Application, Installation, and Maintenance of Life-Safety Dampers

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Presentation Outline

Definition, Application, Installation, and Maintenance

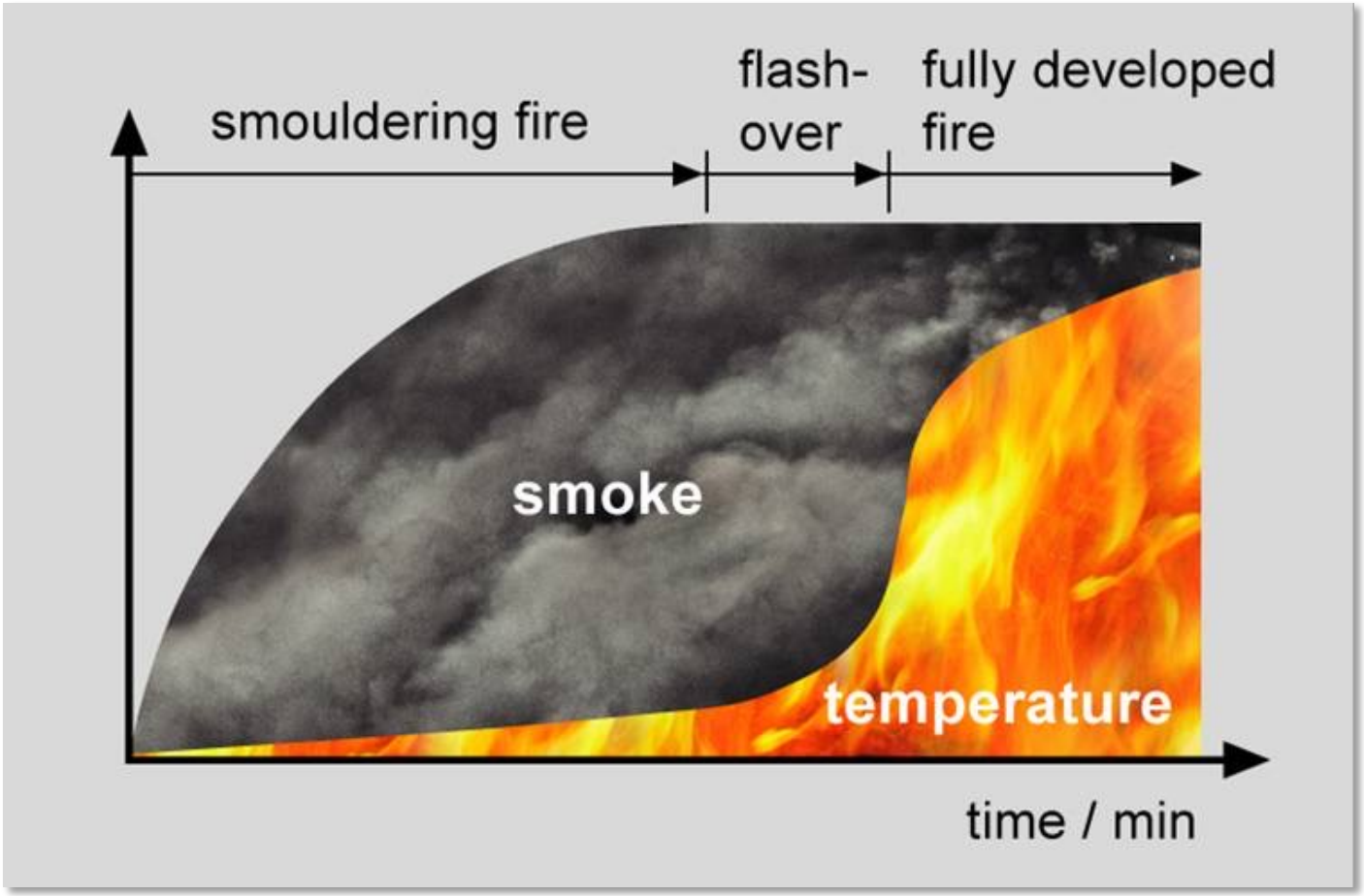
- Fire Dampers
- Smoke Dampers
- Combination Fire/Smoke Dampers
- Ceiling Radiation Dampers

Learning Objectives

- Understanding why we have Life Safety Dampers.
- Understand the individual purpose of a F.D., S.D., and Combination F/S Damper.
- Know the basic installation of each of the Life Safety Dampers.
- Know where in the codes these dampers are addressed in regard to Periodic Testing and Maintenance.

Predominant Threat

Smoke



- Smoke is present from the beginning of a fire until it is too late.

Predominant Threat

Smoke

- Smoke is present from the beginning of a fire until it is too late.

Predominant Threat

Smoke

- Is the leading cause of firefighter injuries and fatalities.
- Impedes visibility.
- Can contain toxic and unburned gases.
- Fire consumes the oxygen in the air.
- CO poisoning accounts for 50% of fatalities.
- Can reach temperatures as high as 1,300°C (2,370°F).

Standards and Governing Bodies

- International Building Code (IBC) - chapters 7 and 9
- International Fire Code (IFC) – Chapter 7
- National Fire Protection Association (NFPA) – NFPA 90A, 80, 92, 105
- Local building codes
- Underwriters Laboratories - standards 555, 555S, 555C
- SMACNA – breakaway duct connections
- Air Movement and Control Association (AMCA) – AMCA Standard 500D
- Others: Warnock-Hersey (Intertek), ETL, ARL, FM, Gypsum Assoc.

