Life Safety Dampers

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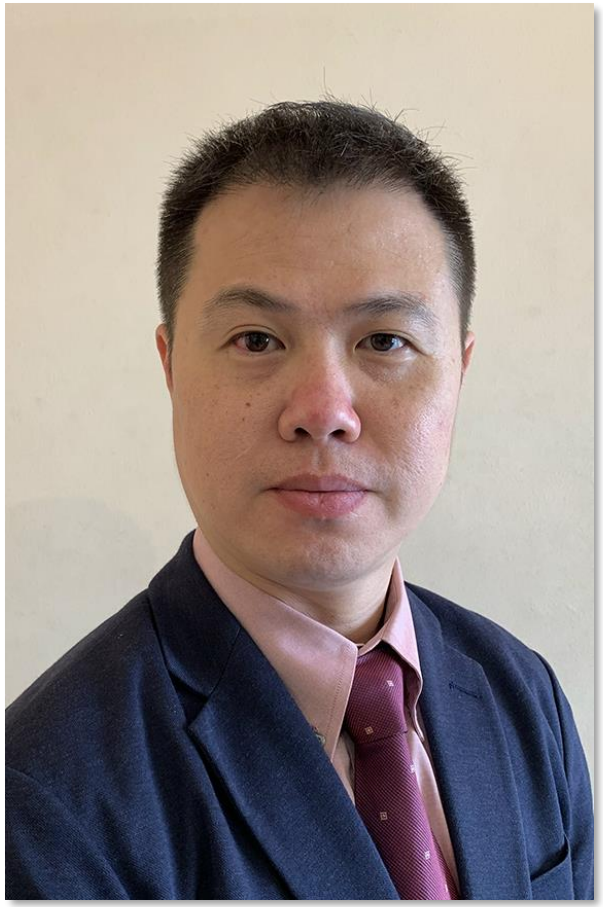
Preston Koh

Marketing Manager, Asia AMCA

Webinar Moderator

- Joined Asia AMCA in 2013
- Responsible for AMCA memberships in the Asia Region
- Responsible for Marketing activities & events in the Asia Region



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  - Questions can be submitted anytime via the GoToWebinar platform and will be addressed at the end of the presentation.
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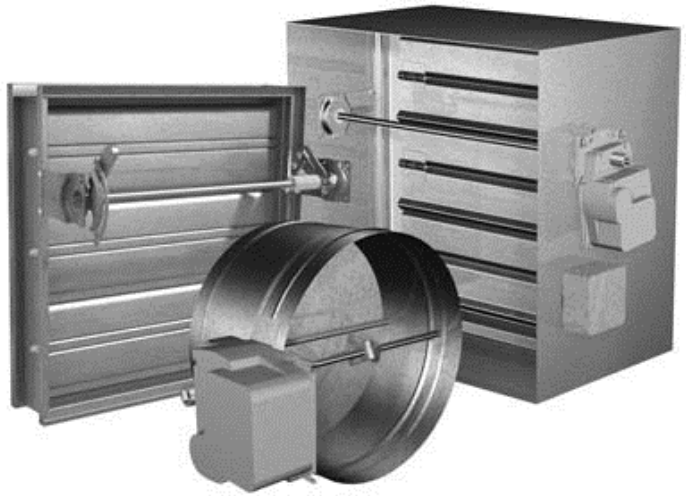
Alex Talwar

- Application Engineer II – Commercial Dampers
- 7 years at AMCA Member Company
  - 5 years as Damper Test Lab Supervisor and Product Development Engineer
- Bachelor's Degree in Engineering Physics (University of Michigan '06)
- Member of ASHRAE, NFPA, and Various AMCA Committees

Purpose & Learning Objectives

The purpose of this presentation is to inform industry professionals about Life-Safety Dampers. At the end of this presentation attendees will be able to:

- Identify different Life-Safety Damper Product Types
- Outline Life-Safety Damper Rating Requirements
- Explain Installation Requirements & Options
- Discuss Available Options / Accessories
- Explain Testing/Maintenance Requirements



Codes & Standards

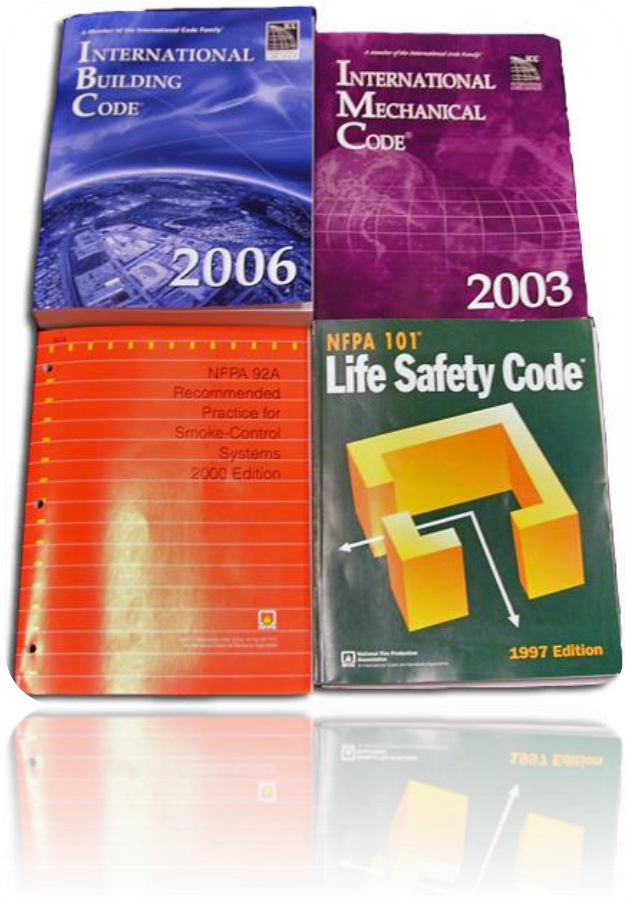
IBC
INTERNATIONAL BUILDING CODE

amca INTERNATIONAL

NFPA
NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards

UL
Underwriters Laboratories

IFC

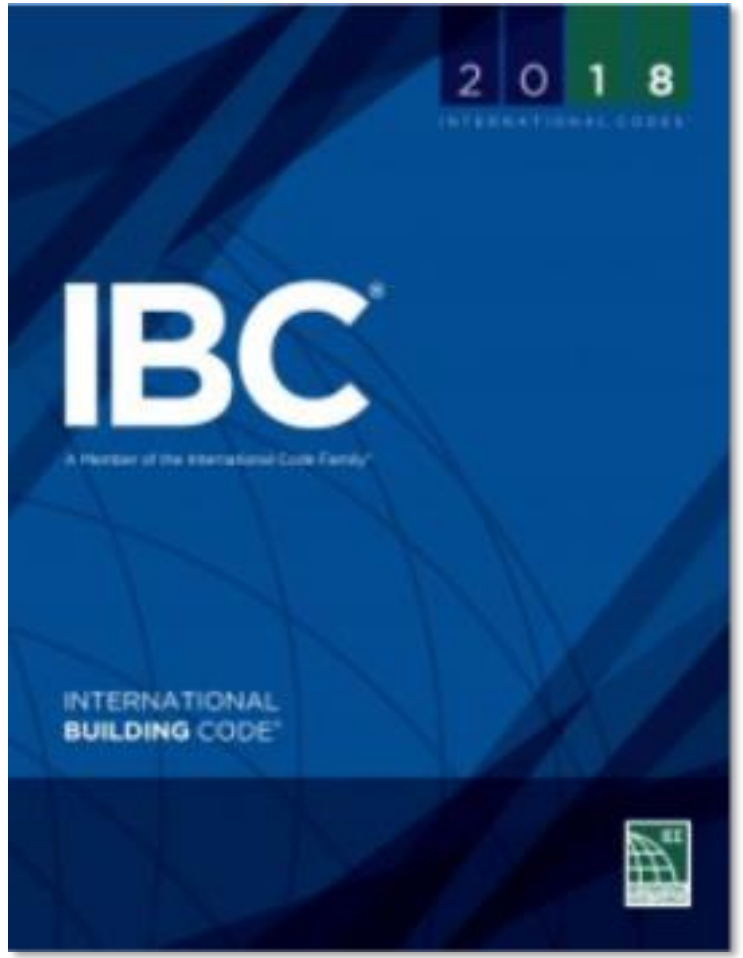


Required Elements of an “Approved” Life-Safety Damper Installation

1. Rater Barrier
2. Listed Product
3. Installation Requirements

Building Code

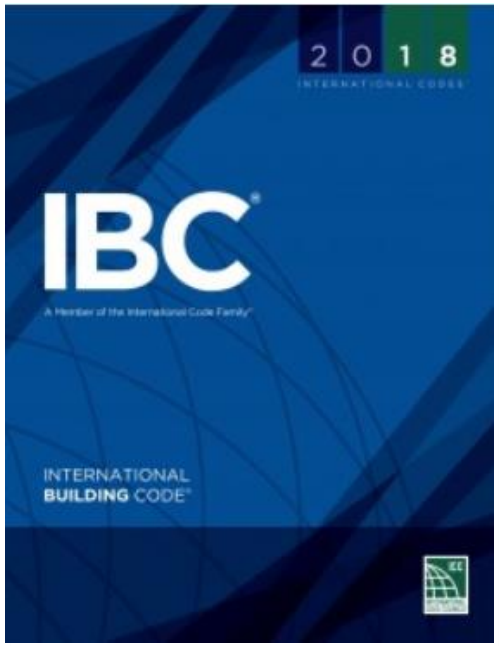
- **International Building Code (IBC)**
  - Ch. 7 – Fire & Smoke Protection Features
    - Sec. 717 – Ducts & Air Transfer Openings
- Baseline Requirements:
- Dampers must be listed & labeled to applicable UL standard
- Dampers must be installed in accordance with manufacturer's instructions
- Defines the type of damper required to protect penetrations through each type of rated building element



Code Mandated Applications of Life-Safety Damper

Sections 717.5 – Where Life-Safety Dampers are Required

- 717.5.1 Fire Walls
- 717.5.2 Fire Barriers
- 717.5.3 Shaft Enclosures
- 717.5.4 Fire Partitions (includes corridors)
- 717.5.5 Smoke Barriers
- 717.5.6 Exterior Walls
- 717.5.7 Smoke Partitions



Standards - NFPA

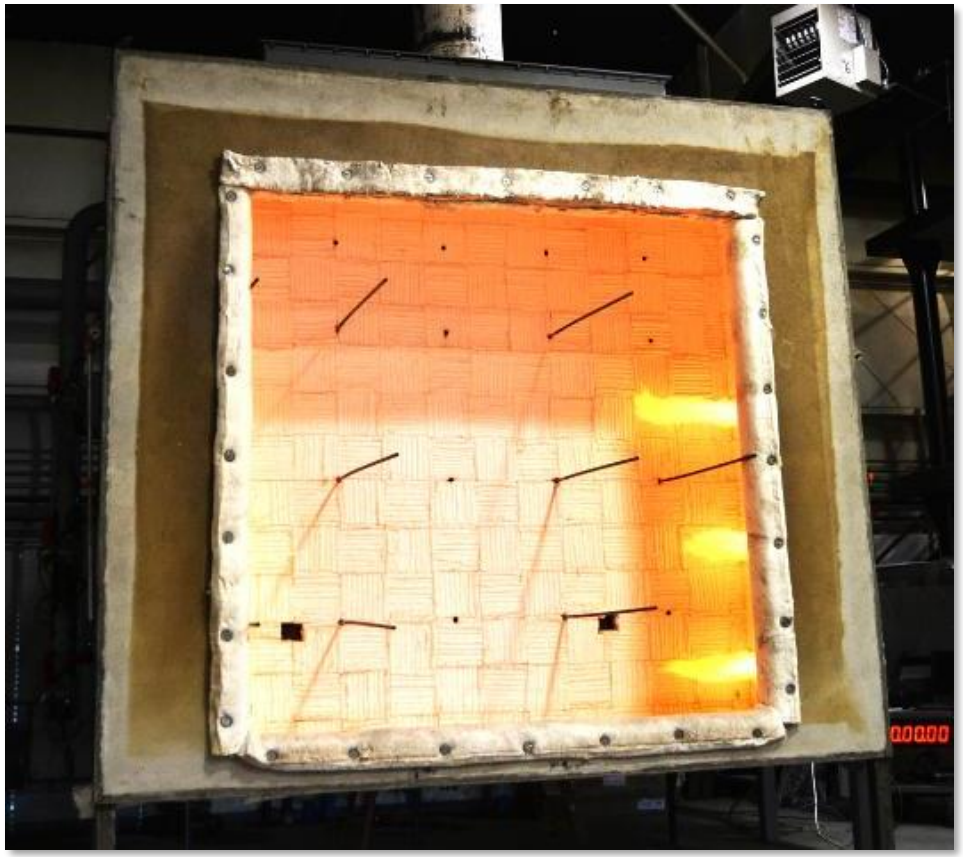
National Fire Protection Association

- Installation, Testing and Maintenance
  - NFPA 80
    - Standard for Fire Doors
  - NFPA 105
    - Standard for Smoke Doors
  - NFPA 90A and 90B
    - Standard for Installation of Air-conditioning and Ventilating Systems
  - NFPA 92
    - Standard for Smoke-Control Systems

