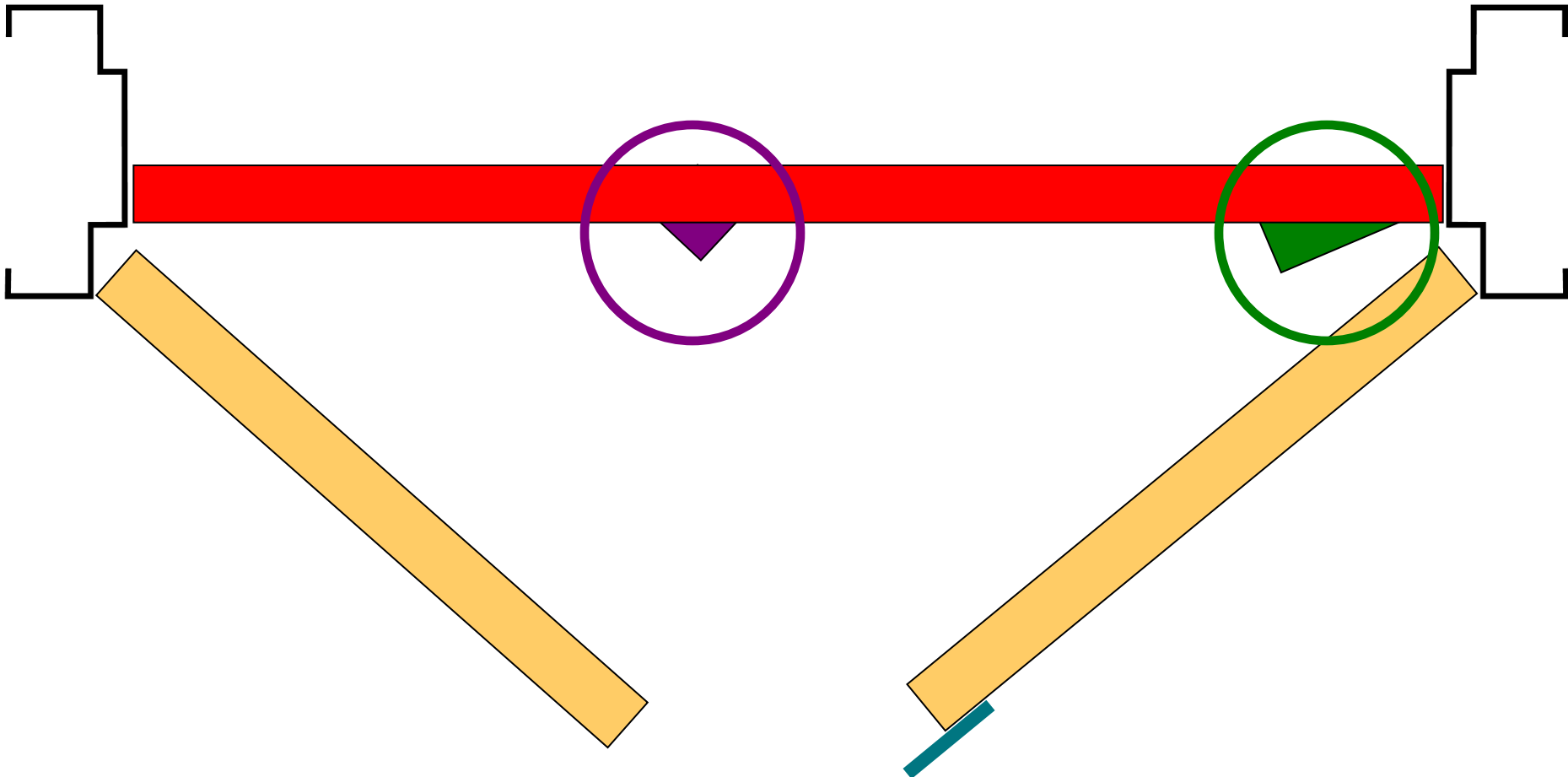
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Door Coordinator

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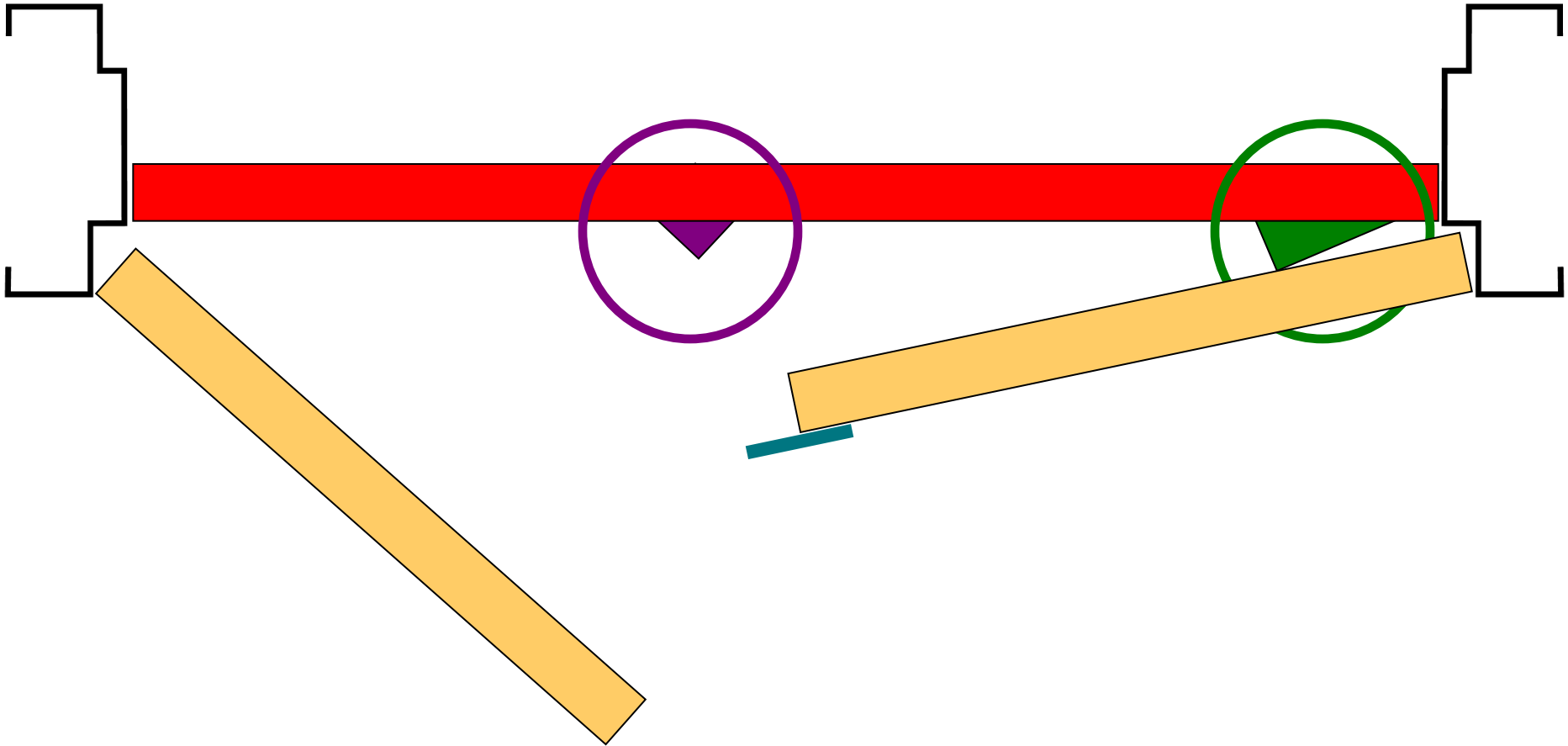
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Door Coordinator