Application

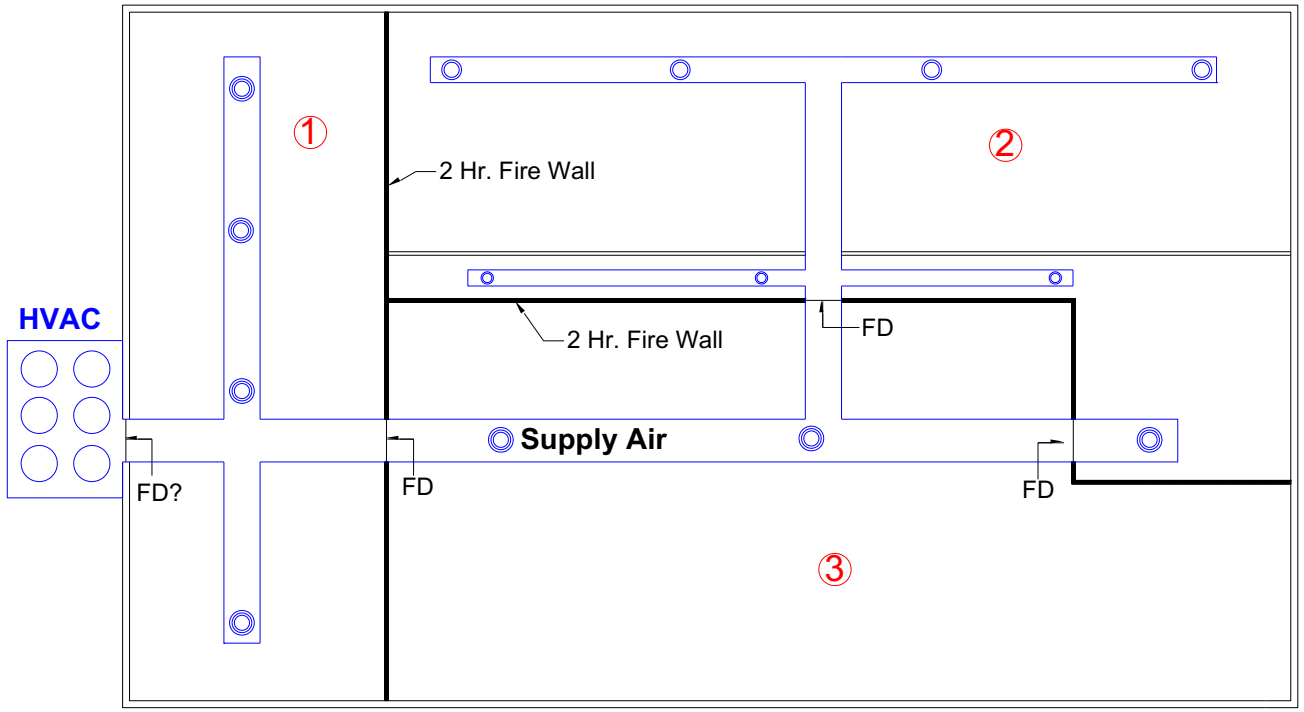
Typical Compartmentalization

Fire and Smoke Control Operation – Chapter 7, IBC

During Fire Emergency

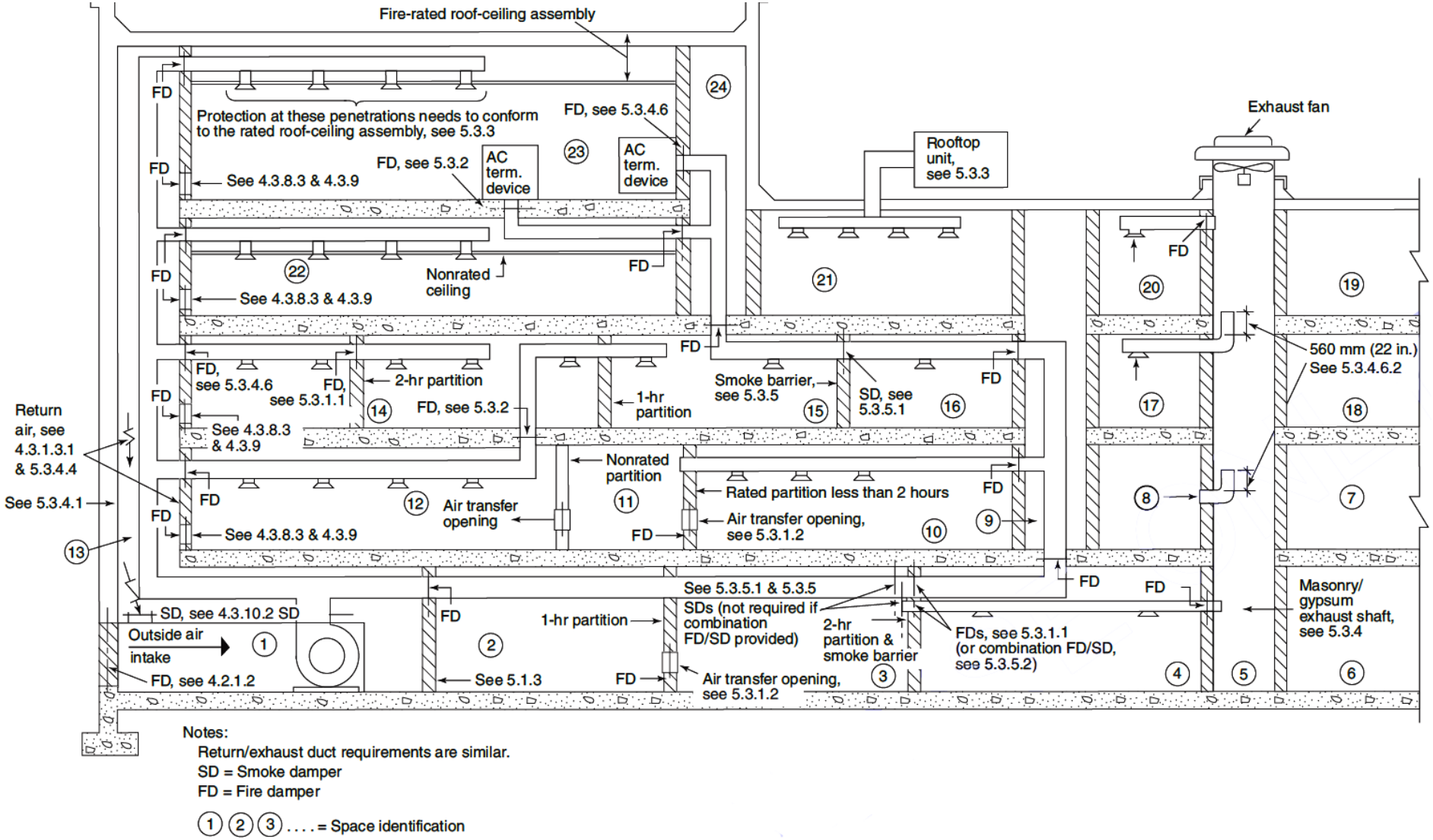
- Dampers (both fire and smoke) close to contain fire and smoke in separate compartments.
- 85% of life-safety dampers are sold for this method.

COMPARTMENTALIZATION



Plan View

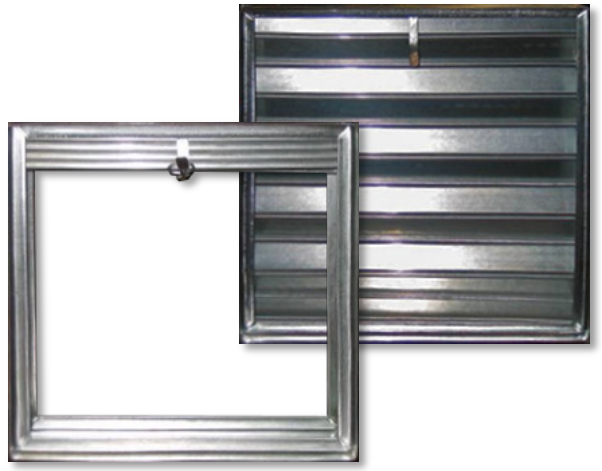
NFPA 90 – Annex A



Notes:
Return/exhaust duct requirements are similar.
SD = Smoke damper
FD = Fire damper

(1) (2) (3) . . . . = Space identification

What Is a Fire Damper?



Fire Dampers (IBC 717.3.2.1)

Fire dampers designed to protect duct and air transfer openings when they penetrate fire rated partitions.

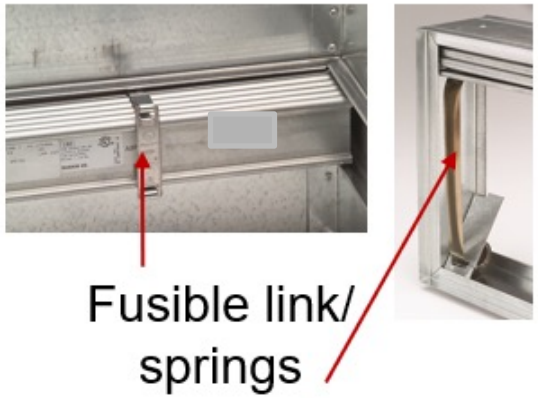
Fire Damper (NFPA 90A, 3.3.14.3)

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

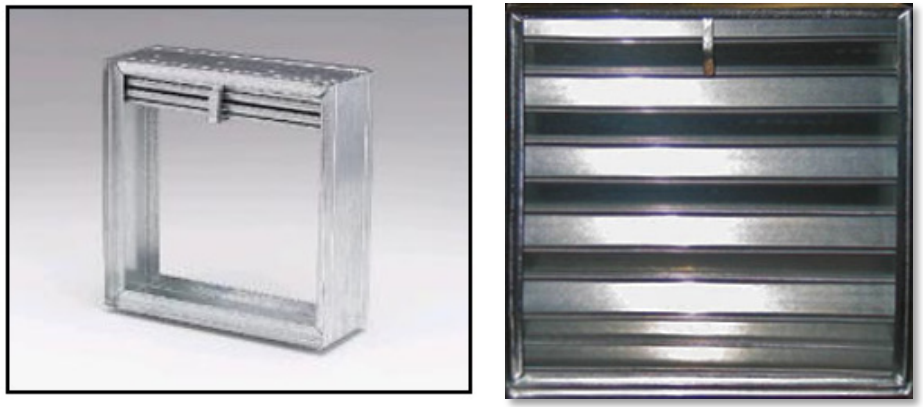
Fire Dampers (UL Marking Guide)

Fire dampers are used to restrict the spread of fire where ducts and air transfer openings penetrate fire walls, fire barriers, fire partitions, horizontal assemblies and shaft enclosures.

What Is a Fire Damper?

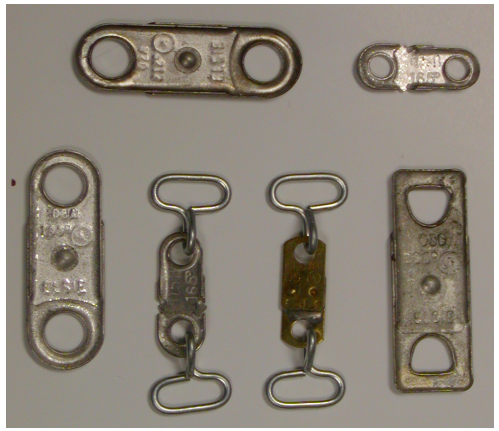


Curtain fire damper
(for dynamic systems)



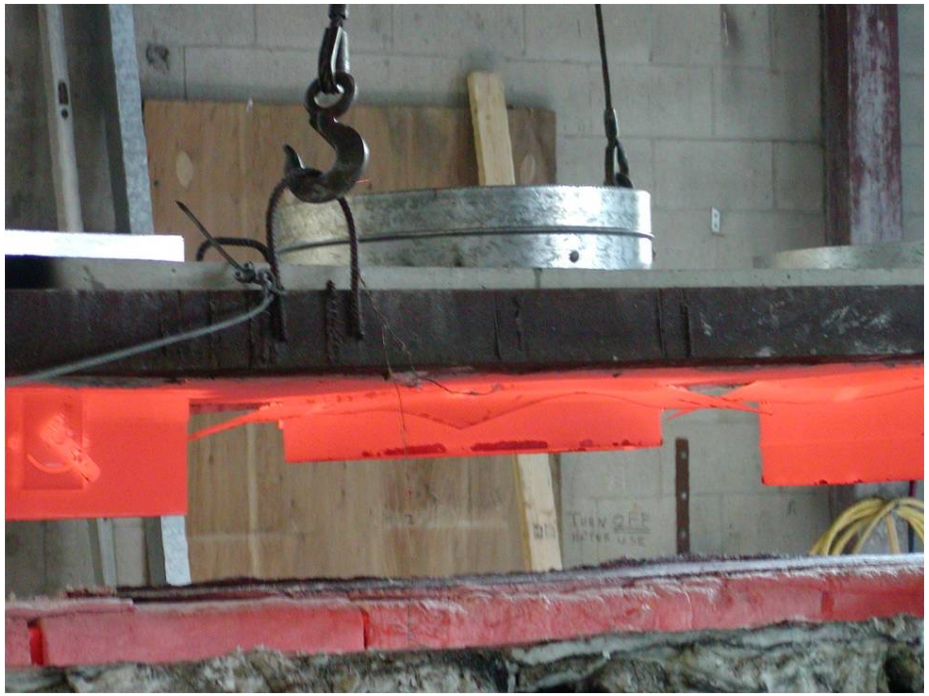
Curtain fire damper
(for static systems)