Standards - UL

Underwriters Laboratories

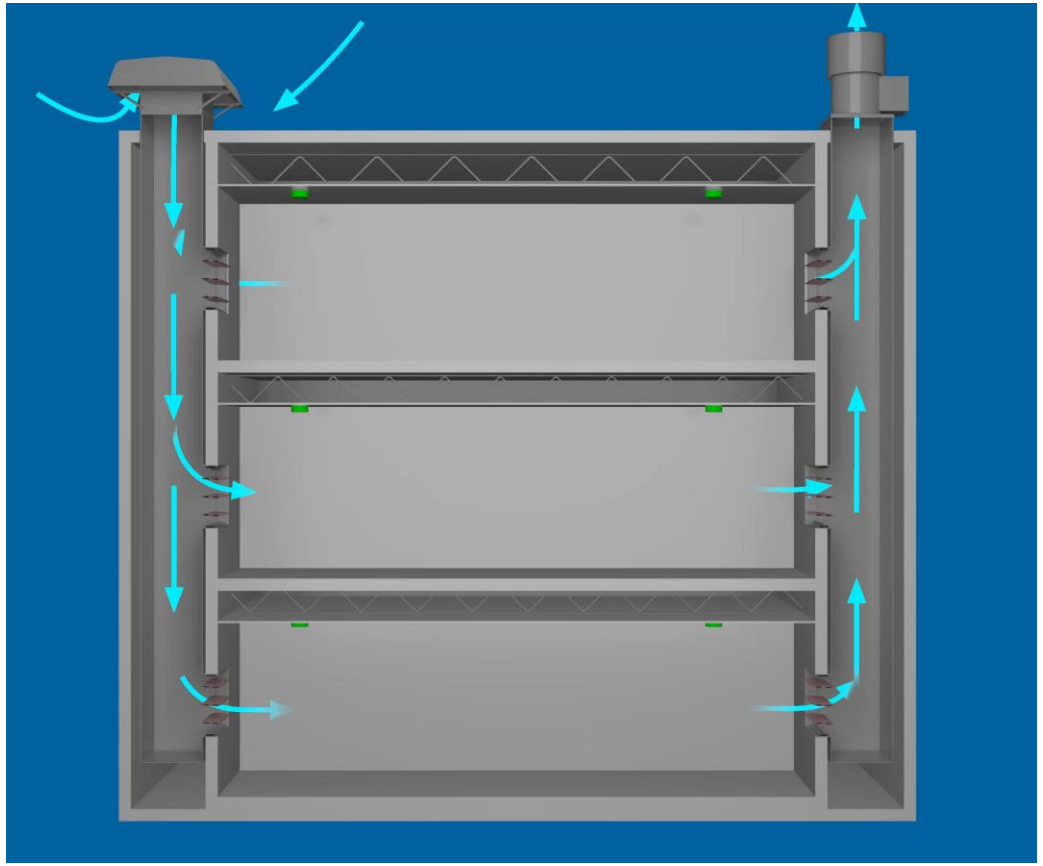
- Testing, Evaluation and Certification
  - UL 555 - standard for Fire dampers
  - UL 555S - standard for Smoke dampers
  - UL 555C - standard for Ceiling Radiation dampers
- UL's "Follow-Up Service" ensures that dampers are built as they were tested



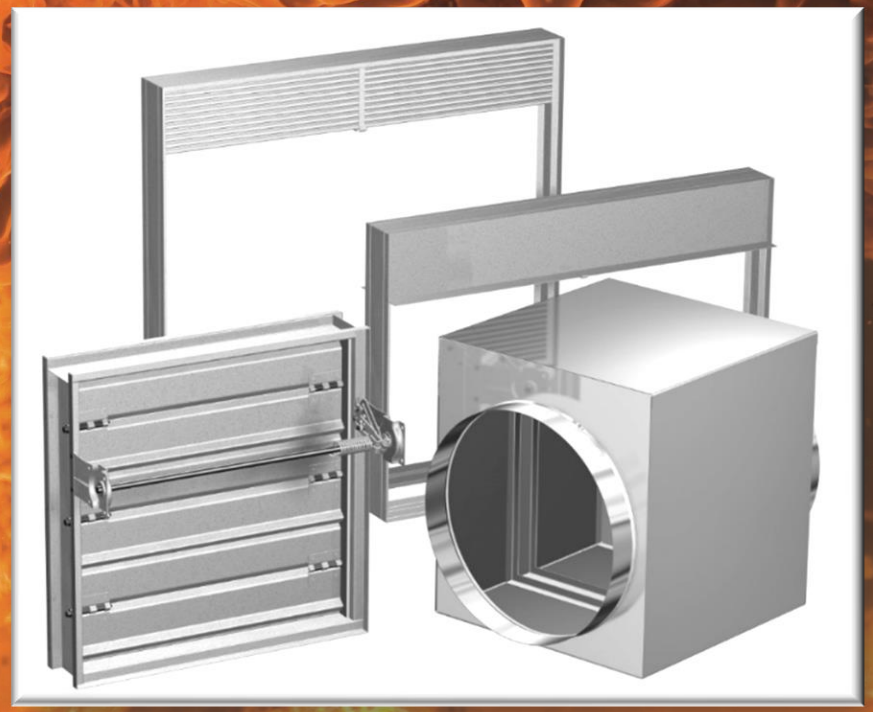
Purposes of Life-Safety Dampers

- Containment
  - Building codes require life-safety dampers to protect duct penetrations thru rated construction
  - Fire and smoke rated construction is used to “compartmentalize” a building into fire & smoke zones to prevent the spread of fire
- Engineered Smoke Control Systems
  - Smoke and Fire Smoke Dampers are often used as part of an engineered smoke control system to evacuate smoke and/or pressurize zones adjacent to the fire

Dampers in an Engineered Smoke Control System

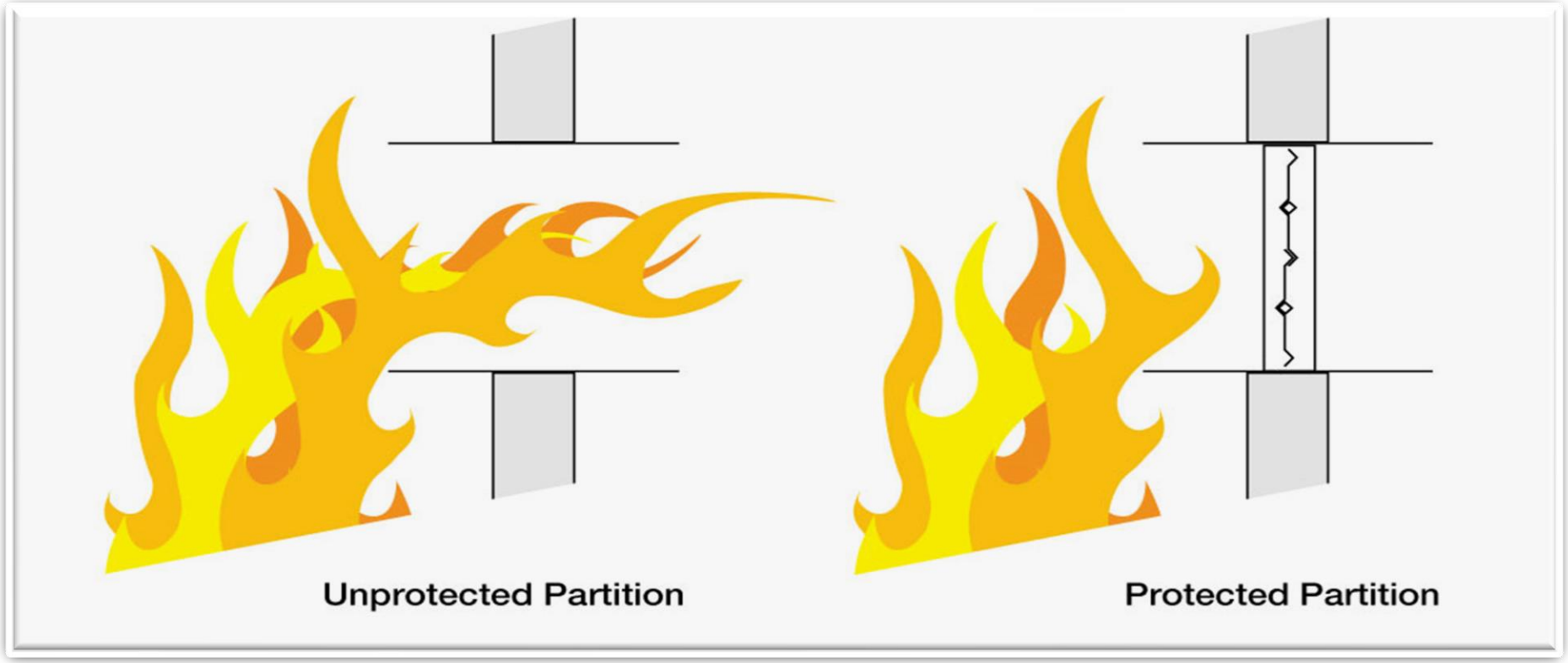


Fire Dampers UL555



Purpose of Fire Damper

- To maintain the fire-resistance rating of fire walls, barriers and partitions when penetrated by air duct or transfer openings



Hourly Fire Resistance Rating

IBC table 717.3.2.1

Type of Penetration	Minimum Damper Rating (hours)
Less than 3 hour fire resistance rated assemblies	1½
3 hour or greater fire resistance rated assemblies	3

2 hour assembly rating = **1.5** hour rated damper

3 hour assembly rating = **3** hour rated damper

4 hour assembly rating = **3** hour rated damper

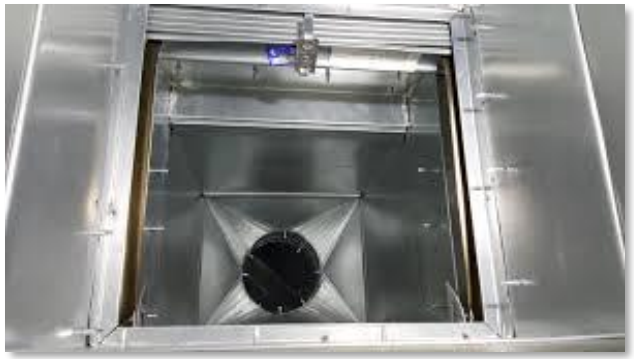
UL 555 Fire Test

Fire Damper Operation

UL Marking and Application Guide

- Static
  - Used in duct systems or penetrations where the HVAC system is automatically shut down in the event of a fire.
- Dynamic
  - To be used in applications where fan pressure and airflow will be on during a fire incident.

