

# Fire, Smoke, and Combination Fire Smoke Dampers



# Agenda

- ▶ **Installation/Configuration**
  - Fire Dampers
  - Smoke Dampers
  - Combination Fire/Smoke Dampers
- ▶ **Operational Test/Inspection**
- ▶ **Periodic Test/Maintenance**



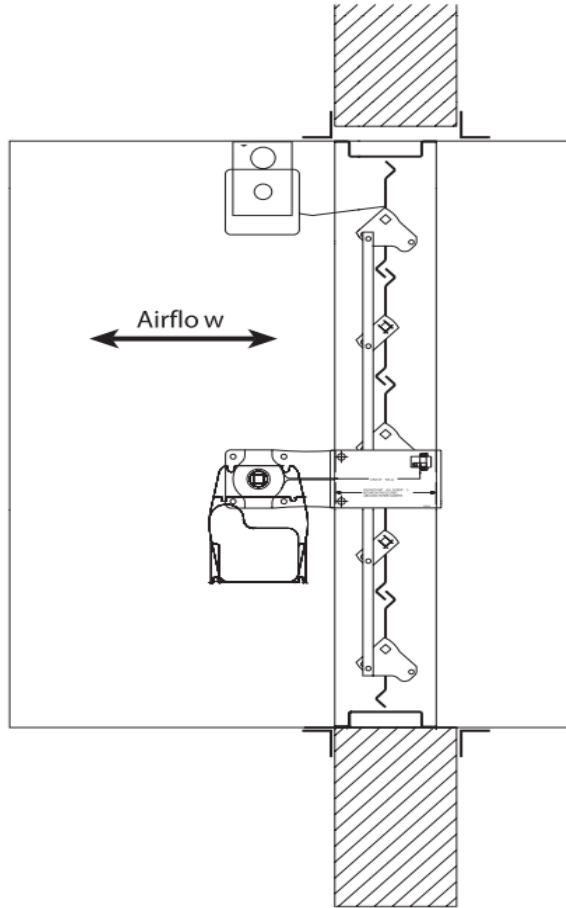
# Damper Selection

- **Comply with code requirements**
- **Design for long term use**
- **Modification restrictions**



# What makes an approved system?

- ▶ **Barrier**
- ▶ **Product**
- ▶ **Installation**



# What is it?

## ► Labels





# Is it right?

UL | Online Certifications Directory - Search Results - Microsoft Internet Explorer

Address: http://database.ul.com/cgi-bin/XYV/cgfind.new/LISEXT/1FRAME/srchres.html?collection=/data3/venty\_collections/lisext&dkhome=/data3/venty\_sw\_rev2<