Multi-blade
fire damper



Fusible links

Fire Test on a Damper

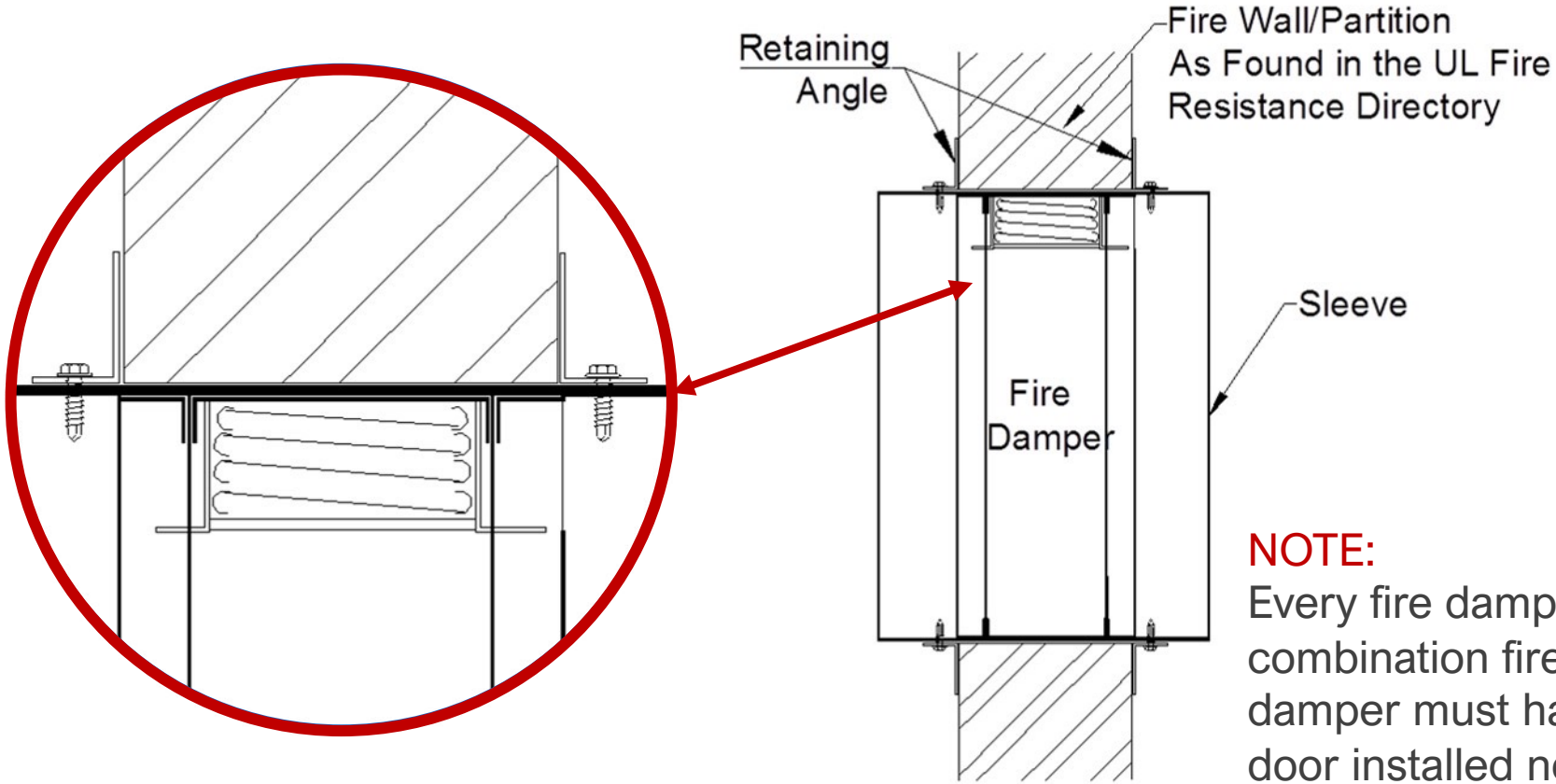


End of 1.5-hr test: 1,800^{o}F

Immediately following fire test:
30-psi hose stream

Fire Dampers

Basic or Typical Installation



Two-sided Angle Installation

Angle on each side of the wall

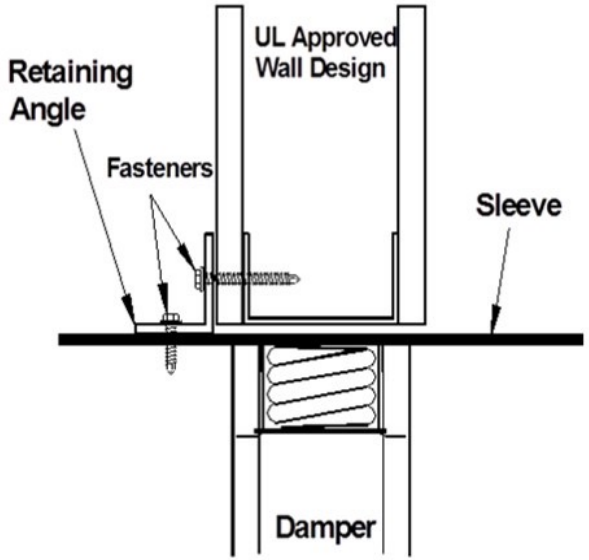
NOTE:
Every fire damper and combination fire/smoke damper must have an access door installed next to it.

Fire Dampers

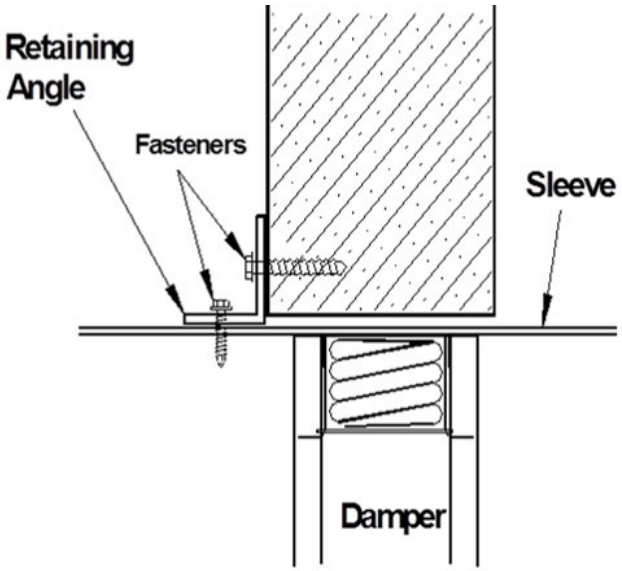
Optional Installations

(Check with manufacturer and local municipalities)

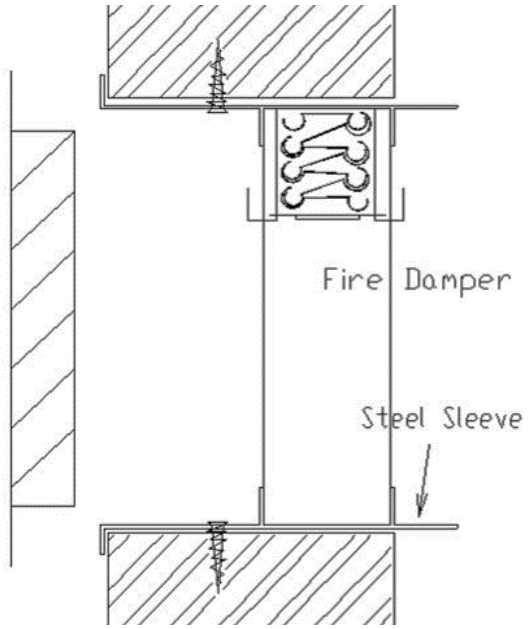
Steel/Gypsum Wall



Masonry Wall



Grille Mount



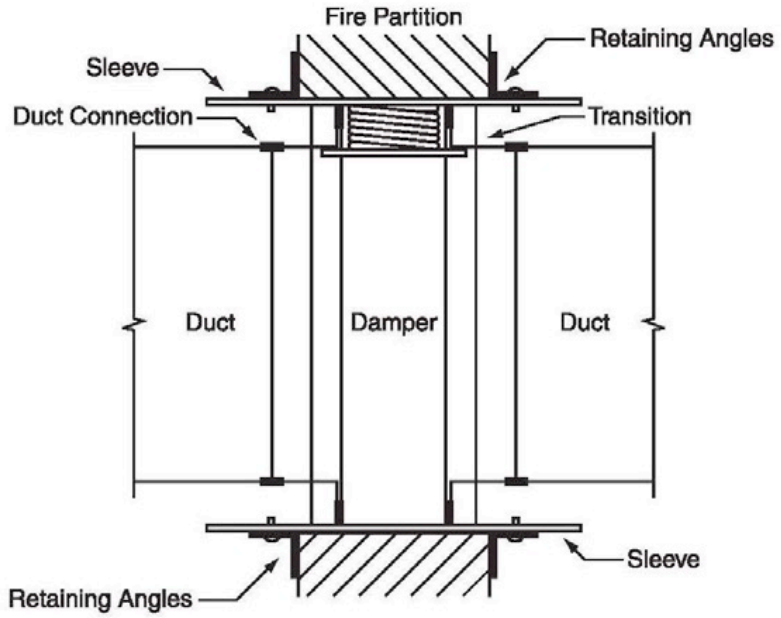
In-Wall Type

One retaining-angle method

Fire Dampers

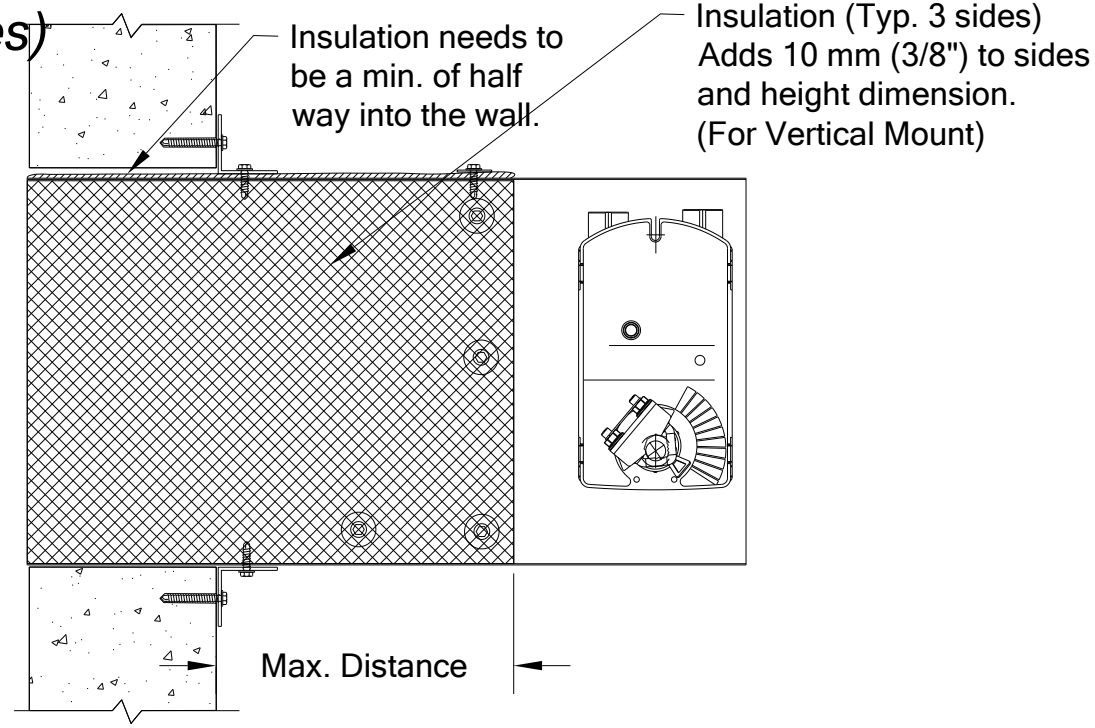
Optional Installations

(Check with manufacturer and local municipalities)