Air Transport Opening

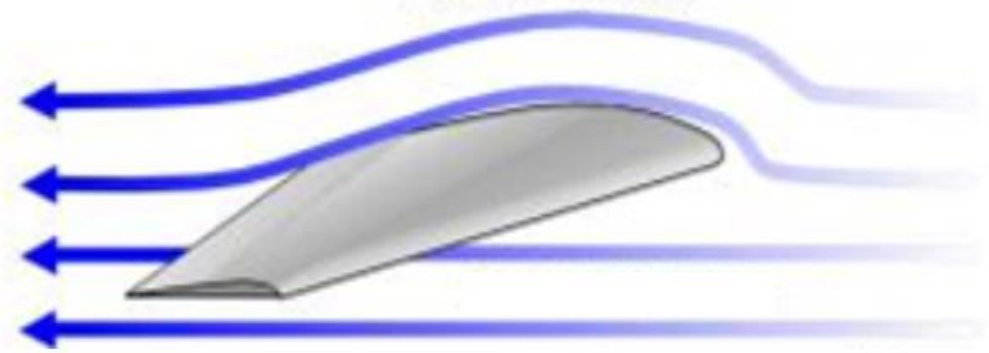


Fire Damper Actuation Temperature

- For Most Fire Dampers this is the Fusible Link Temperature Rating
  - 165°F – standard
    - 160°F minimum per IBC
  - 212°F – max for static applications
    - Helps avoid nuisance trips from heating equipment
  - 286°F
  - 350°F – max for dynamic application

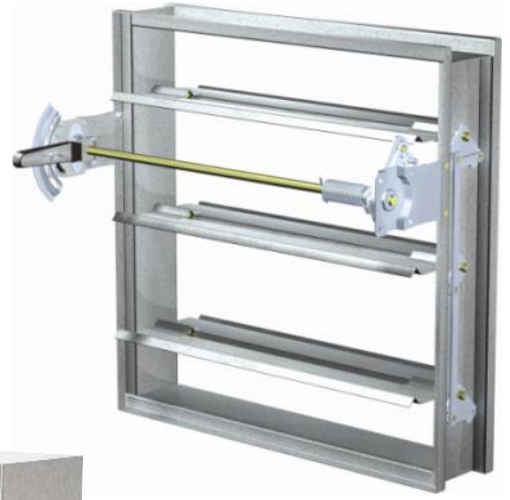
Velocity & Pressure Ratings for Dynamic Fire Dampers

- Operational closure velocity rating
  - **2,000 fpm** (UL555 minimum rating)
  - 3000 fpm
  - 4000 fpm
- Operational closure pressure rating
  - **4-in. wg** (UL555 minimum rating)
  - 6-in. wg
  - 8-in. wg
- Broadest product offering is rated for **2,000fpm** and **4-in. wg**

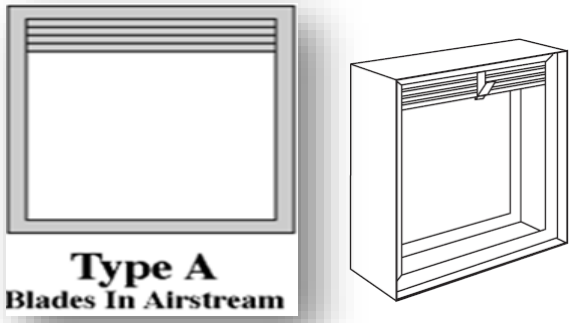


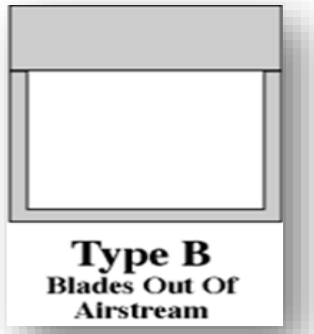
Damper Construction

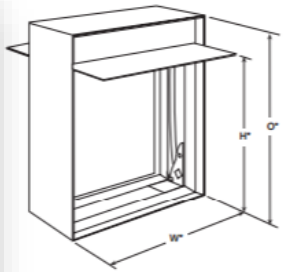
- Two common construction types
  - Curtain
    - Static or Dynamic rating
    - Low cost
  - Multi-blade
    - Typically have Dynamic rating
    - Larger sizes than curtain models
    - Can double as a balancing damper
- Material
  - Galvanized
  - 304 & 316 stainless steel
  - * No aluminum models * (1,221°F melting point)

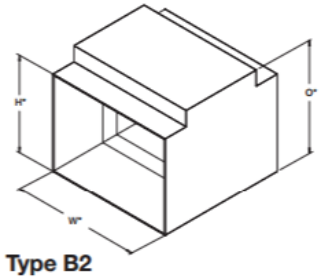


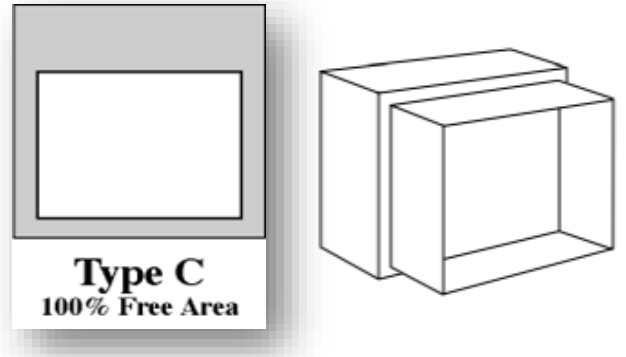
Fire Damper Transition Options

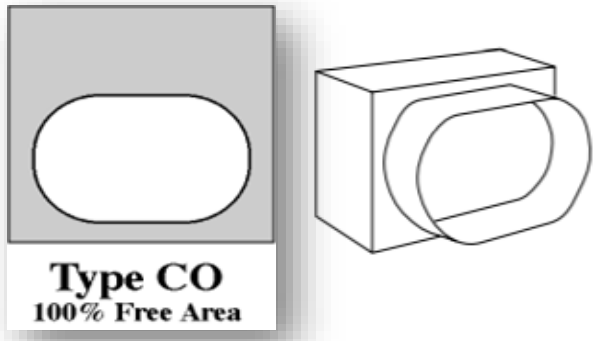


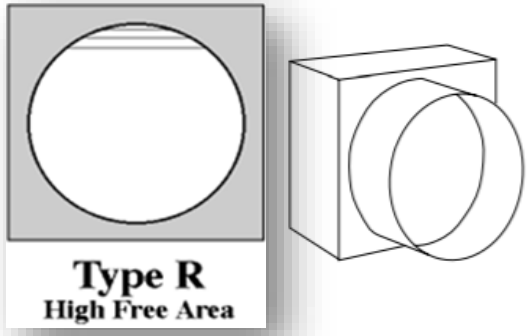


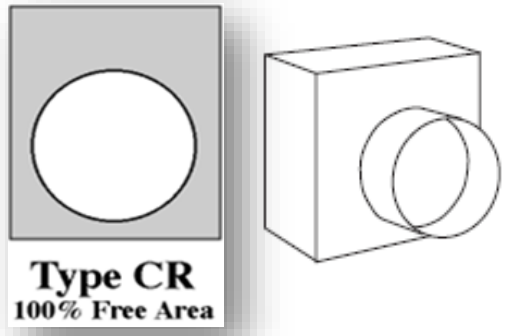








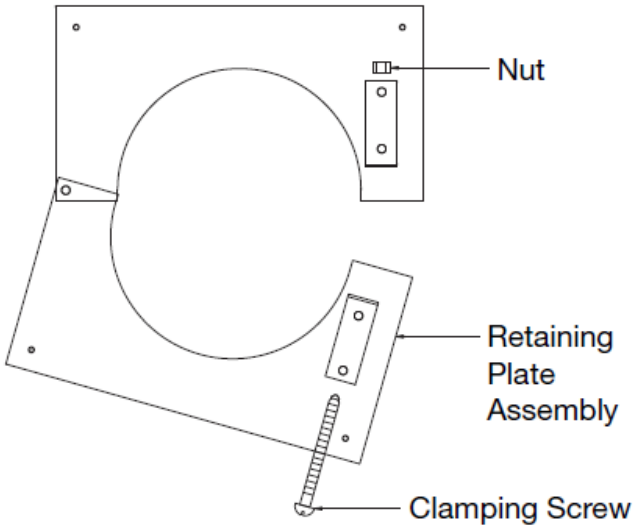




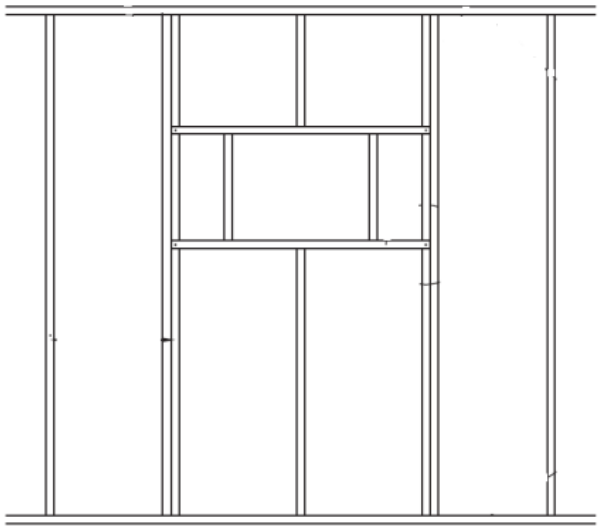
True Round Life-Safety Dampers

True Round Dynamic Fire Damper

True Round Fire Smoke Damper



Retaining Plate
Included with the Damper

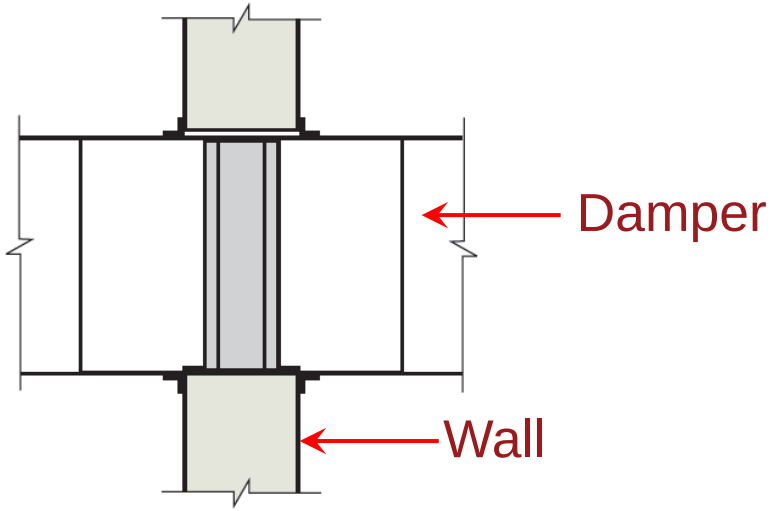


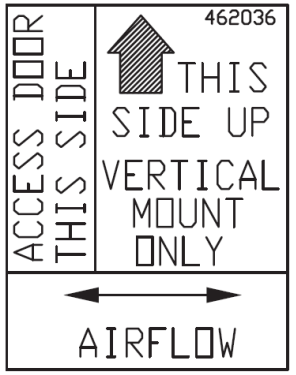
The Opening in the Wall Does Not Have to be Round!