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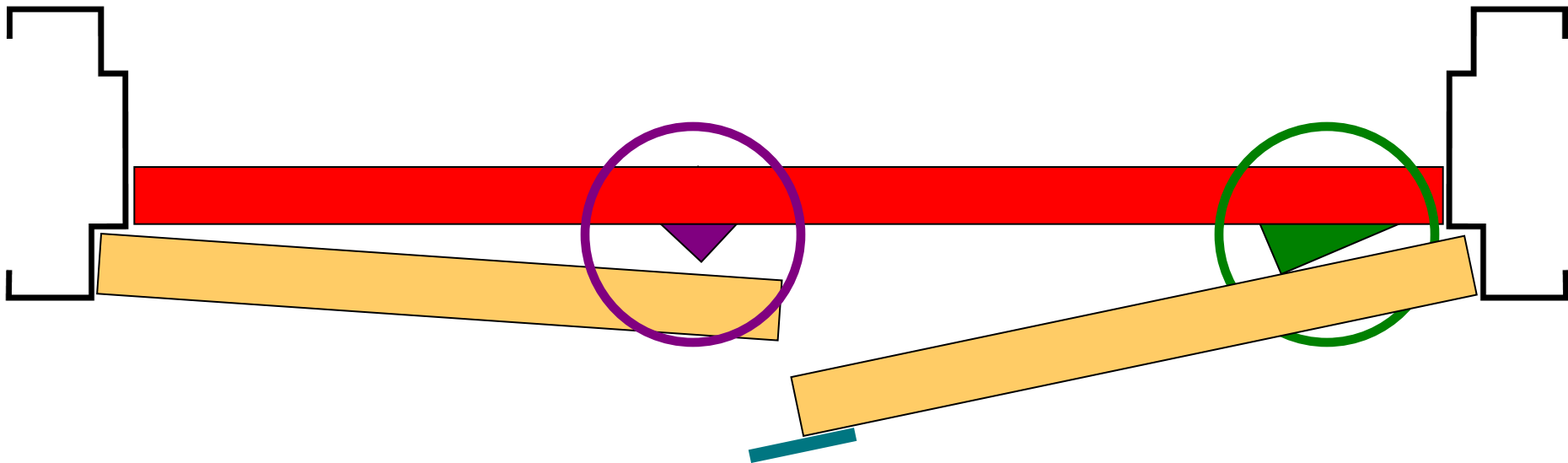
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Door Coordinator

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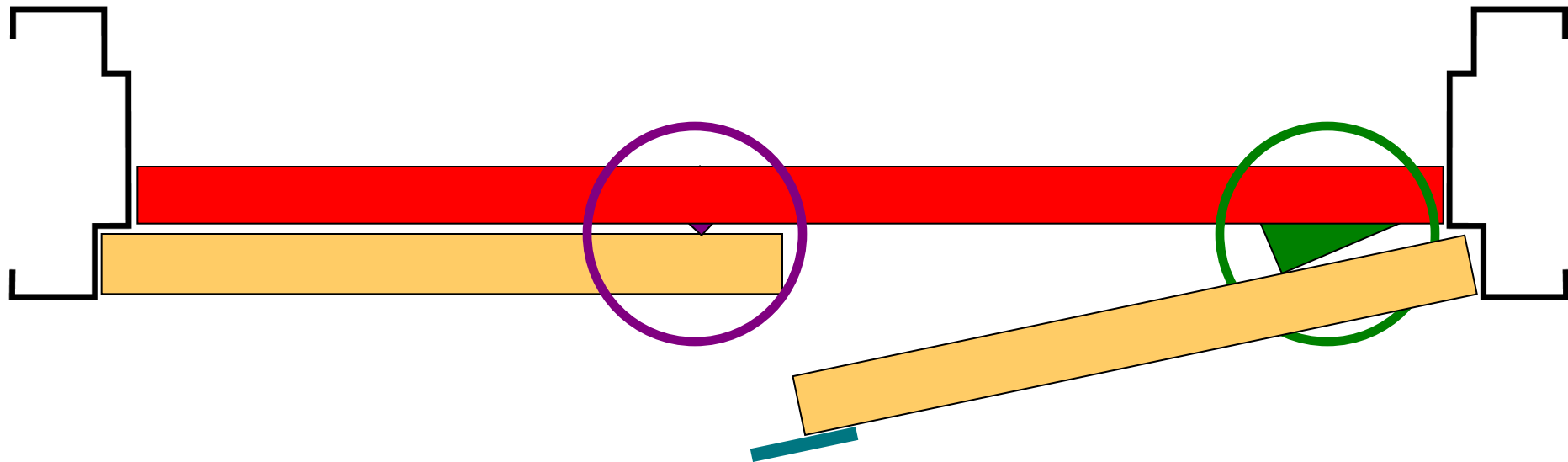
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Door Coordinator