In-Wall Type B or C

Retaining angle around outer sleeve



Out-of-Wall Type

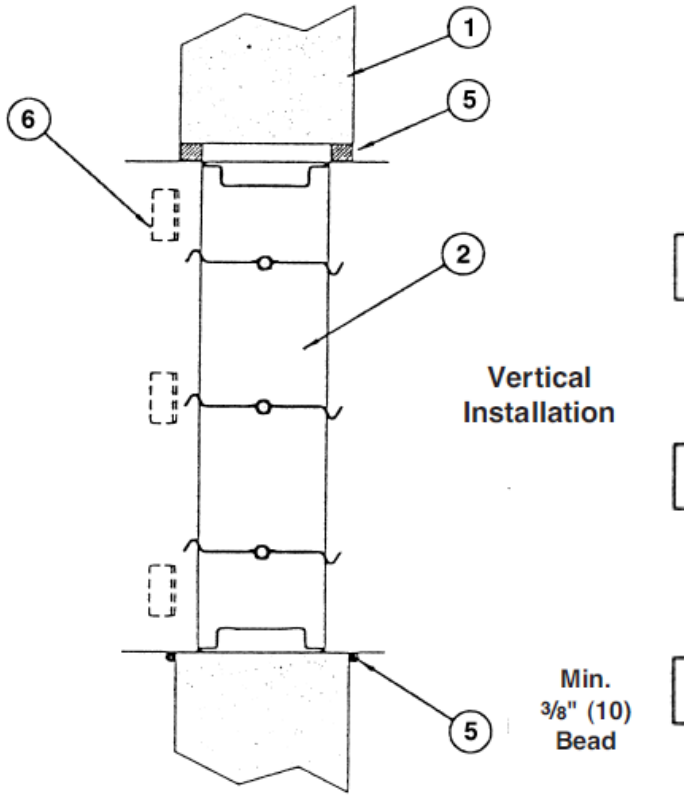
Factory-supplied insulation required

Fire Dampers

Optional Installations

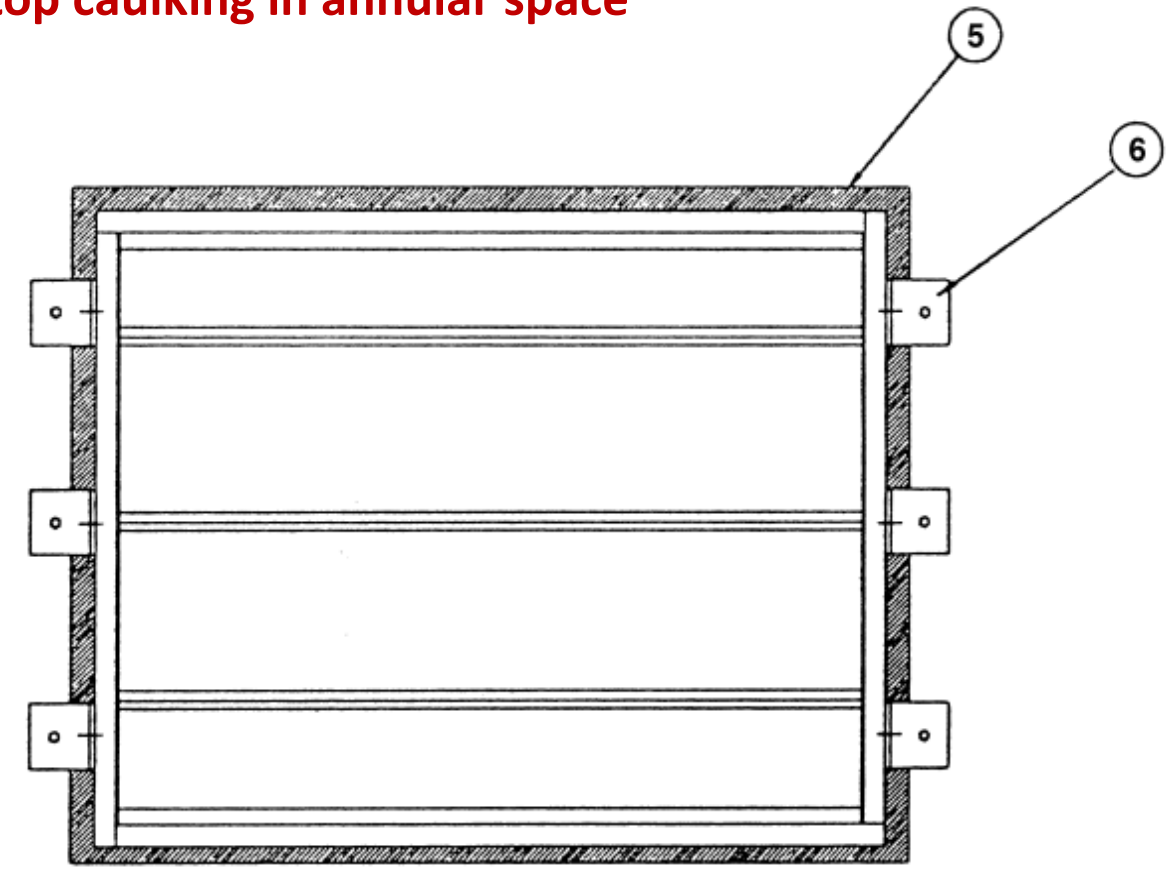
(Check with manufacturer and local municipalities)

Firestop caulking in annular space



Vertical Installation

Min. 3/8" (10) Bead



Fire Dampers and Combination Fire/Smoke Dampers

Approved Breakaway Duct Connections

Plain “S” Slip

Hemmed “S” Slip

Double “S” Slip

Inside Slip Joint

Flat Drive Slip

Drive Slip Joint

Standing “S”

Standing “S” Bar Reinforced

Standing “S” Angle Reinforced

What Is a Smoke Damper?

Smoke Dampers (IBC 717.3.2.2)

Smoke dampers are leakage rated dampers that protect duct and air transfer openings in smoke barriers, in order to reduce smoke spread out of the compartment.

Smoke Dampers (NFPA 90A, 3.3.14.4)

Smoke dampers are a device within an air-distribution system to control the movement of smoke.

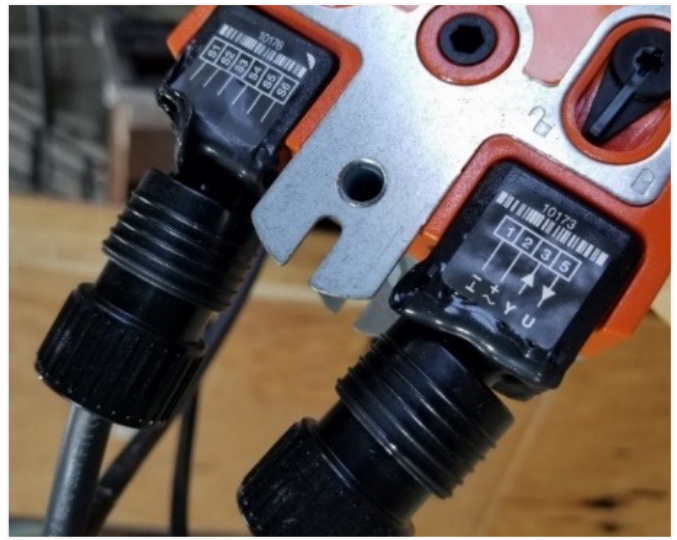
Smoke Dampers (UL Marking Guide)

Smoke dampers are used to restrict the movement of smoke where ducts and air transfer openings penetrate assemblies that are designed to restrict the movement of smoke.

What Is a Smoke Damper?

Smoke-detector activation/ actuator

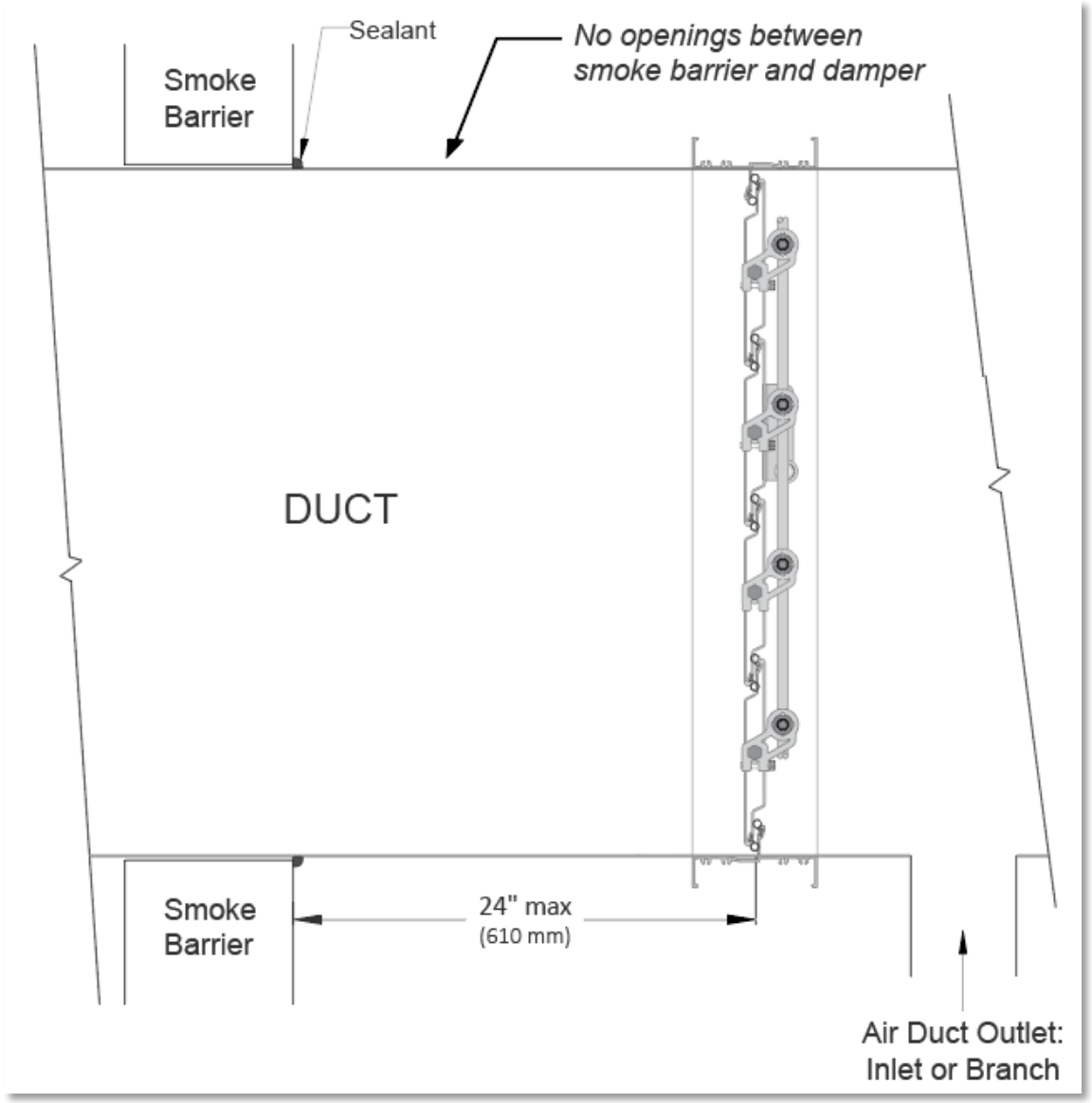
Heated-Air Test on a Smoke Damper



Smoke Dampers

Installation Requirements
NFPA 90A-15, 5.3.5.1

Maximum allowable distance from smoke barrier:
610 mm (24”)



What Is a Combination Fire/Smoke Damper?