Fire and Fire Smoke Damper Installation

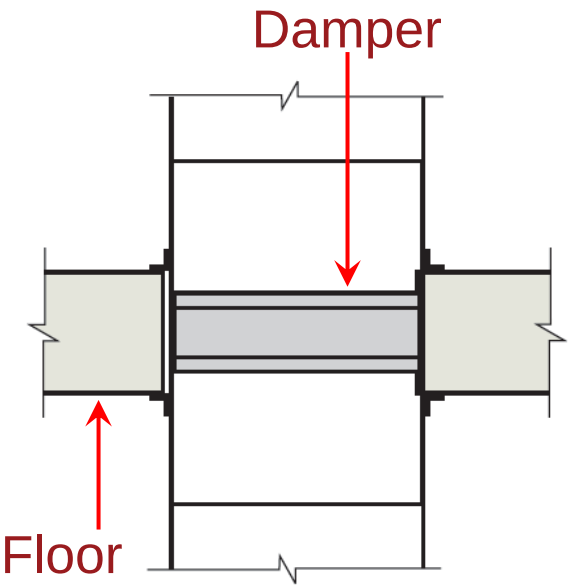
Fire and Fire Smoke Damper Installation

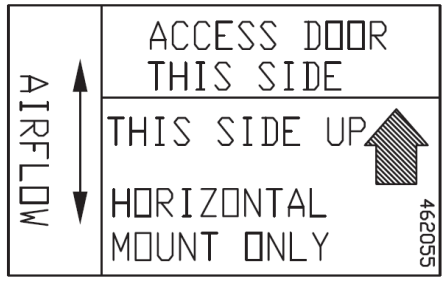
Mounting Orientations – Curtain Dampers





Vertical Label





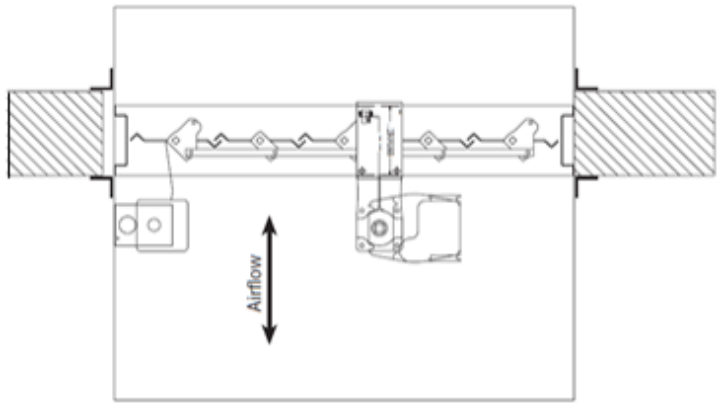
Horizontal Label

Curtain dampers are only listed and labeled to be mounted in the orientation they were ordered for

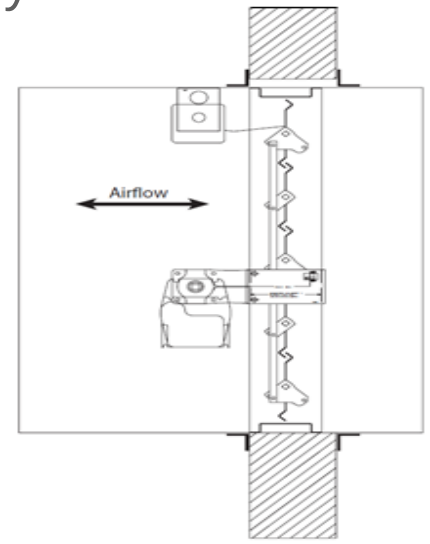
Fire Damper Installation Requirements

Mounting Orientations – Multi-Blade Fire Dampers

"Most" multi-blade fire dampers are approved to be mounted vertically or horizontally

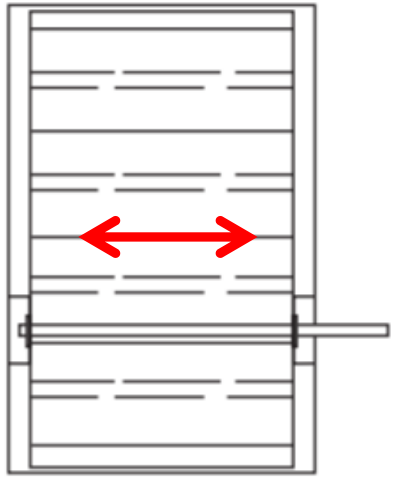


Horizontal

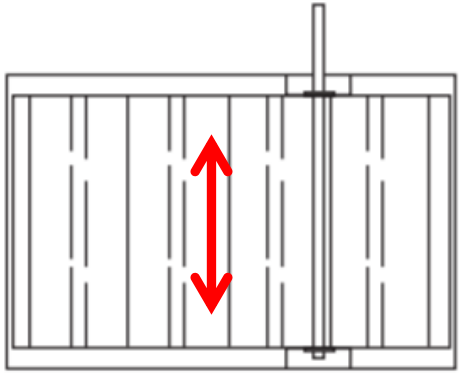


Vertical

Traditional models: Blades must be horizontal



Only models specifically tested for vertical blade mounting may be mounted with their blades running vertically

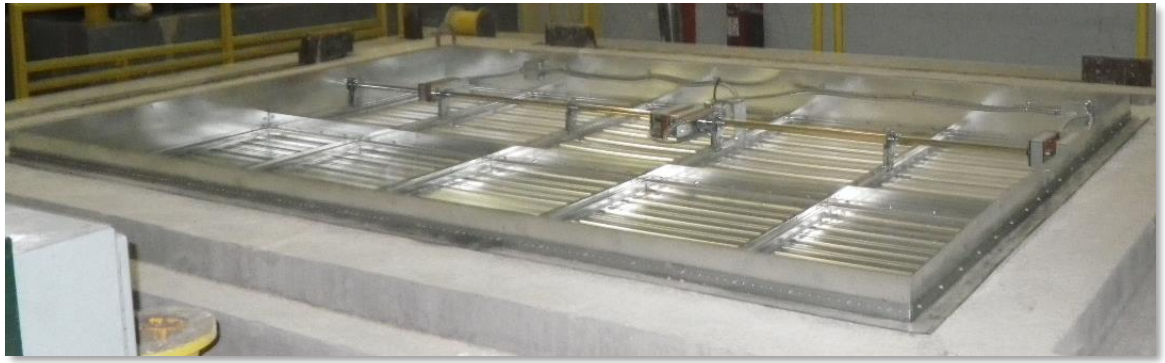


Fire and Fire Smoke Damper Installation

Wall or Floor Opening Dimensions

Dampers must be ordered to fill the full opening.

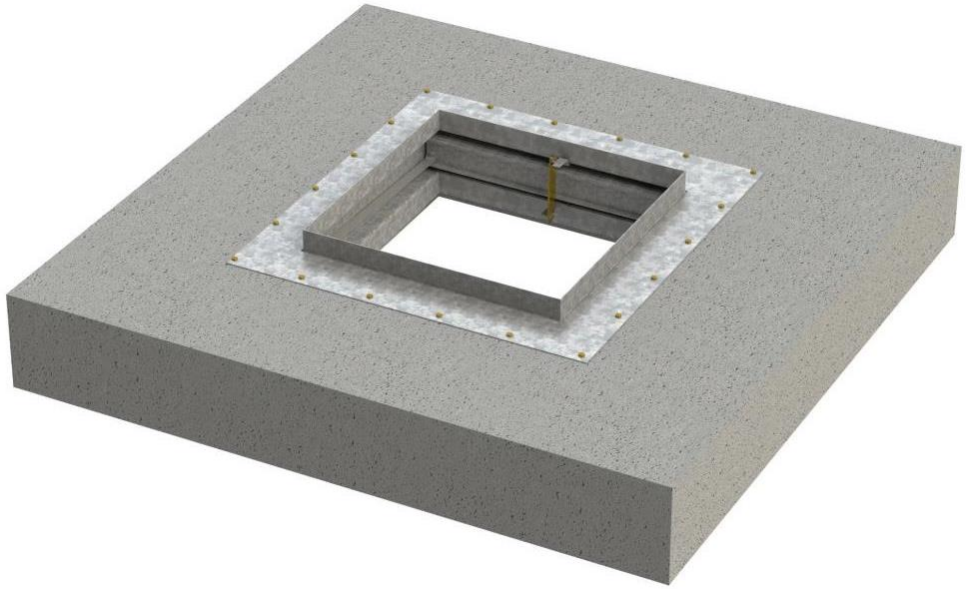
You can not order multiple dampers to fill a single opening!



Fire and Fire Smoke Damper Installation

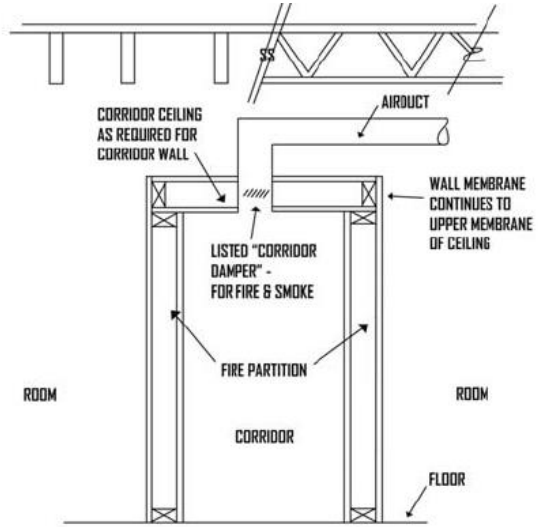
Horizontal Installations

Fire and Fire Smoke dampers are only approved to be installed horizontally in concrete floors



Exceptions

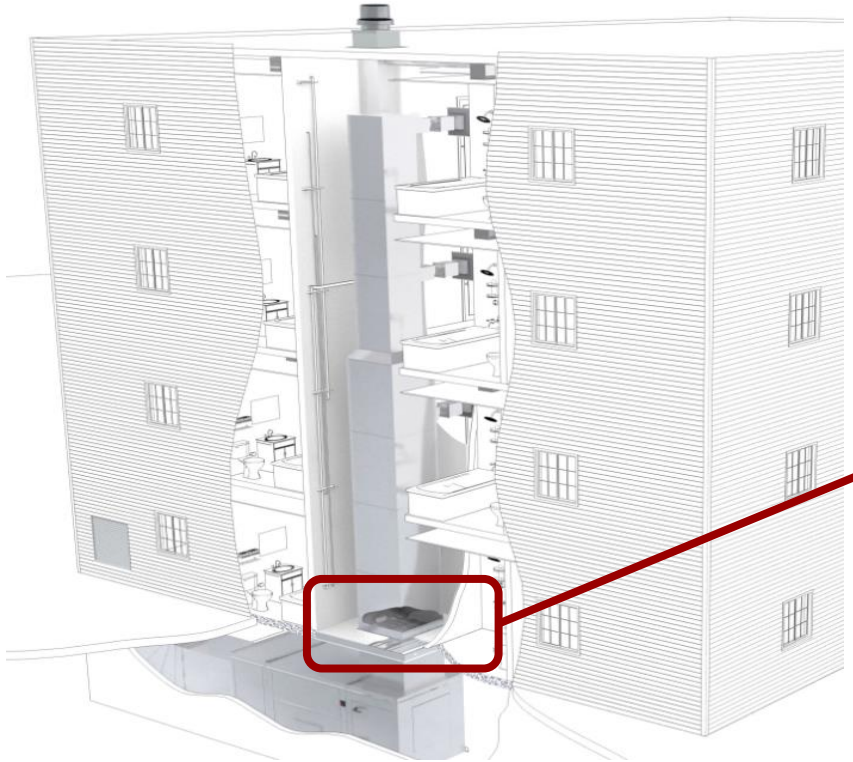
1. Tunnel Corridor Ceilings (model CFSD)
2. UL Design I503