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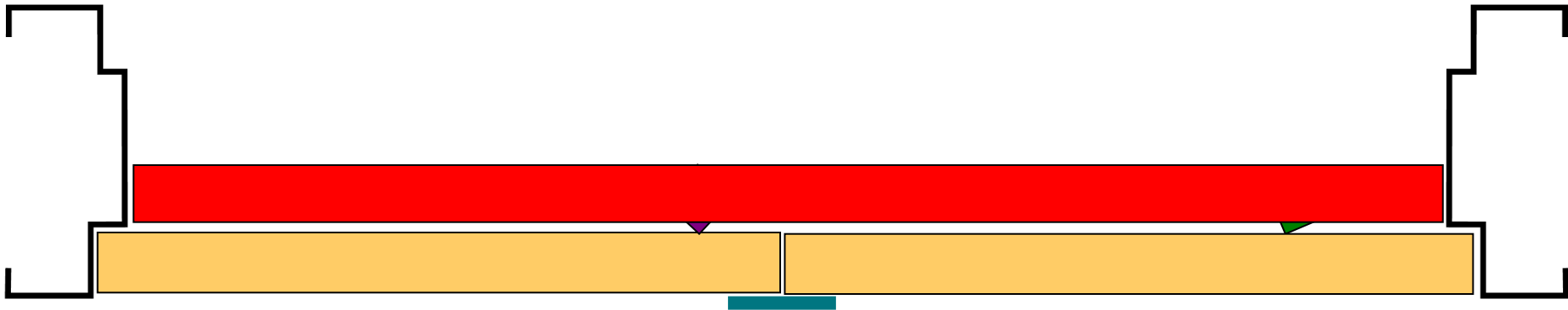
active



Door Coordinator

inactive

active



Uncoordinated



Astragals

NFPA 80 – 2007:

6.4.7* Astragals.

6.4.7.1 Doors swinging in pairs, where located within a means of egress, shall not be equipped with astragals that inhibit the free use of either leaf.

6.4.7.2* Pairs of doors that require astragals shall have at least one attached in place to project approximately $\frac{3}{4}$ in. (19 mm) or as otherwise indicated in the individual published listings.

Previous editions of NFPA 80 required astragals for doors rated more than 90 minutes.

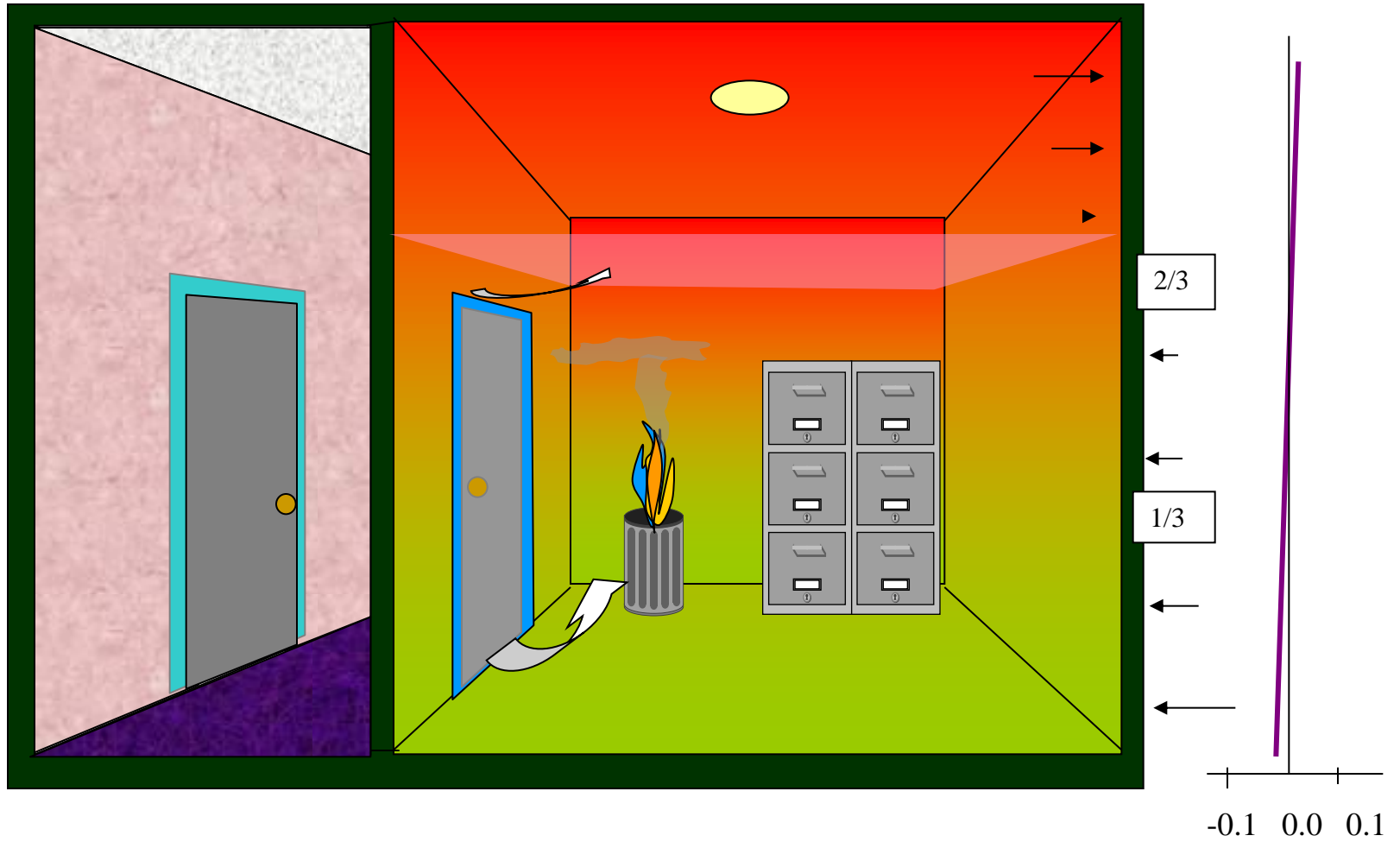
The overlapping astragal on this pair will prevent one door from being opened.