Combination Fire/Smoke Dampers (IBC 717.3.2.3)

Combination fire and smoke dampers are dampers that meet both fire- and smoke-damper requirements.

Combination Fire/Smoke Dampers (NFPA 90A, 3.3.14.4)

Combination fire and smoke dampers are devices that meet both fire- and smoke-damper requirements.

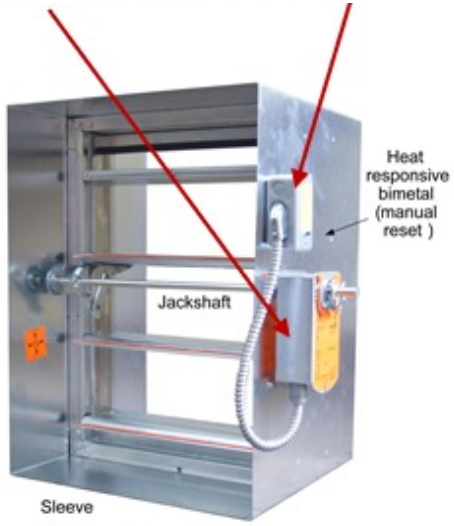
Combination Fire/Smoke Dampers (UL Marking Guide)

Combination fire/smoke dampers are used to restrict the spread of fire and the movement of smoke where ducts and air-transfer openings penetrate assemblies that are designed to restrict the passage of both fire and smoke.

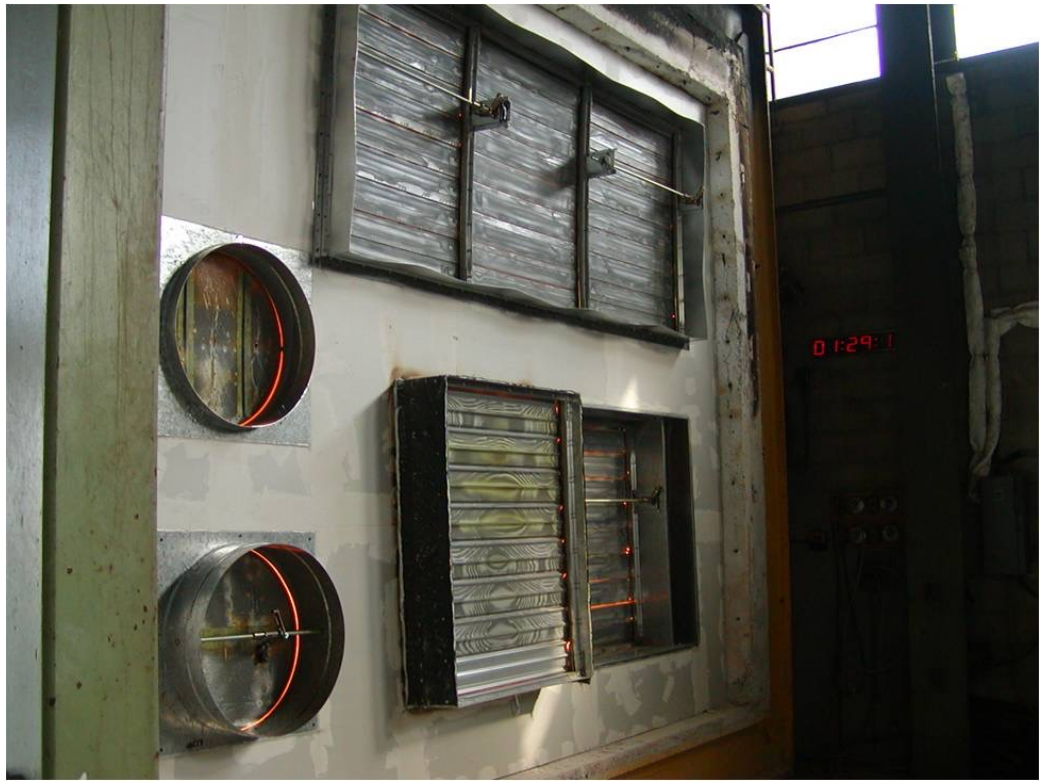
What Is a Combination Fire/Smoke Damper?

Smoke-detector activation/actuator/ HRD

Heat-responsive device



Test on a Combination Fire/Smoke Damper



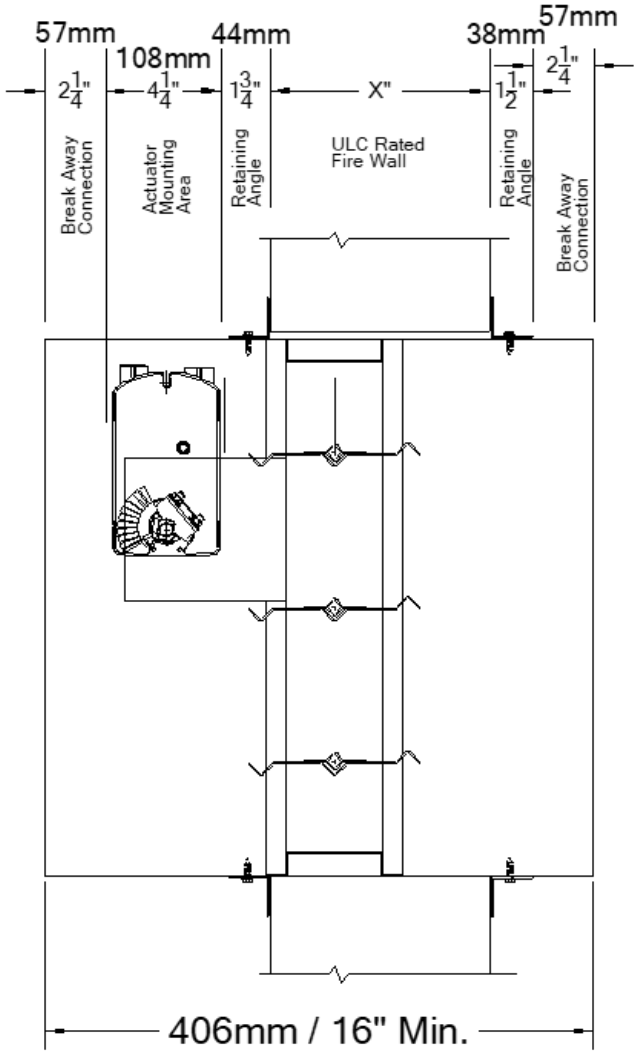
1½ hours elapsed test time,
approximately 1800°F

Immediately following fire test,
30-psi hose stream for 3 minutes

Combination Fire/Smoke Dampers

Typical Installation

In Floor



In Wall

Two-angle method

Combination Fire/Smoke Dampers

Static and Dynamic Systems

Tested and approved for use in:

- Dynamic systems
- Static systems

Tested for closure under heated airflow (dynamic systems).

Two utilization methods:

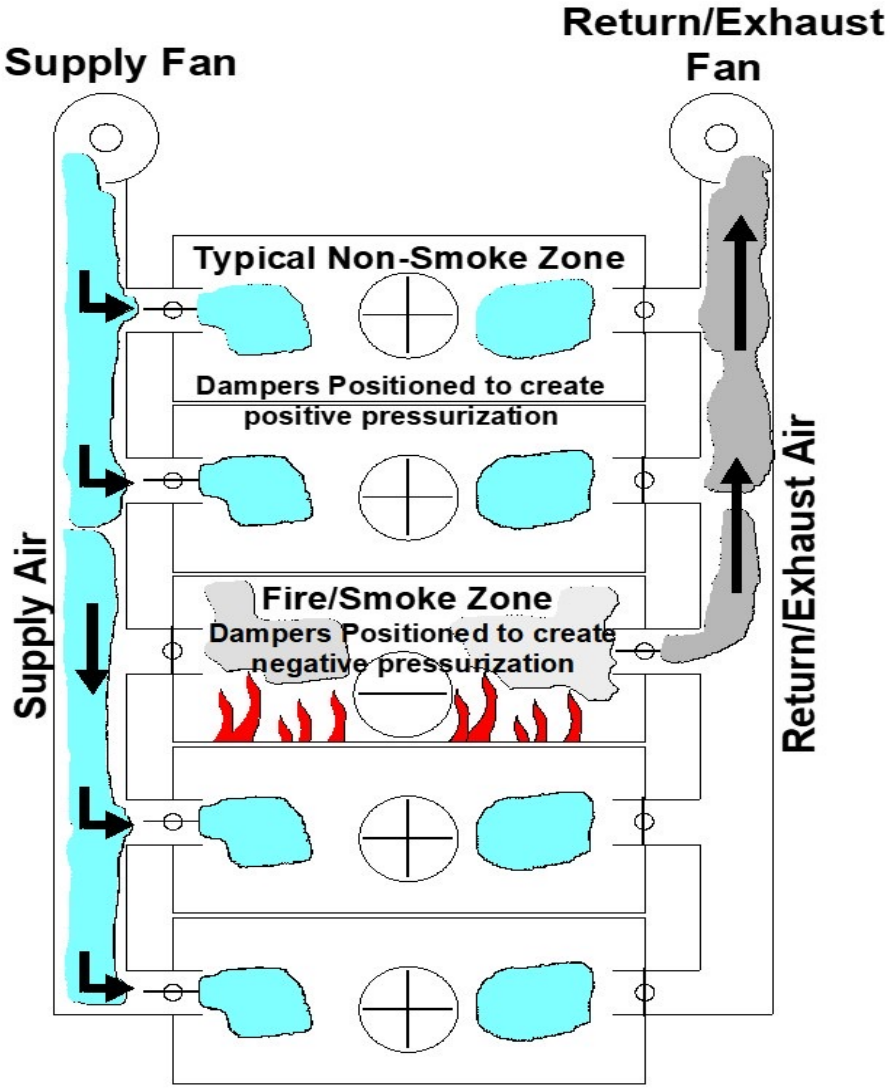
1. Containment
   - Maintain compartmentalization. Use local duct smoke detectors to close damper to prevent spread of smoke.
2. Re-openable
   - As part of an engineered smoke-control system.
   - When properly located in or immediately adjacent to returns, area smoke detectors are clear indicators of where a fire is located.
   - Sprinkler flow switches are necessary back-up.