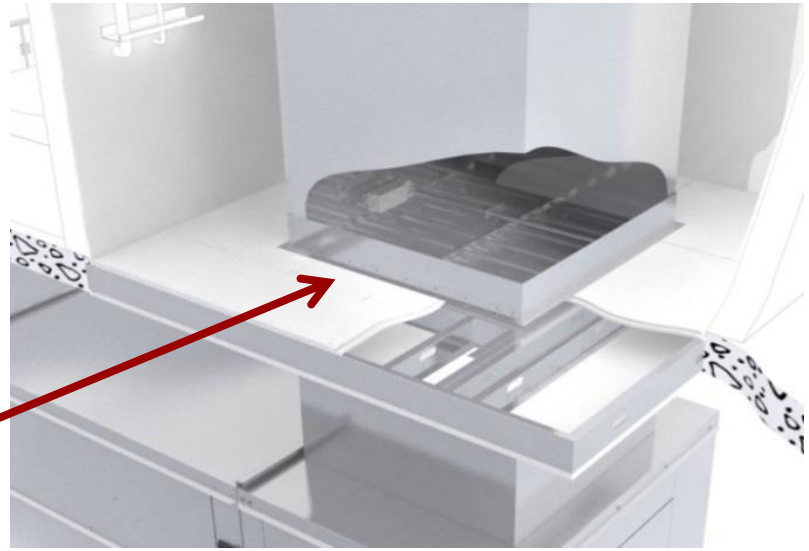


Fire and Fire Smoke Damper Installation

Design I503: Horizontal Non-Concrete Barrier

An Innovative Solution to a Common Construction Challenge





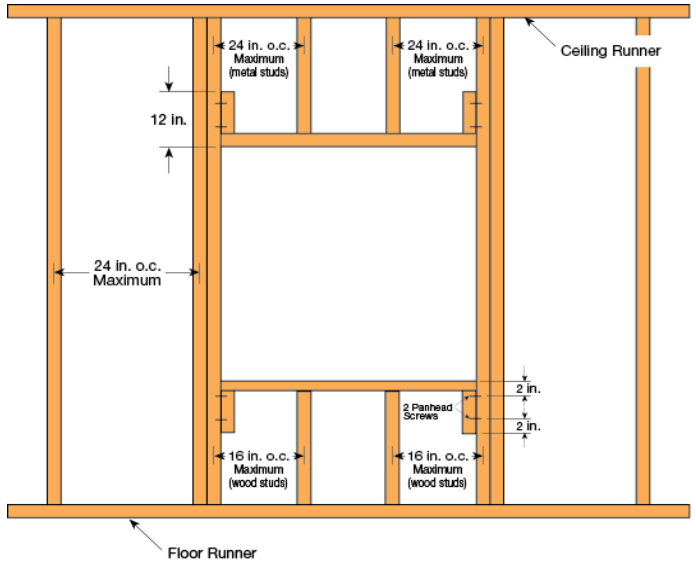
Note: Design I503 is a non-load bearing barrier

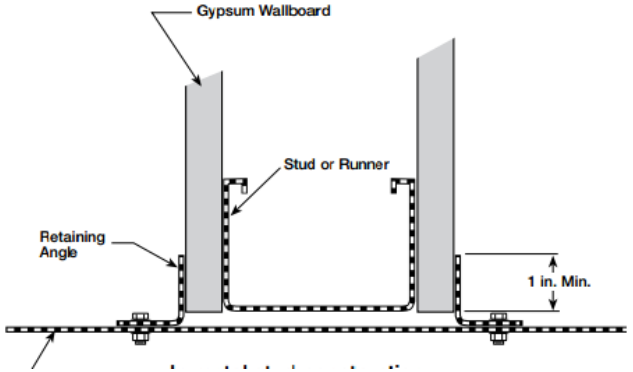
Horizontal Non-Concrete Installation
UL Design I503

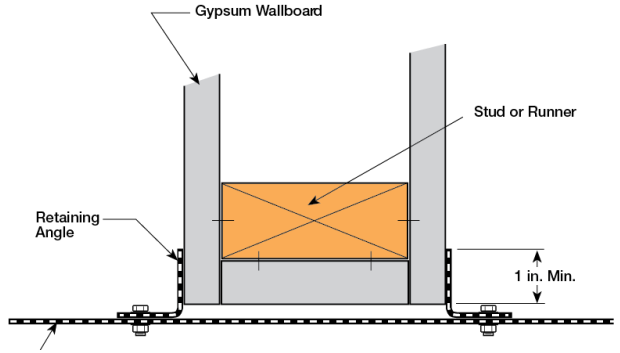
Installation Requirements
Fire and Fire Smoke Dampers

Framing of Opening

- Double vertical studs required for dampers over 36”x36”
- Damper opening in wood stud walls must be lined with sheet rock
- Openings in steel stud walls not need to be lined

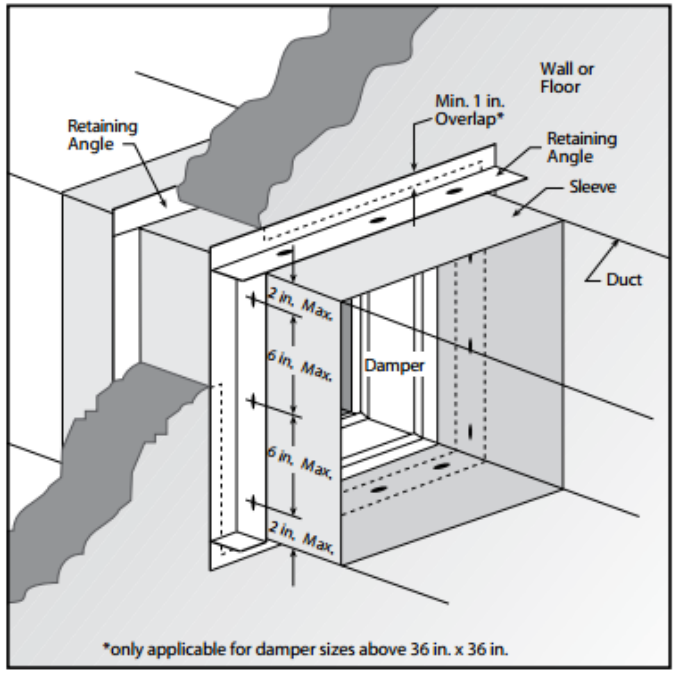


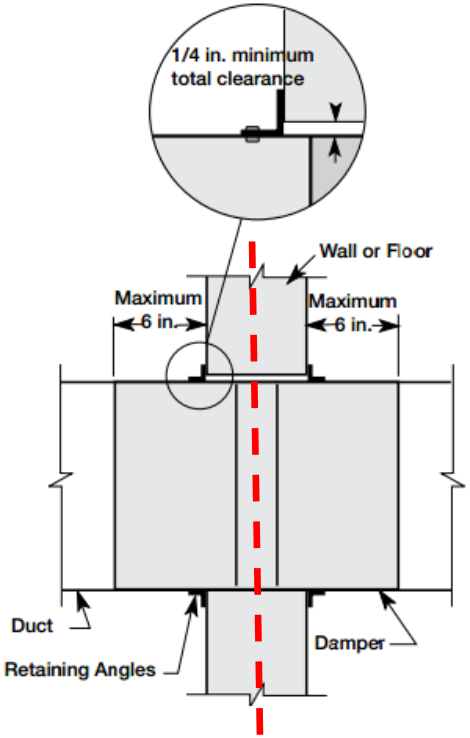




Traditional Installation
Fire and Fire Smoke Dampers

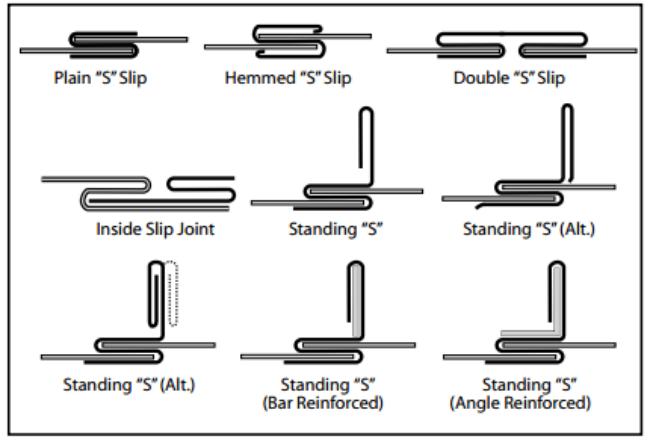
- The centerline of the damper frame must be in the plane of the wall/floor
- Requires annular space between the damper sleeve and wall opening
- Retaining Angle Installation
  - Angles must be fastened to the sleeve (not to the barrier)



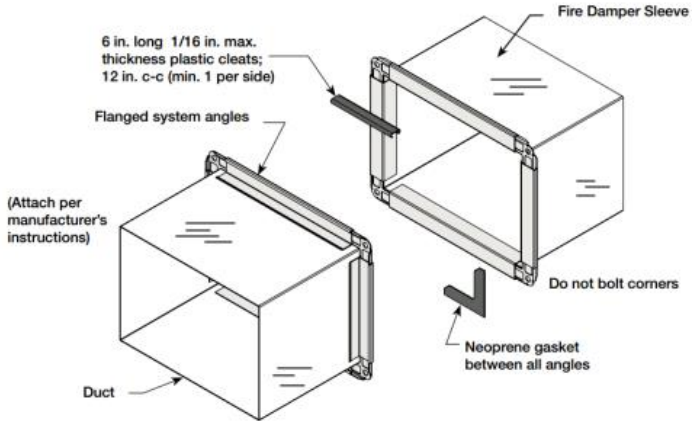


Traditional Installation
Fire and Fire Smoke Dampers

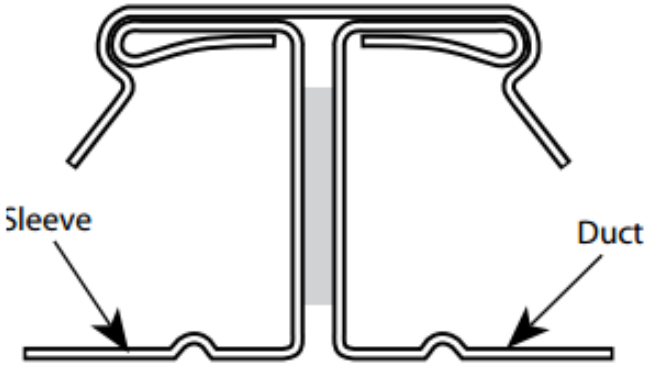
Approved Duct to Sleeve Breakaway Connections



Transverse Joints



Manufactured Flange Systems



TDC/TDF

UL 555 Duct Impact Test

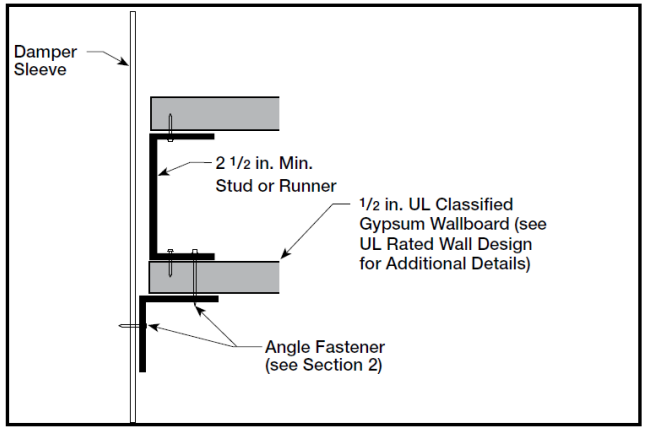
UL 555 Duct Impact Test

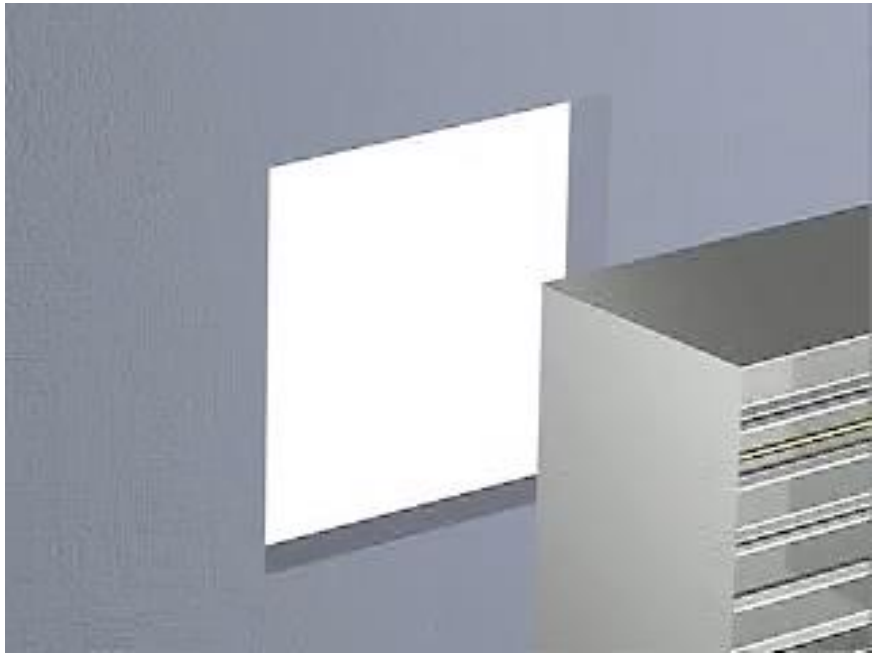
UL 555 Duct Impact Test

Alternative Installation Methods

Single Side Installation

- No annular space requirements
- Angles must be attached to both the sleeve and the barrier
- Allowable damper sizes:
  - Vertical Mount:
    - 80”x50”
    - 50”x80”
    - 40”x100”
  - Horizontal Mount
    - 144”x96”