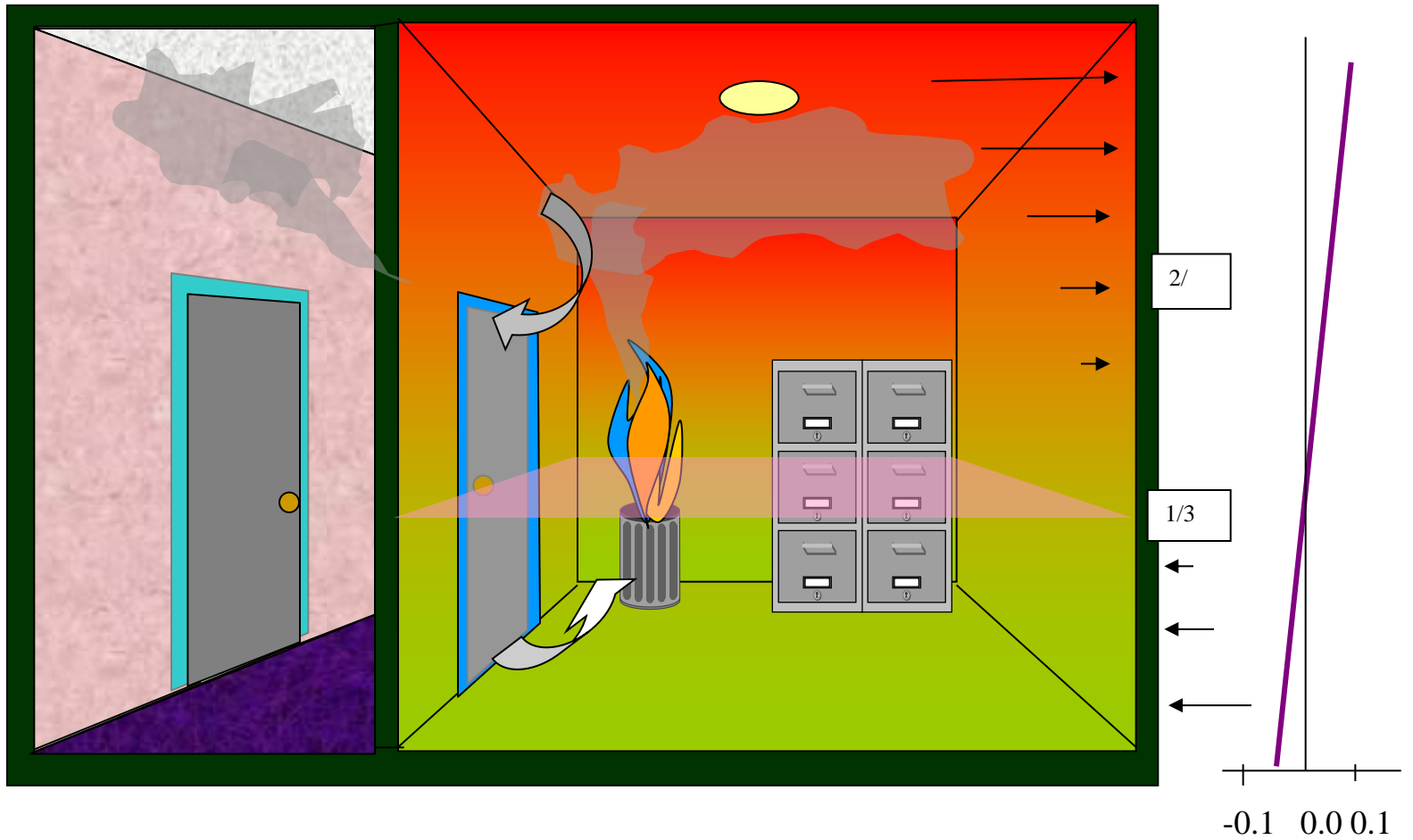
Fire Test Methods



Early Stage



Advanced Stage



In Real Life

- The level of thermal discontinuity can be clearly seen here.
- The neutral pressure plane would be just above that level.