Basic Smoke-Control Operation

Chapter 9

During Fire Emergency

Dampers operate to pressurize zones adjacent to fire zone and contain smoke to fire zone.



Minimum Damper Code Requirements

IBC Section	Min. Damper Rating
717.3.2.1 Fire Dampers	• UL-555 • 1-1/2-hr rated (assemblies less than 3 hr) • 3-hr rated (assemblies greater than or equal to 3 hours) • Dynamic rating required when fans are to remain on during a fire event
717.3.2.2 Smoke Dampers	• UL-555S • Class 1 or Class 2 • 250°F minimum
717.3.2.3 Fire/Smoke Dampers	• Meet the fire-damper and smoke-damper requirements mentioned above
Corridor Dampers	• UL-555 and UL-555S • 1-hr rated • Class 1 or Class 2 • 250°F minimum
Ceiling “Radiation” Dampers	• UL-555C • Fire rating to match fire rating and be approved for the assembly installed in. • Dynamic rating required when fans are to remain on during a fire.

IBC Section	Assembly Type	Typical Rating	Function	Required Protection
717.5.1	Fire wall	3 hr	Continuous wall from foundation to/through roof and won't collapse if the structure on either side collapses in fire.	Fire Damper
717.5.2	Fire barrier	2 hr	Occupancy separations, incidental-use areas, shaft enclosures, exit enclosures, exit passageways, horizontal exits, exterior walls.	Fire/Smoke Damper
717.5.1.1 717.5.2.1	Horizontal exits	2 hr	Means of egress.	Fire/Smoke Damper
717.5.3	Shaft enclosure	2 hr	Extending through one or more stories of a building, connecting vertical openings in successive floors/roof.	Fire/Smoke Damper
717.5.4	Fire partition	1 hr	Walls separating dwelling units or tenant spaces in covered malls, corridor walls, elevator-lobby separations.	Fire Damper
717.5.4.1	Corridor	1 hr	An enclosed exit access component that defines and provides a path of egress travel.	Fire/Smoke Damper Radiation/Smoke Damper
717.5.5	Smoke barrier	1 hr	Bisects floors of underground buildings and patient floors of a hospital, hospital egress, and areas of refuge.	Smoke Damper
717.5.6	Exterior walls	2 hr	Bearing or nonbearing walls used to enclose a building.	Fire Damper
717.5.7	Smoke partition	0 hr	Corridor and care-suite walls in Group I-2, certain elevator lobbies.	Smoke Damper
717.6.1	Horizon through penetration	2 hr	Through penetrations of horizontal assemblies (floors or roof assemblies).	Shaft Enclosure Fire Damper
717.6.2	Ceiling-membrane penetration	1 hr	Penetrations of ceiling membrane of floor/ceiling or roof/ceiling assembly.	Ceiling Radiation Damper

Requirements for Inspection and Maintenance

International Fire Code - IFC
Chapter 7

Section 706

Duct and Air Transfer Openings

- 706.1 – Maintaining Protection
  - Dampers protecting ducts and air transfer opening shall be inspected and maintained in accordance with **NFPA 80** and **NFPA 105**.

National Fire Protection Association

NFPA 80

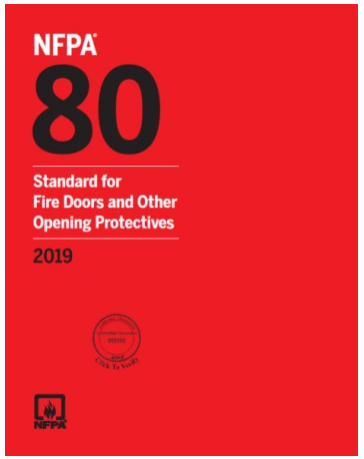
Standard for Fire Doors and Other Opening Protectives

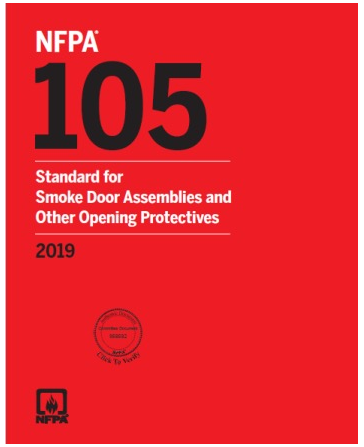
- Chapter 19: Installation, Testing, and Maintenance of Fire Dampers

NFPA 105

Standard for Smoke Door Assemblies and Other Opening Protectives

- Chapter 7: Installation, Testing, and Maintenance of Smoke Dampers





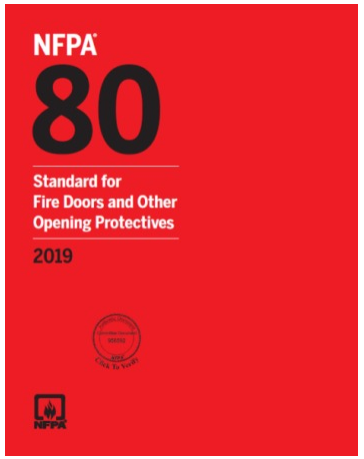
NFPA 80 and 105

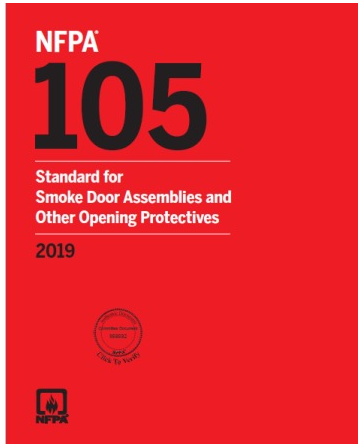
Operational Testing

2019 NFPA 80, Sect. 19.3

19.3.1 – After the installation of a damper is completed, an operational test shall be conducted.

- Conducted after installation
- Verifies that there is unobstructed access to the damper
- Verifies that the damper operates as designed





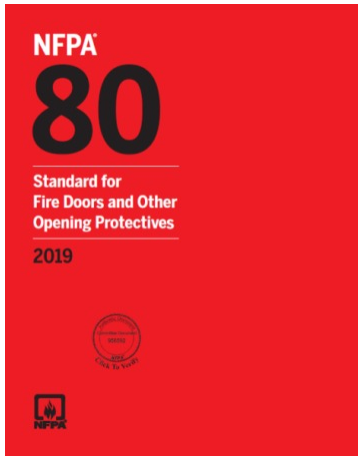
NFPA 80 and 105

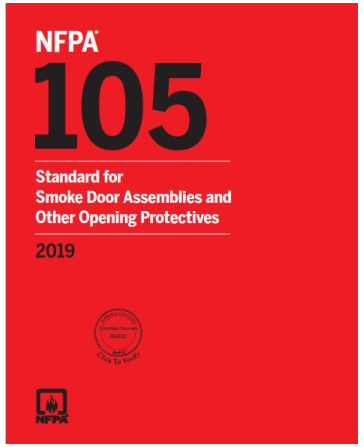
Acceptance Test

2019 NFPA 80, Sect. 19.4

19.4.1 – Acceptance testing of fire dampers shall be preformed by a qualified person with knowledge and understanding of the operating components of the type of assembly being subject to testing and the system in which it is installed.

- Conducted after construction and balancing of the HVAC system is complete (just prior to turning the building over)
- Confirms proper operation of damper under maximum airflow conditions (for actuated dampers)



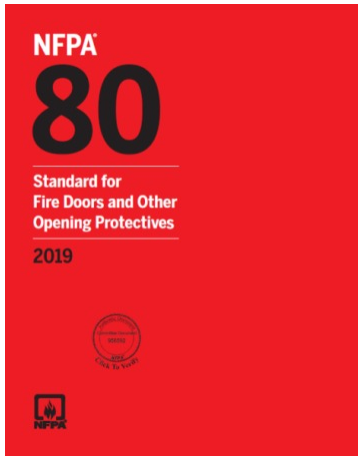


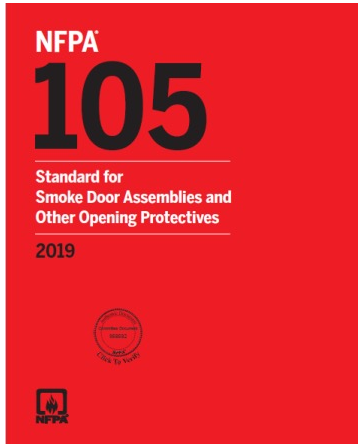
NFPA 80 and 105

Acceptance Test cont.

2019 NFPA 80, Sect. 19.4

- This test also includes visual inspection of a damper for damage, missing parts, and operation
- For an actuated damper, power to be removed, proper closing to be confirmed, power reapplied, and damper opened properly
- For a non-actuated damper, the fuse link shall be removed and proper closing confirmed. Then, the damper shall be manually placed in its open position and the fuse link reinstalled.