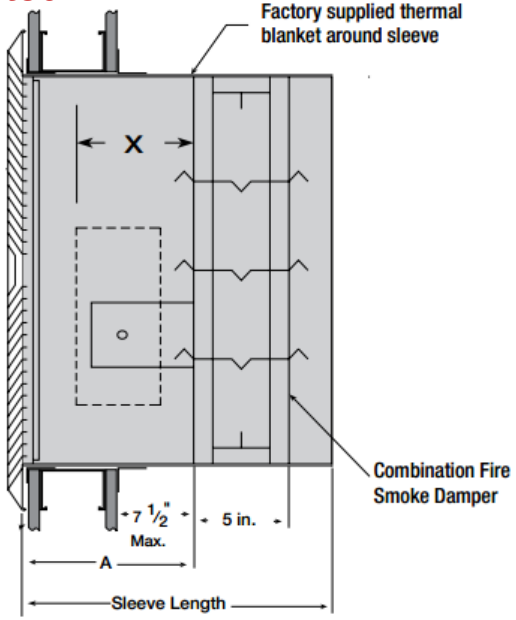
* Larger assemblies and 3 hours ratings require angles on *both* sides of barrier

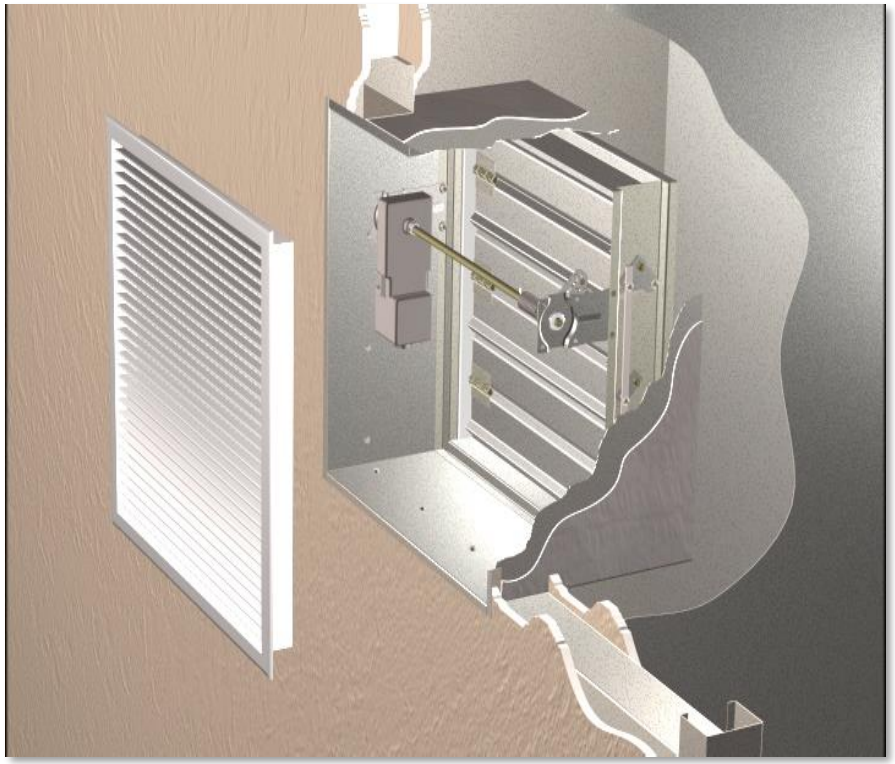
Alternative Installation Methods

Out-Of-Wall Installations

Only valid for specific models that were tested outside the plane of the rated barrier

Commonly used in shaft wall installations where there is no external access to the actuator.

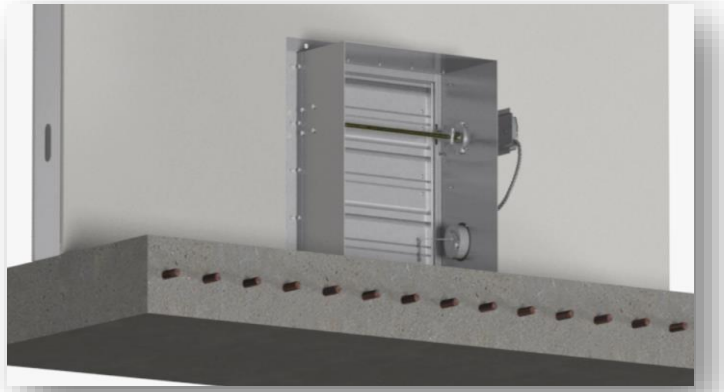




Alternative Installation Methods

3 Sided Retaining Angle Installation Method

- The retaining angle may be omitted from any of the four sides
- UL approved



Additional Alternate Installation Methods

Check manufacturer literature for additional installation methods

Instruction Manuals

Multiblade Fire Dampers and Combination Fire Smoke Dampers (#481318 IOM)

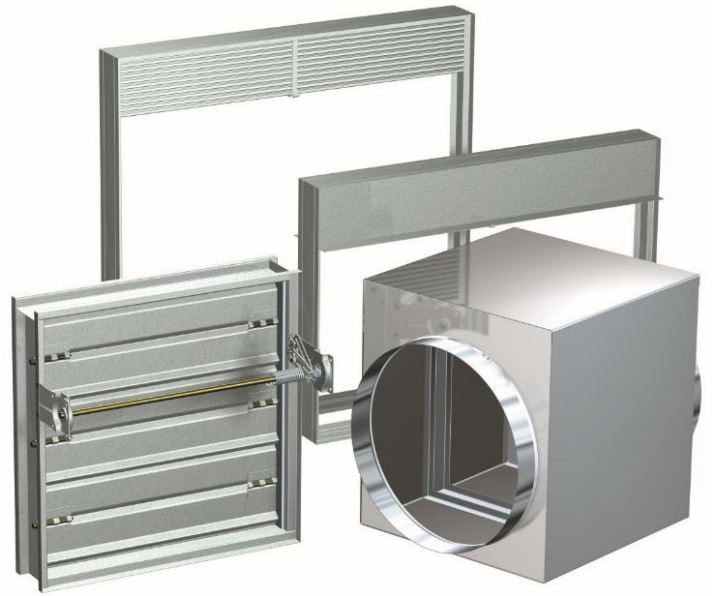
Supplements

- Concrete Floor with Steel Deck Supplement (#463562 IOM)
- Damper Maintenance
- Drive Slip Breakaway Connection (#468769 IOM)
- External to Internal Mount for FSD and SMD Series (IOM #481950)
- Field Supplied Sleeves on Fire Smoke Dampers (#463543 IOM)
- Fire Resistant Ventilated Duct Assembly (#469692 IOM)
- Firestop Material (#469419 IOM)
- Fusible Link Replacement (#471602 IOM)
- Greenheck Test Switch (#474102 IOM)
- Grille Installation Supplement (#463622 IOM)
- Metal Stud in Shaftwall Partition Supplement (#462100 IOM)
- No Flow Duct Smoke Detector (#465915 IOM)
- No Flow Duct Smoke Detector (System Sensor)
- Open or Closed Indicator (#459656 IOM)
- Quick Connect Breakaway Supplement (#468502 IOM)
- Resettable Link (#459840 IOM)
- Resettable Link with Blade Indicator - RRL/OCI (#471836 IOM)
- Sealant Supplement (#462703 IOM)
- Single 3-Sided Retaining Angle Supplement - Vertical Mount (#473768 IOM)
- Sleeve Extension Supplement (#462103 IOM)
- Smoke Detector DUCTSD (#482753 IOM)
- Smoke Detector DUCTSD (System Sensor)
- Temperature Limited Override TOR (#471837 IOM)
- Thermal Blanket Kit for DFD FD and FSD Series (#481945 IOM)
- UL I503 Non-Concrete Horizontal Mount Damper (#481007 IOM)

Recap of Fire Damper Specification Criteria

Specification Requirements

- Hourly Fire Rating
- Actuation Temperature
  - Dynamic vs. Static
- Velocity / Pressure Ratings
- Mounting Orientation
- Be Conscious of Size Limitations
- Installation Options



Smoke Dampers
UL555S

UL 555S Classifications

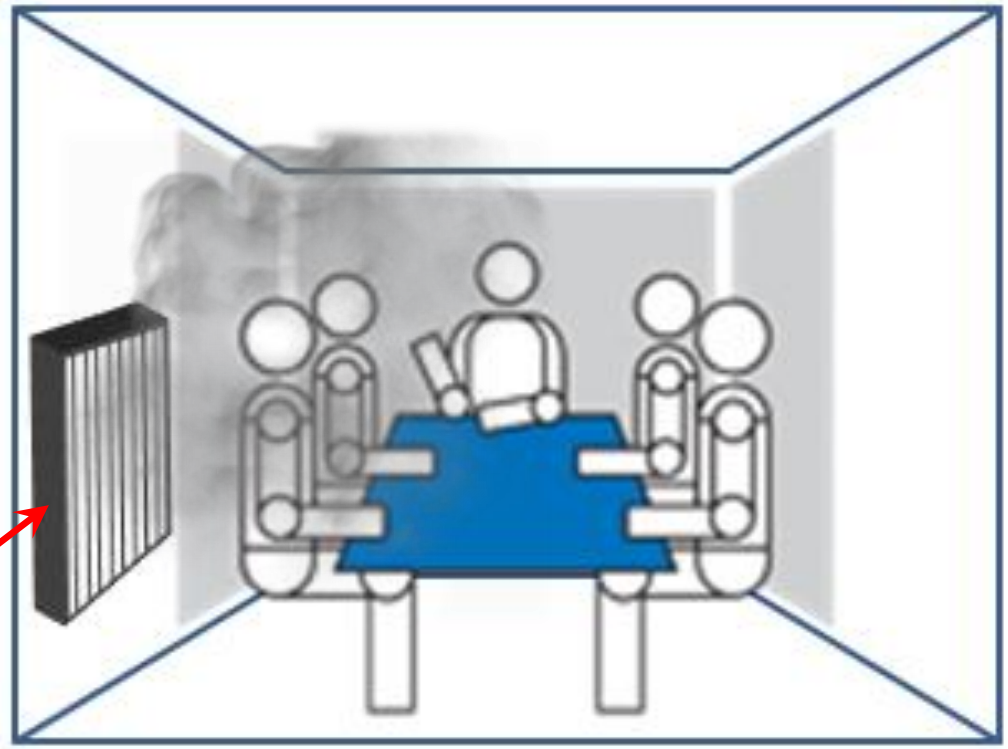
- Velocity and pressure rating
  - Tested to same performance values as dynamic fire dampers
- Leakage class
  - I (8 cfm/sq. ft @ 4 in. wg)
  - II (20 cfm/sq. ft @ 4 in. wg) *
  - III (80 cfm/sq. ft @ 4 in. wg)
- Elevated temperature rating
  - 250° F
  - 350° F