Fire Test Methods

- UL 10B – Neutral/Negative Pressure
 - Neutral pressure plane at top of the tested assembly
- UL 10C – Positive Pressure
 - Neutral pressure plane at 40” above the floor
- NFPA 252 - Flexible - May be conducted using positive pressure (at 40” above the floor), or neutral pressure (@ top of door)
- Category A Doors – intumescent, if required, is part of door
- Category B Doors – intumescent, if required, is field-applied

Fire Test Methods

IBC 2009:

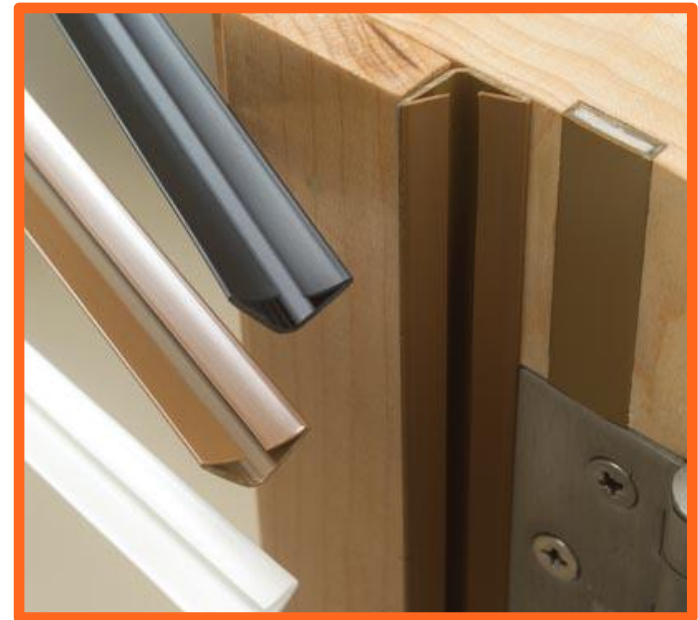
715.4.1 Side-hinged or pivoted swinging doors. *Fire door* assemblies with side-hinged and pivoted swinging doors shall be tested in accordance with NFPA 252 or UL 10C.

After 5 minutes into the NFPA 252 test, the neutral pressure level in the furnace shall be established at 40 inches (1016 mm) or less above the sill.

NFPA 101 2009 allows either method of fire testing.

Gasketing

- Some fire doors and smoke doors must be tested in accordance with UL1784 for air infiltration
- The maximum air leakage rate of the door assembly shall be $3.0 \text{ ft}^3/\text{min}/\text{ft}^2$ of door opening...
- Gasketing is required to limit air infiltration to this maximum.
- Gasketing must be listed for use on fire doors.
- A bottom seal is not required for fire doors in most locations.



Other Fire Door Basics...

- Job-Site Preparations



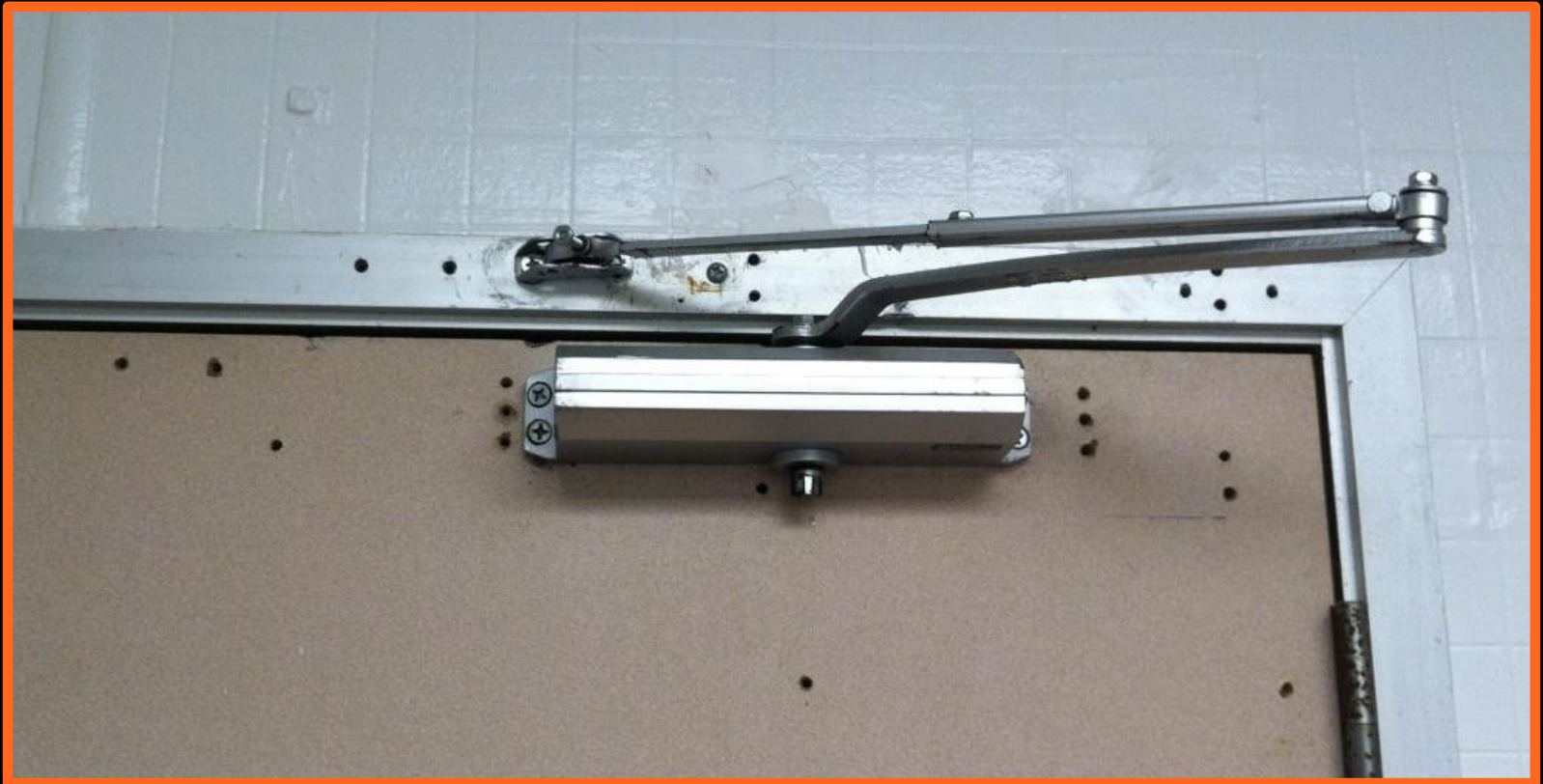
Acceptable Job Site Preparations

- Function holes for mortise locks
- Holes for labeled viewers
- $\frac{3}{4}$ " undercutting on wood and composite doors
- Surface-applied hardware
 - Drilling round holes up to 1" maximum diameter
 - Fasteners
 - Cylinders (may be larger than 1" diameter)

When material is removed, holes must be filled with steel fasteners, or the same material as the door or frame.