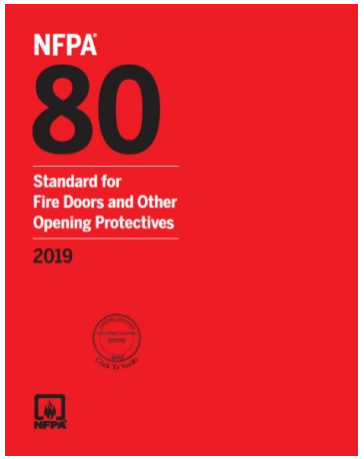


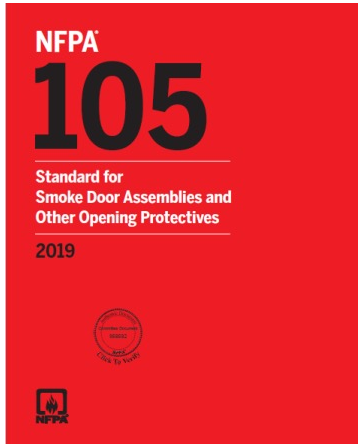
NFPA 80 and 105

Periodic Testing of Life-Safety Dampers

Frequency – 2019 NFPA 80, Sect. 19.5

- Each damper shall be tested and inspected 1 year after acceptance testing and then every 4 years thereafter, except hospitals, which shall be every 6 years
- Field Modifications can be made to existing dampers if not provided with a Remote Position Indication device, must be per manufacturers instructions, and be visually inspected for full operation.



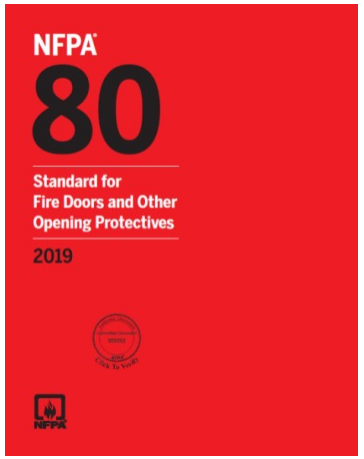


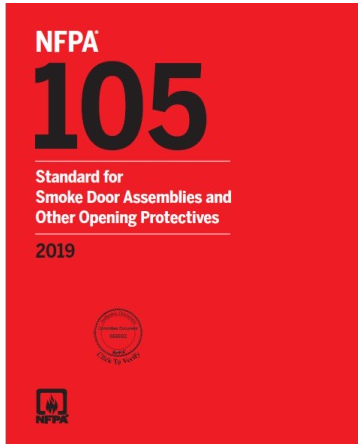
NFPA 80 and 105

Periodic Testing of Life-Safety Dampers

Visual Method – 2019 NFPA 19.5.2.3.2

- May be used on all life-safety dampers
- Is the only option for dampers with a fusible link
- Requires visual confirmation that a damper closes and latches (if applicable) as designed
- For a motorized damper, this method requires visual confirmation that the damper reopens as designed



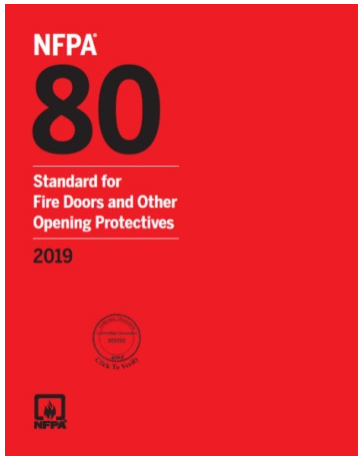


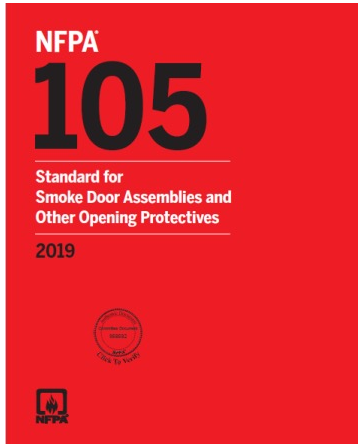
NFPA 80 and 105

Periodic Testing of Life-Safety Dampers

Remote Method – 2019 NFPA 19.5.2.3.3

- May be used on life-safety dampers with “remote inspection capability”
- Is “not” an option for dampers with a fusible link
- For a motorized damper, this method requires visual confirmation during the acceptance inspection that the position switches reflect the fully open and closed positions of the damper.

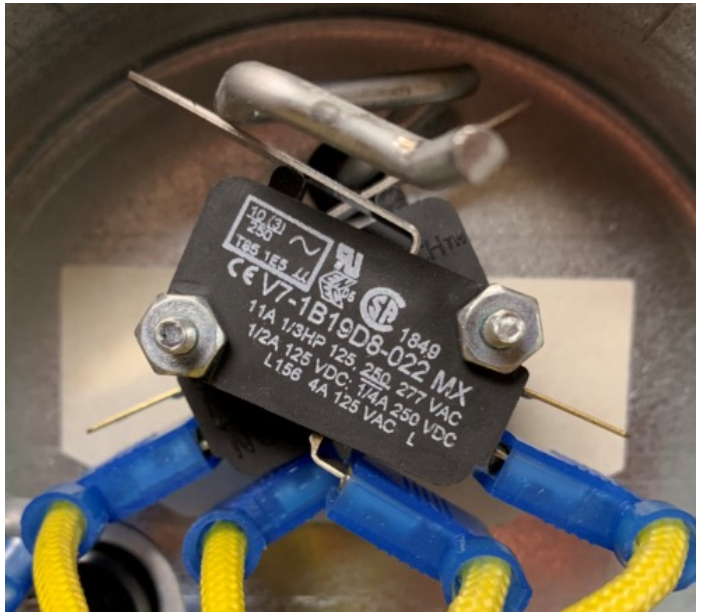




Remote-Test Method

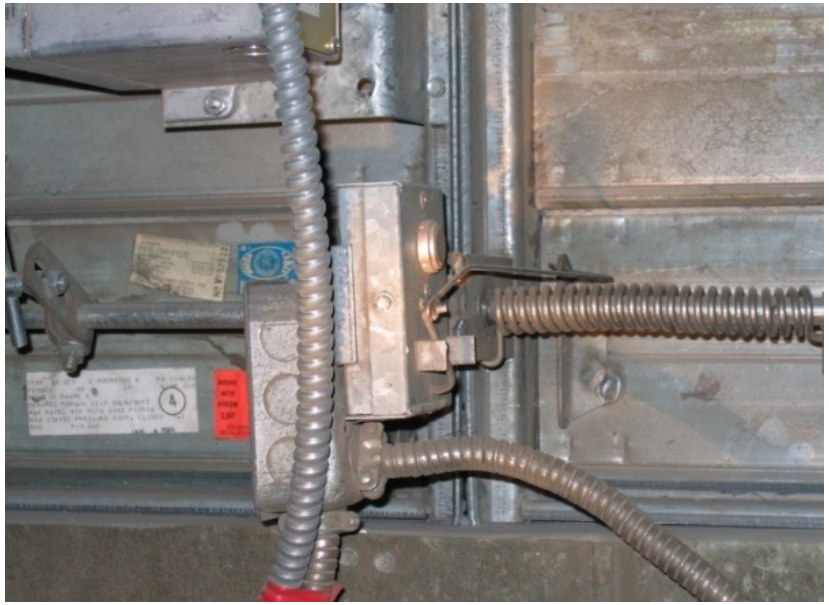
Position-Indication Device

Most position-indication devices use electromechanical switches (one to confirm the open position and one to confirm the closed position)



Remote-Test Method

Position-Indication Device

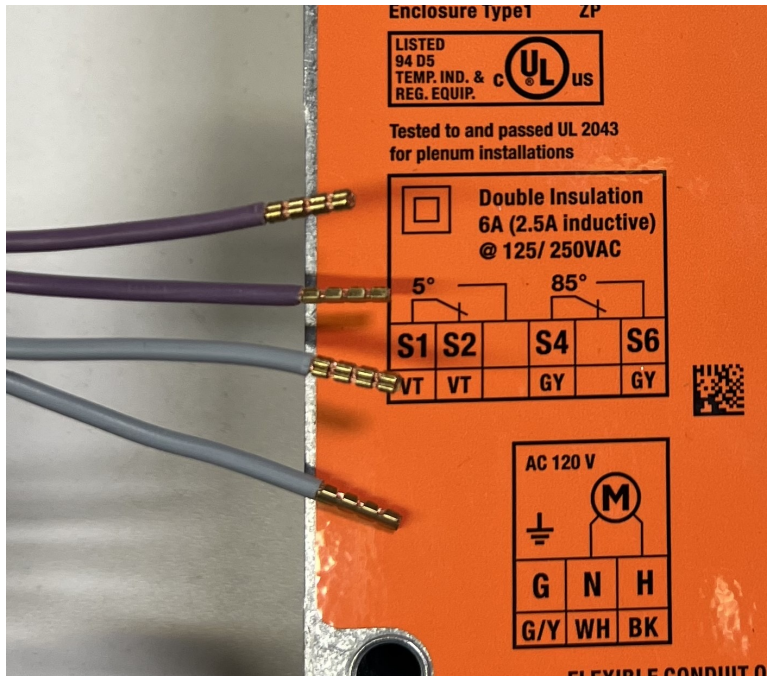


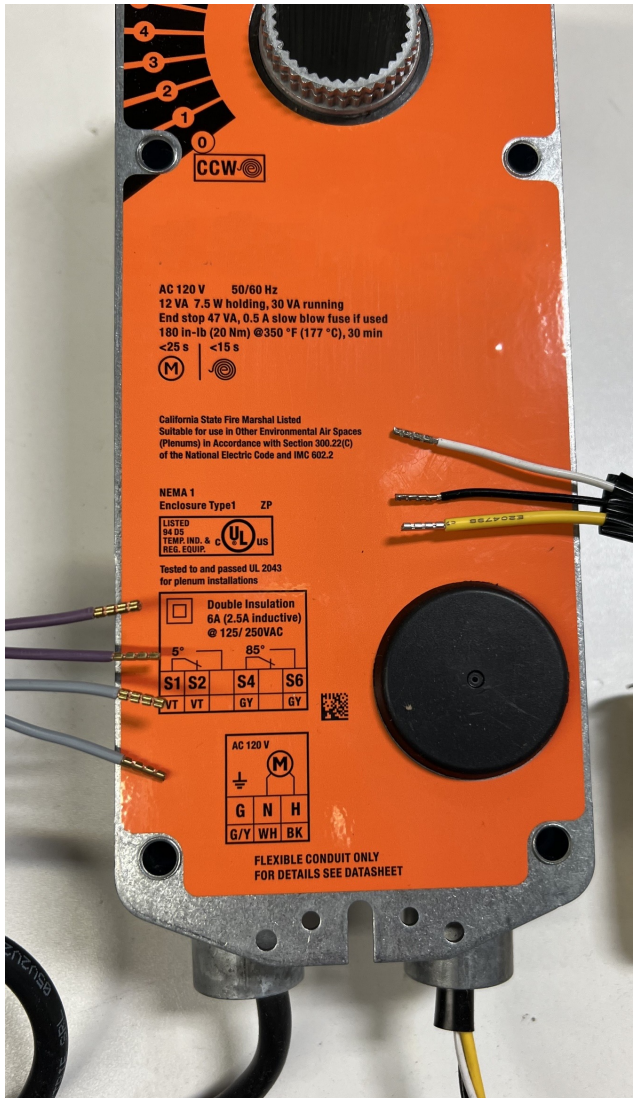
30-plus-year-old switch package still in operation