***** IBC 717.3.2.2: Smoke damper leakage ratings shall be Class I or II.

Amount of Time to Fill a Room With Smoke

Based on Leakage Class

Leakage Class		Length of Time
I	=	**100** minutes
II	=	**40** minutes
III	=	**10** minutes

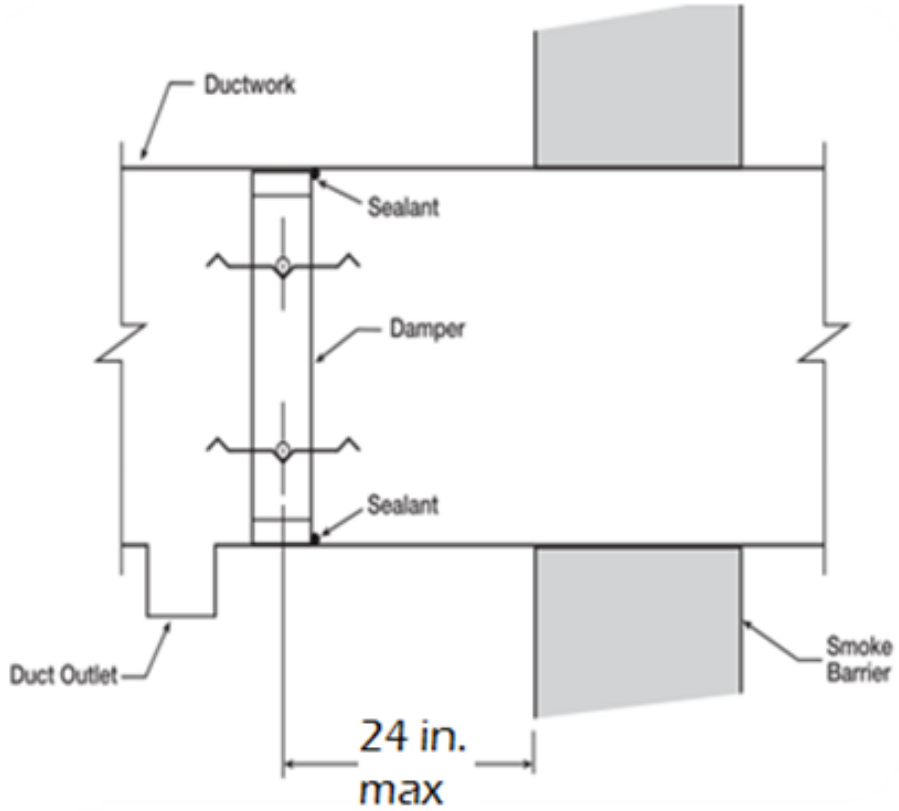


24″W x 24″H damper at maximum rated pressure

3200 FT^3 space

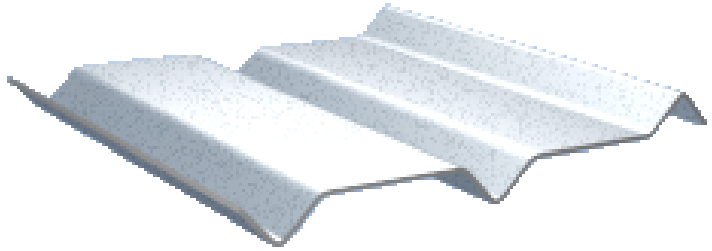
Smoke Damper Installation

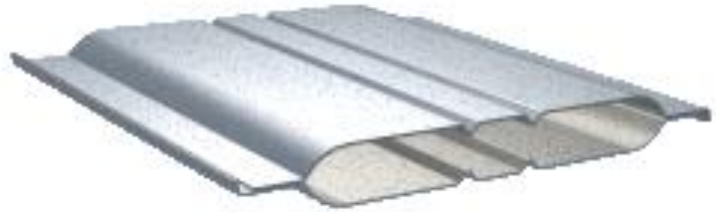
- Installation
  - Centerline of blades must be within 24 inches of a rated smoke barrier
  - Can be installed directly in ductwork or in sleeve/barrier like fire damper
  - No annular space requirement
- Actuation (per IBC 717.3.3.2)
  - Listed smoke detector within 5 feet of damper
  - Total-coverage smoke detection system



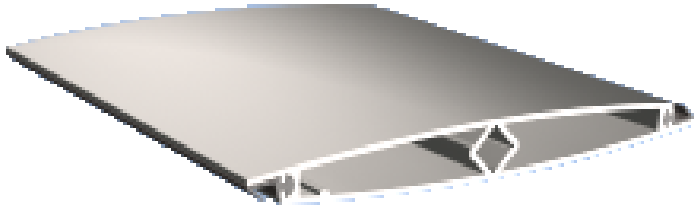
Smoke Damper Construction

- Configured like a control damper
  - Multi-blade
    - 3V or Airfoil blade
  - Round
- Construction
  - Blade and jamb seals
  - Aluminum models available
    - Extruded blades and fram
  - No sleeve requirement
  - Larger max. listed sizes and fire-smoke dampers

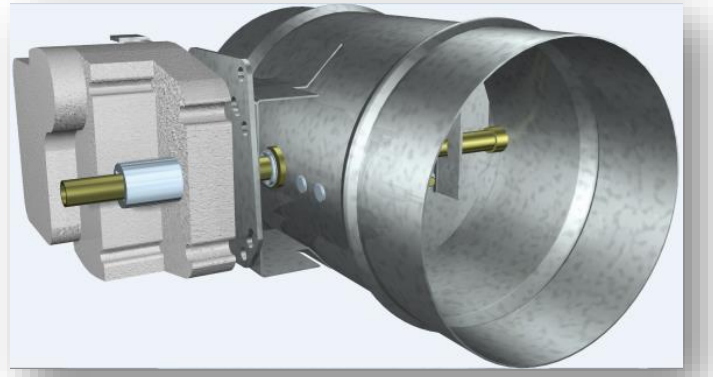




Fabricated Airfoil



Extruded Airfoil



Round

Fire/Smoke Damper Actuators

- Mounting
  - Must be factory installed per UL
  - Internal or external location
- Operation
  - Always spring return
- Testing requirement
  - 20,000 cycles – two position
  - + 100,000 repositions – modulating

Fire/Smoke Damper Actuators

- Electric
  - Two position
  - Modulating / Balancing
- Power connection
  - 24 VAC
  - 120 VAC
    - Transformer required on 208V, 277V, 460V
- Pneumatic
  - 20-25 psi supply
  - 60-80 psi supply

Fire/Smoke Damper Actuators

- Actuator elevated temperature rating
  - 250°F or 350°F
- Various torque ratings for different models (18 in*lb up to 180 in*lb)
- May use multiple actuators on larger damper assemblies*

**up to maximum qty and damper size allowed by UL*

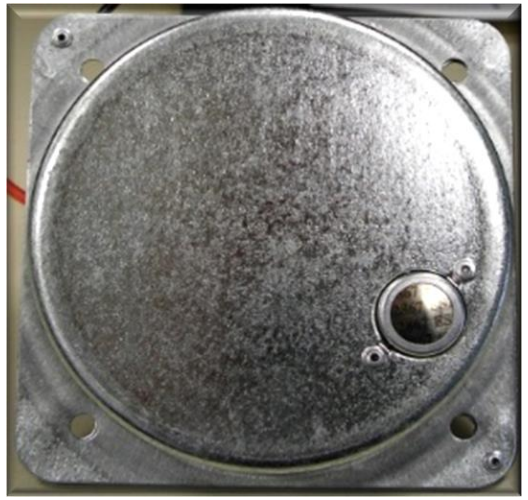
Combination Fire & Smoke Dampers

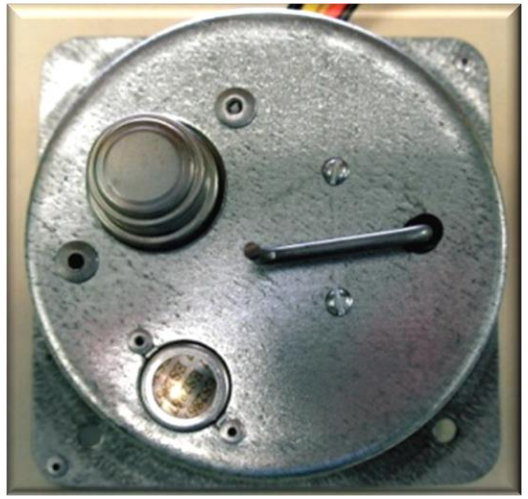
Purpose of Fire/Smoke Damper

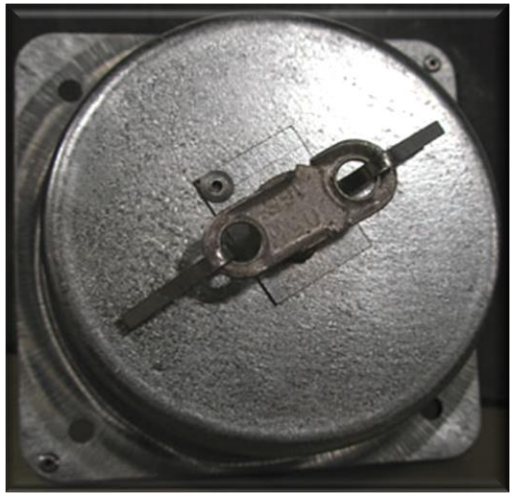
- Provide the same level of protection as individual fire and smoke dampers
- Fire rating – UL555 certified
- Leakage rating – UL555S certified
  - Always supplied with factory mounted actuator
- Always dynamically rated

Fire/Smoke Damper Closure Devices

- RRL
  - Electric thermal switch
- RRL/OCI
  - RRL + open / close indication
- TOR
  - Secondary override temp. for smoke control applications
- Fusible Link 
  - Often used for fail open operation
- PRV
  - Pneumatic relief valve







Operational Test and Inspection

Damper Test and Inspection Requirements

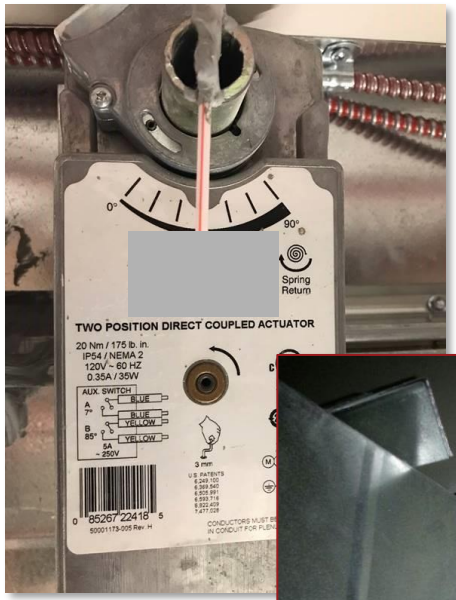
International Fire Code (IFC)

Requires fire dampers to be maintained in accordance with NFPA 80 & smoke dampers to be maintained in accordance with NFPA 105

Operational Testing

NFPA 80 & 105

- Operational test:
  - NFPA 80 – Fire Dampers
    - “After the installation of a damper is completed, an operational test shall be conducted.”
- NFPA 105 – Smoke Dampers
  - “An operational test shall be conducted after the building’s HVAC system has been balanced.”