When material is removed, holes must be filled with steel fasteners, or the same material as the door or frame.



Glazing

4.4.5* Glazing material shall be permitted in fire doors having the fire protection ratings shown in Table 4.4.5 when tested in accordance with NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, and shall be limited in size and area in accordance with Table 4.4.5.

Table 4.4.5 Fire Door Rating

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

^aSee also requirements in 4.4.4.

^bSee 4.4.5.1.

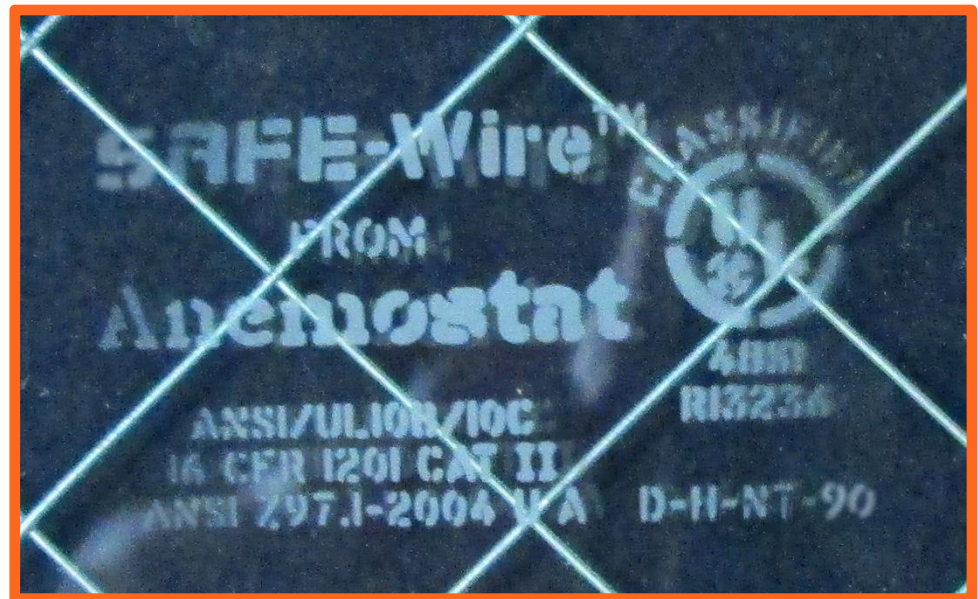
^cFire protection-rated glazing materials exceeding 100 in.² (0.065 m²) in area are not permitted in temperature rise-rated doors.

Glazing

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

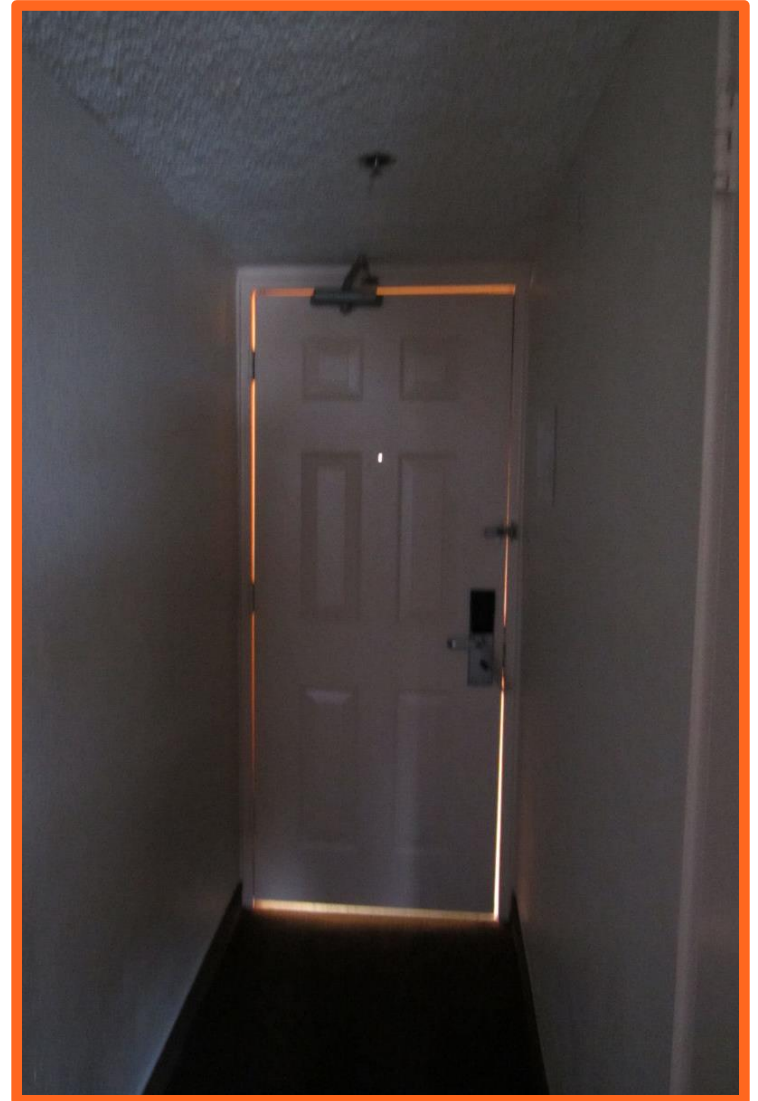
4.4.6 Each individual glazing unit shall be identified with a label that is visible after installation.