Remote-Test Method

Position-Indication Device

Most actuators have switching options to indicate their open and closed positions





Remote-Test Method

Position Indication

Remote Communication

The damper's position-indication device can communicate the damper's position to any one of several devices or systems:

Local Indicator Lights

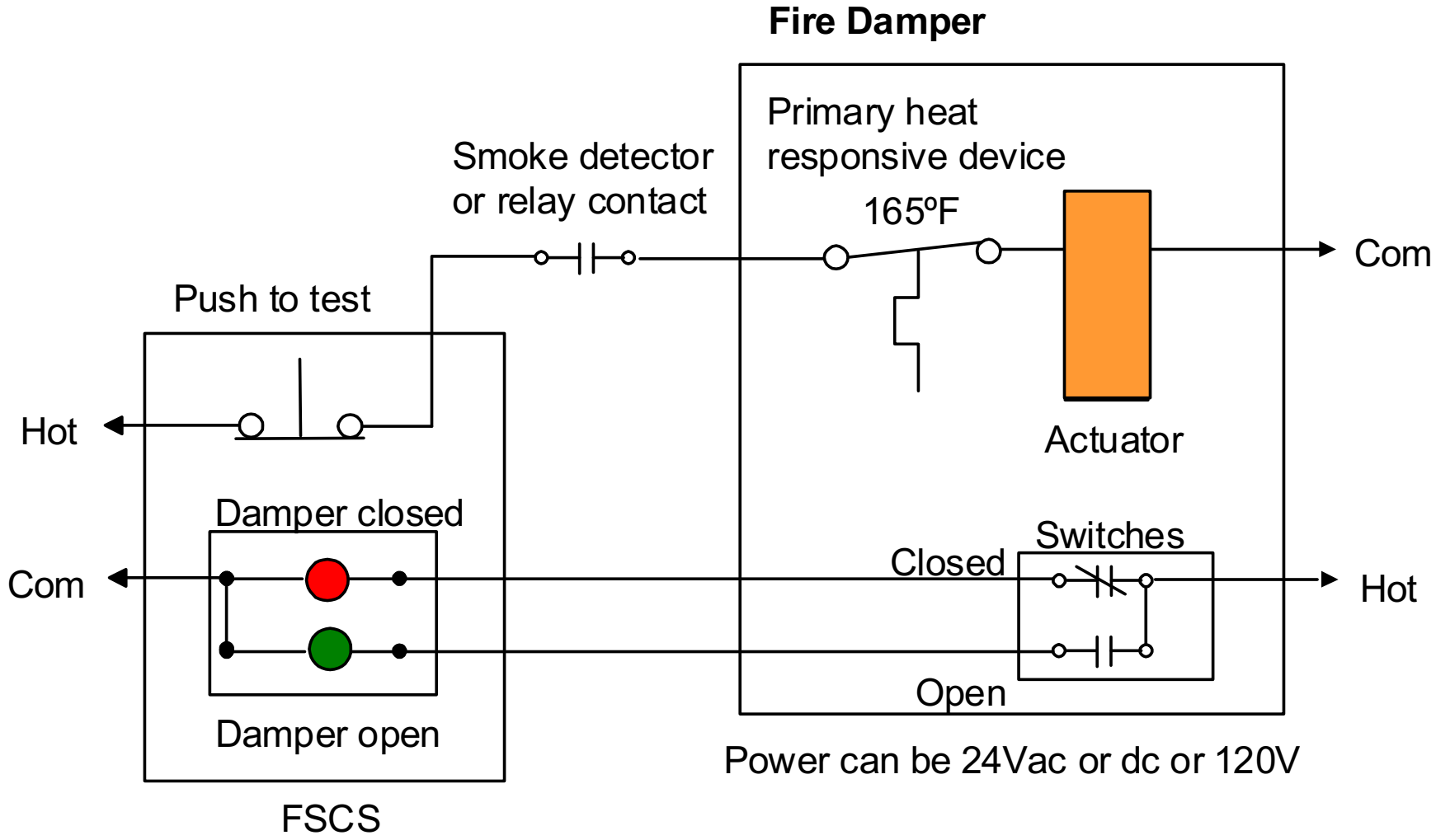
Smoke-Control System

BACnet™

Building Automation System

Remote Testing

Basic Wiring

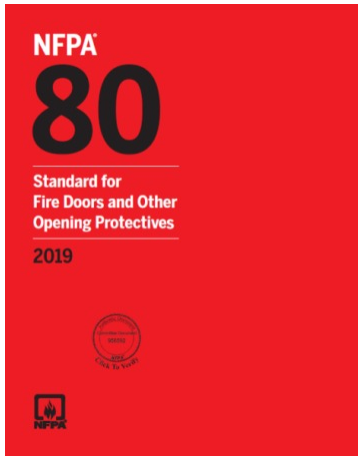


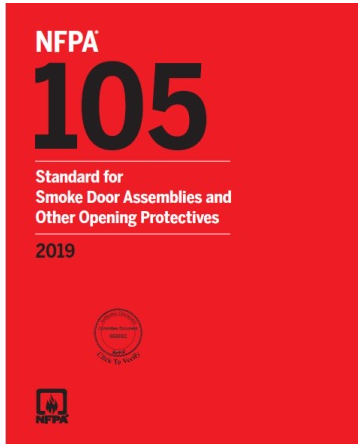
NFPA 80 and 105

Maintenance of Life-Safety Dampers

Maintenance – 2019 NFPA 19.6

- Reports of changes in airflow or noise to make sure not damper-related
- Exposed moving parts shall be dry-lubricated
- If damper found to not be operable, repairs shall begin without delay
- All maintenance and repairs shall be documented
- Side note: Refer to manufacturer's installation instructions and call manufacturer for recommendations





Remote-Test Method

Benefits

Reduced Cost

Accessing life-safety dampers for visual inspections can be very time-consuming and require areas of a building to be unusable during the inspection

Increased Compliance

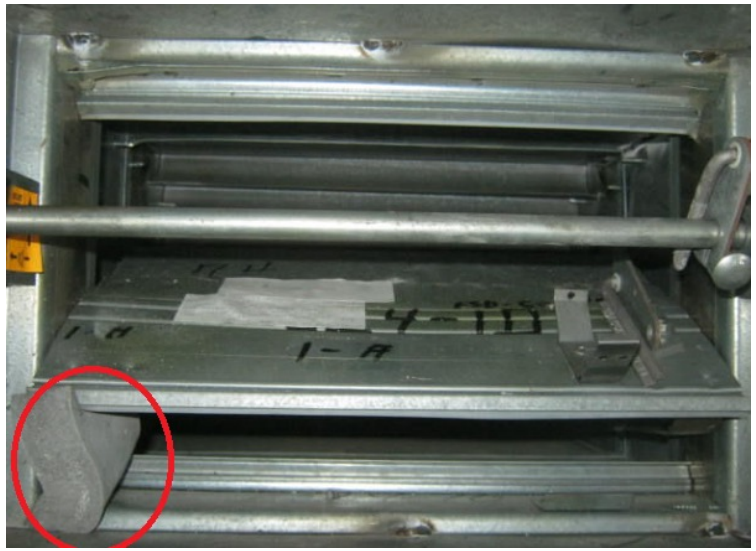
Because of difficult accessibility, high cost, and lack of enforcement, code-mandated periodic testing is not conducted on many life-safety dampers. The simplicity of the remote-test method will result in increased compliance and, thus, safer buildings.

Reasons for Inspection and Maintenance

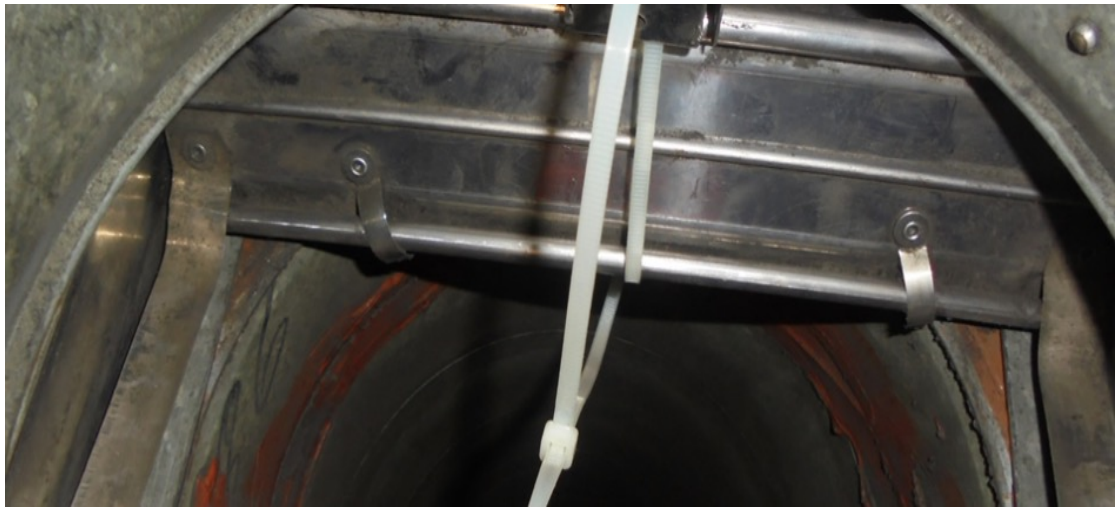
Typical Drywall Installation

Metal-Stud/Gypsum Firewall

Reasons for Inspection



Reasons for Inspection



Reasons for Inspection

Garbage found behind damper

Reasons for Inspection

Age-Old Dilemma:

How to install a square damper in a round hole

Questions?

Thank You

To receive PDH credit, you must complete the post-course evaluation