Periodic Testing and Maintenance

Periodic Testing

IFC / NFPA 80 & 105

- Frequency
  - “Each damper shall be tested and inspected 1 year after installation.”
  - “The test and inspection frequency shall then be every 4 years, except in buildings containing a hospital, where the frequency shall be every 6 years.”

Periodic Testing

IFC / NFPA 80 – Fire Dampers with Fusible Links

- Remove fusible link, allow damper to close, return to open position, reinstall fusible link, verify damper is unobstructed

IFC / NFPA 80 & 105 – Smoke & Combination Fire Smoke

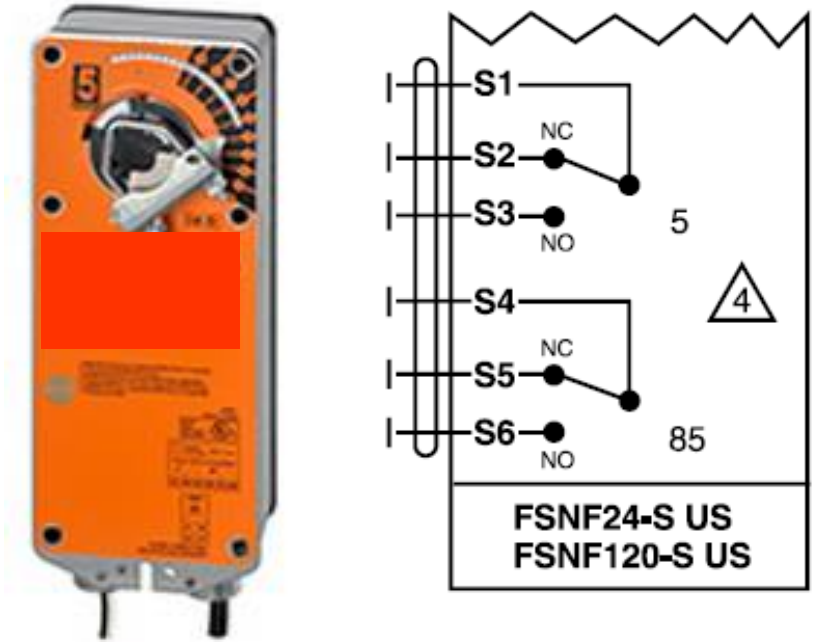
- Traditional test method requires visual confirmation of damper operation
- 2019 editions of NFPA standards now allow for remote testing
- Damper position indication (OCI or actuator end switch) can provide confirmation of damper operation

Commonly Specified Features

Commonly Specified Features

Position Indication

On-Blade



Actuator auxiliary switches

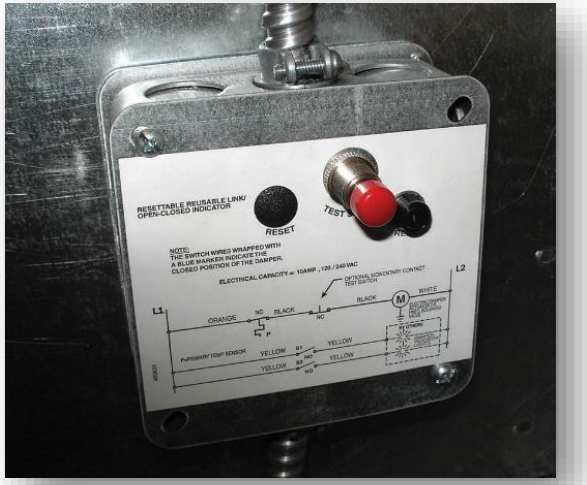
Commonly Specified Features

- Modulating fire-smoke actuator
  - Eliminates the need for additional control or automatic balance dampers
  - Position control signal provided by local devices or building control system
  - On-board controls override position signal to close damper during fire event

Commonly Specified Features

Test Stations

- Local



  - Momentary Test Switch
    - Damper mounted

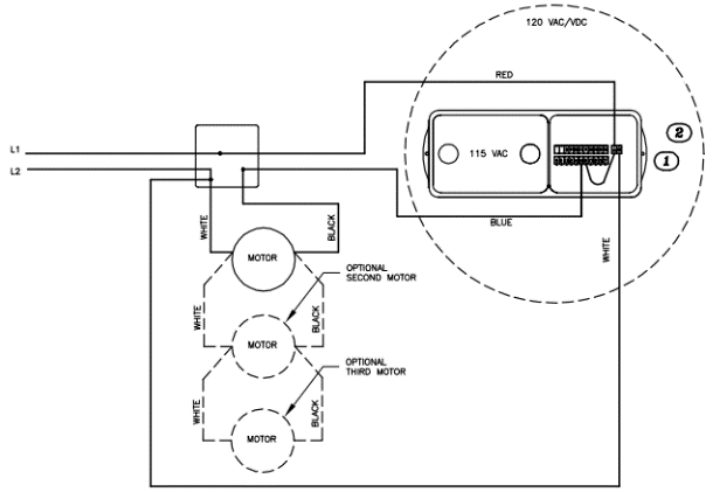
- Remote

  - Wall mounted test panels
    - Various configurations
      - Testing and position indication
      - Position indication only

Commonly Specified Features

Factory Mounted and Wired Smoke Detectors

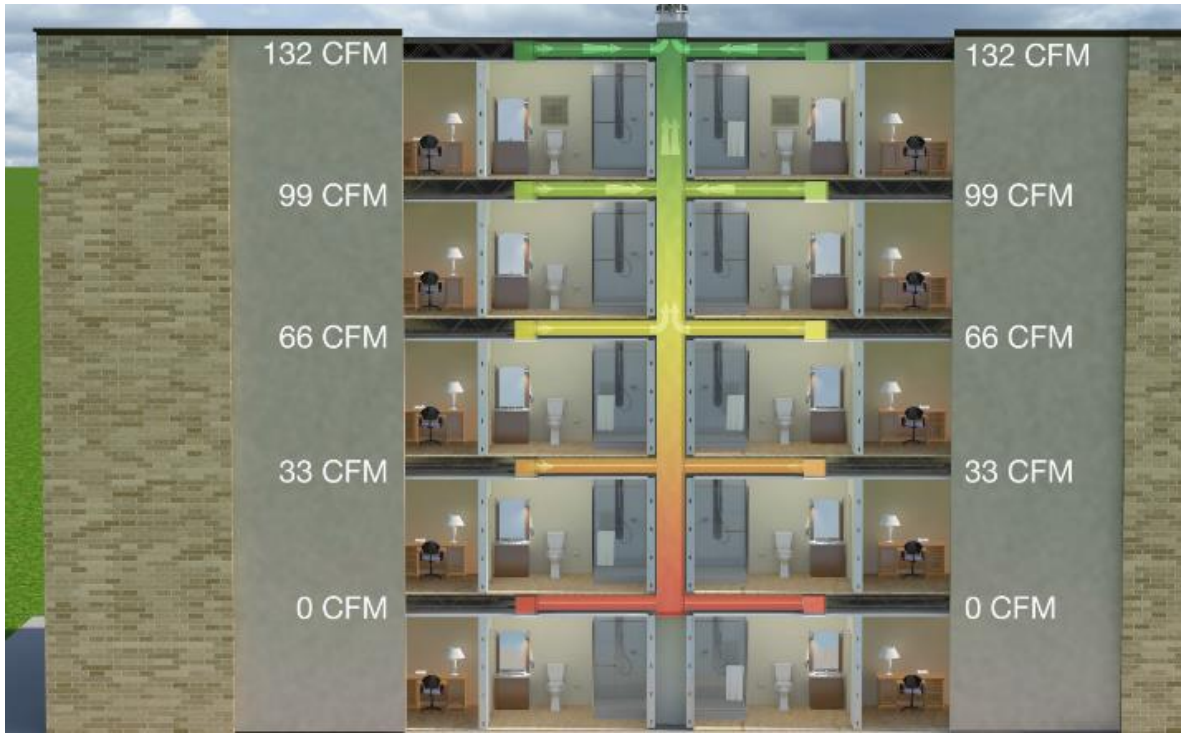
Flow Sampling



No Flow

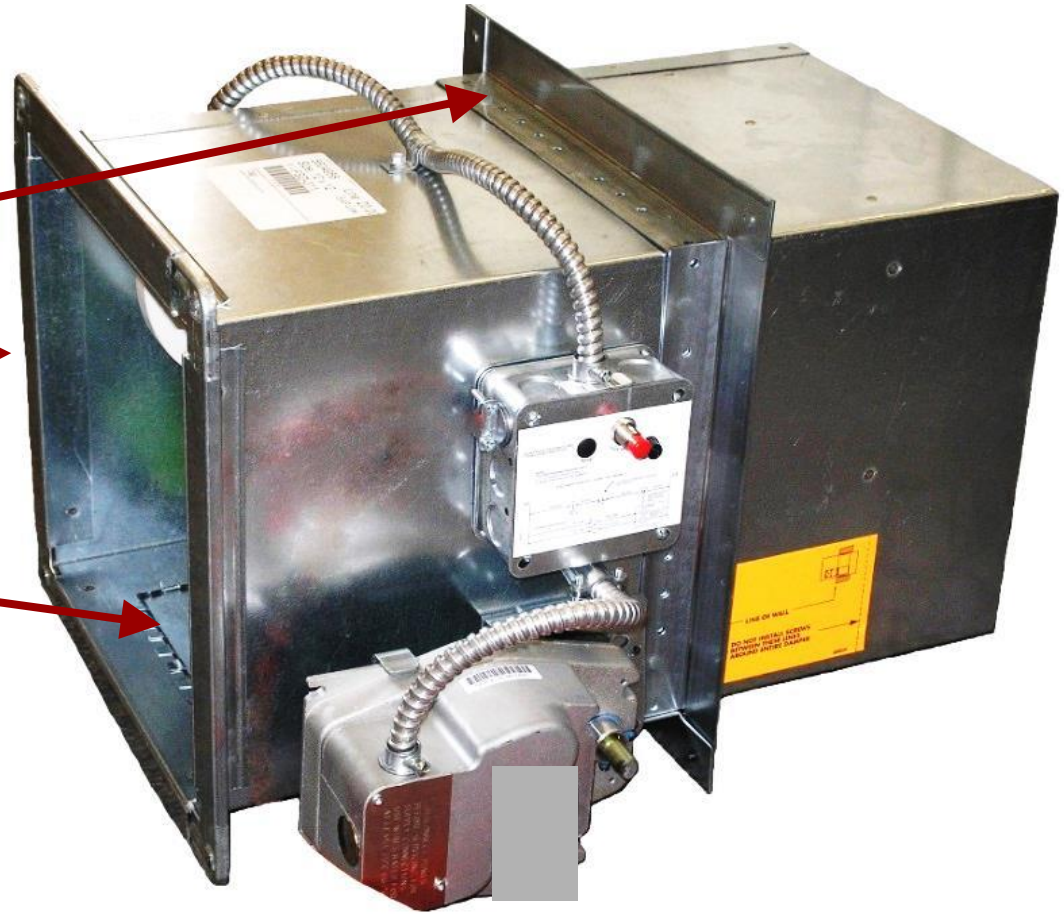
Commonly Specified Features

Automatic Balancing Dampers



Installation Time Savers

- Factory mounted accessories
  - Retaining angles
  - Quick connect breakaway
  - Access doors



Resources

- **AMCA International**: www.amca.org
- **AMCA *inmotion* Magazine articles:** https://www.amca.org/educate/#inmotion

  > 2019 Edition: Remote Periodic Testing of Life-Safety Dampers

  > 2020 Edition: Field Modifications of Fire, Smoke, and Combination Fire/Smoke Dampers

- **AMCA Publication:** www.amca.org/store

  > **503-08:** Fire, Ceiling (Radiation), Smoke and Fire/Smoke Dampers Application Manual *(Available for purchase)*

- **AMCA White Papers:** https://www.amca.org/educate/ #articles-and-technical-papers

  > Fire and Smoke Dampers: Best Practice Design Tips

Thank you for your time!

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Questions?