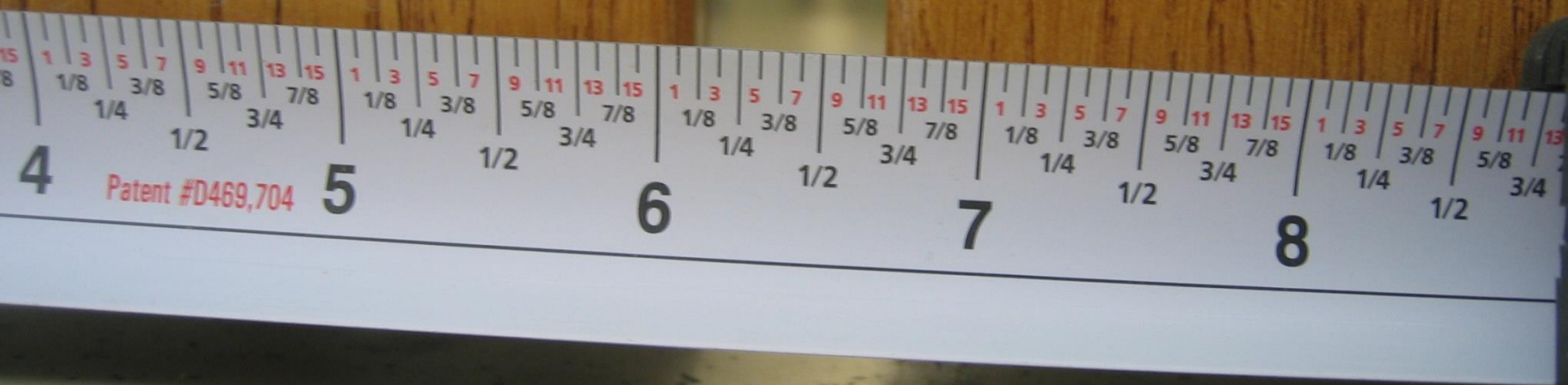
Glass in all doors must now be impact-resistant – no exception for fire doors.



Clearance

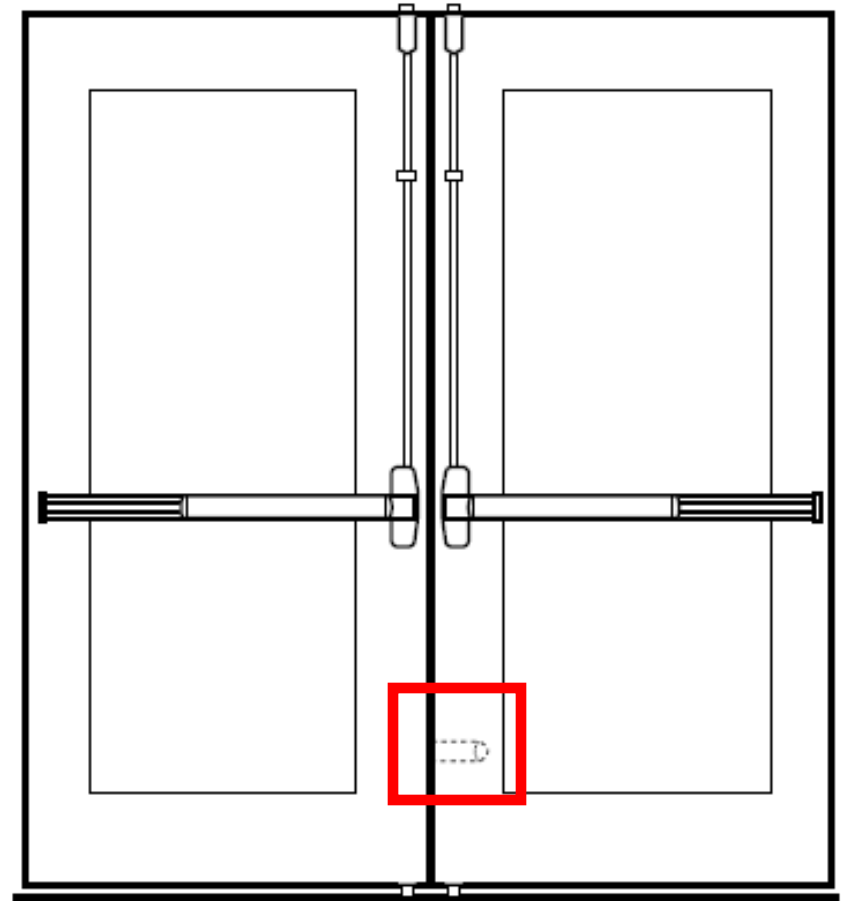
- Bottom of Door
 - 3/4" max under the door
 - 3/8" max if bottom of door is more than 38" AFF
- Jambs, Head, and Meeting Stiles
 - Hollow Metal Doors – 1/8" +/- 1/16"
 - Wood Doors – 1/8"





Panic hardware for fire doors is Fire Exit Hardware

- Label: “Fire door to be equipped with fire exit hardware.”
- No mechanical dogging
- Less bottom rod applications
 - “Fire pins” are used to fix door panels in the closed position.
 - Hardware is not required to be operable after fire



Oops.



EXIT



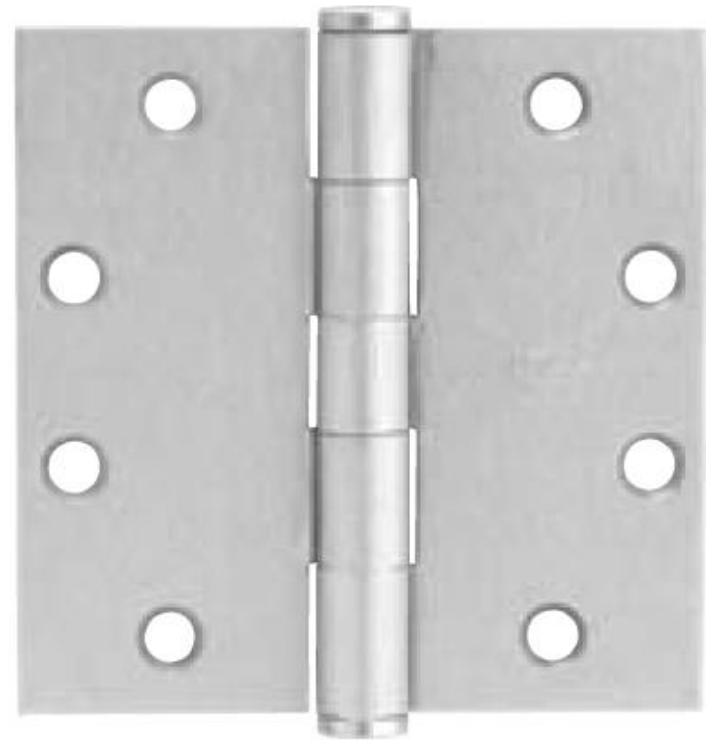
Protection Plates

- 16” maximum above the bottom of the door
- Or UL listed
- Or installed “under label service”



Hinges for Fire Doors

- Steel base material
- Ball bearing
- Proper size, weight, and quantity
- 2 hinges for 60" in height, 1 additional hinge for each additional 30" (or portion)
- Spring hinges are limited to 3070 doors or as tested



Hinge Fasteners

NFPA 80 – 2007:

6.4.3.2.3 Mortise hinges shall be secured to wood and plastic-covered composite doors or wood core doors with No. 12 × 1¼ in. (31.75 mm) flat, threaded-to-the-head, steel wood screws. Pilot holes shall be drilled that are 5/32 in. (4 mm) in diameter.

6.4.3.2.4 Surface hinges shall be attached with steel throughbolts.

6.4.3.4 Shimming. When required to meet the clearances stated in 6.3.1.7, the shimming of hinges using steel shims shall be permitted.

Not OK



Signage

NFPA 80 – 2007:

4.1.4 Signage. Informational signs shall be permitted to be installed on the surfaces of fire doors in accordance with 4.1.4.1 through 4.1.4.4 or in accordance with the manufacturer's published listing.

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

Signage

NFPA 80 – 2007:

4.1.4.2 Means of Attachment.

4.1.4.2.1 Signs shall be attached to fire doors by use of an adhesive.

4.1.4.2.2 Mechanical attachments such as screws or nails shall not be permitted.

4.1.4.3 Signs shall not be installed on glazing material in fire doors.

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

Screws are not allowed for signage on a fire door.



Fire Door Assembly Inspection

- Added to NFPA 80 in 2007
- Responsibility of building owner/property manager
- Documents the condition of the fire door assemblies
- Fire doors have always been required to be kept in code-compliant condition.



NFPA 80 Chapter 5

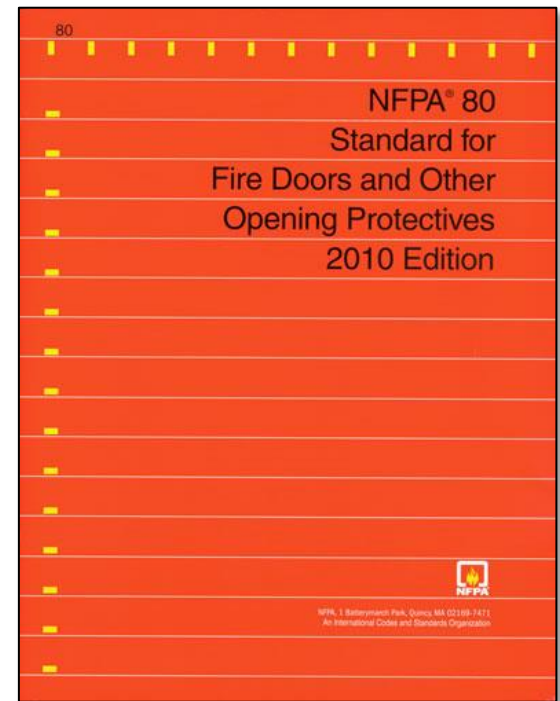
- Visual inspection – both sides of door
- Functional testing of fire door assemblies
- Ensure door leaves will be closed and latched under fire conditions
- Performed by individuals with knowledge and understanding of the operating components of the type of door being subject to testing
- Inspection includes operational test of automatic-closing doors
- 11 inspection criteria in 2007 edition, 13 in 2013 edition
- Deficiencies must be repaired “without delay.”
- 2013 edition requires inspection after installation and maintenance as well as annually.

FDAI Criteria

- Label visible and legible
- No open holes or breaks in door or frame
- Glazing, lite kits, glazing beads securely fastened
- Door, frame, hinges, hardware, threshold, secure, aligned, in working order, no damage
- No missing or broken parts
- Clearances within acceptable limits
- Closer functional, door closes completely
- Coordinator (if installed) works properly
- Latching hardware operates and secures door in closed position
- No auxiliary items that inhibit proper operation
- No field modifications outside of what is allowed by NFPA 80
- Perimeter and meeting stile gasket present if required
- Signage meets requirements of NFPA 80

Session 2 – Fire Doors

- NFPA 80 – format and organization
 - * asterisk, | vertical line, Chapter 6
- Purpose of fire doors
 - compartmentalization to protect egress
- Fire ratings and testing
 - neutral vs. positive pressure
- Basic fire door requirements
 - closing, latching, hinges, plates, glass, gasketing, clearances, job-site preparation
- Fire Door Assembly Inspection



Homework

Watch the video analysis of 30 Dowling Circle fire.

- Apartment building
- Doors equipped with spring hinges
- Carpet and door sweep prevented doors from closing
- 1 Firefighter fatality

Thank You!

This concludes the American Institute of Architects
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