**Underwriters Laboratories Inc.**

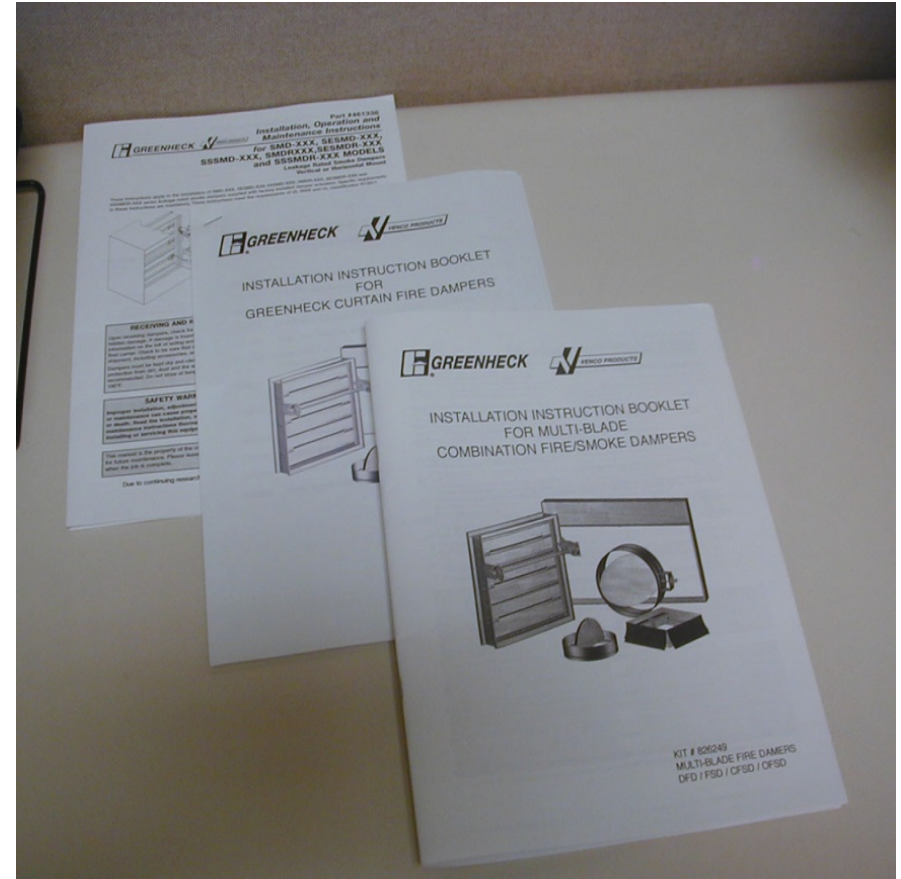
Number of hits: 39

Previous Page

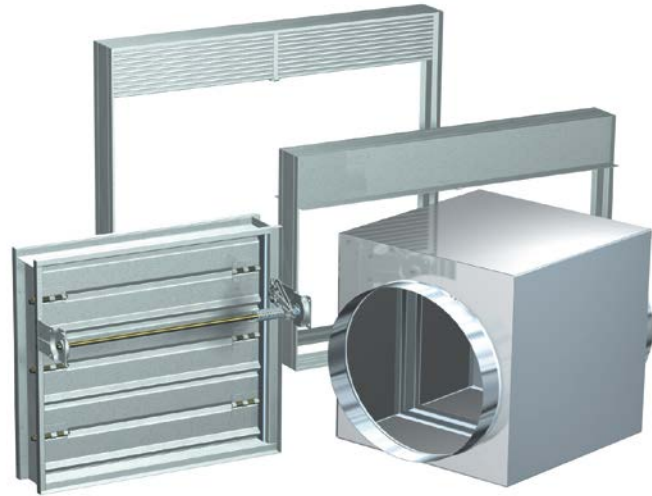
[Refine Your Search](#) · [Home](#)

Company Name	Category Name	Link to File
ACME ENGINEERING & MFG CORP	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R16596</a>
ACTION AIR USA, DIV OF TOMKINS	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R16693</a>
AIR BALANCE INC	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R4708</a>
AMERICAN WARMING & VENTILATING	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R16398</a>
ARLAN DAMPER CORP	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R8610</a>
ARROW UNITED INDUSTRIES, DIV OF MESTEK	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R19235</a>
BUCKLEY ASSOCIATES INC	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R9491</a>
C&S AIR PRODUCTS	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R14981</a>
CESCO PRODUCTS	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R6462</a>
GREENHECK FAN CORP	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R13317</a>
GULF MECHANICAL ACOUSTIC MFG CO	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R20671</a>
HART & COOLEY INC	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R16751</a>
HERCULES INDUSTRIES INC	Dampers for Fire Barrier and Smoke Applications	<a href="#">EMME.R9356</a>

start | Microsoft ... | Microsoft Exce... | CAPS | Out | Microsoft Pow... | UL | Online Ce... | 2:37 PM



# UL 555: Fire Dampers





# UL 555 Classifications

## ▶ **Static**

- For use in HVAC systems that shut off in case of a fire emergency.



## ▶ **Dynamic**

- For use in HVAC systems that continue running during a fire emergency.
- Dynamic airflow test
- Increments of 1000 fpm



# Damper Construction

## ▶ Type

- Curtain
- Multi-blade
  - Blade Type

## ▶ Material

- Galvanized
- 304 stainless steel
- 316 stainless steel

## ▶ Mounting

- Vertical
- Horizontal



# Damper Ratings

- ▶ **Closure Temperature**
  - 165° F (160 minimum per IBC)
  - 350° F (maximum per IBC)
- ▶ **Operational Temperature**
  - 250° F (minimum)
  - 100° F increments

# Damper Ratings

## ▶ **Operational Airflow Rating**

- 2000 fpm
- 3000 fpm
- 4000 fpm
- +

## ▶ **Operational Closure Pressure Rating**

- 4 in. wg.
- 6 in. wg.
- 8 in. wg.
- +

# Combination Fire Smoke & Fire Dampers - Ratings

## ▶ IBC

- 717.3.2.1 Fire Protection rating. Fire dampers shall have the minimum fire protection rating specified in table for the type of penetration.

Type of Penetration	Minimum Damper Rating (hours)
Less than 3-hour fire resistance rated assemblies	1.5
3-hour or greater fire resistance rated assemblies	3





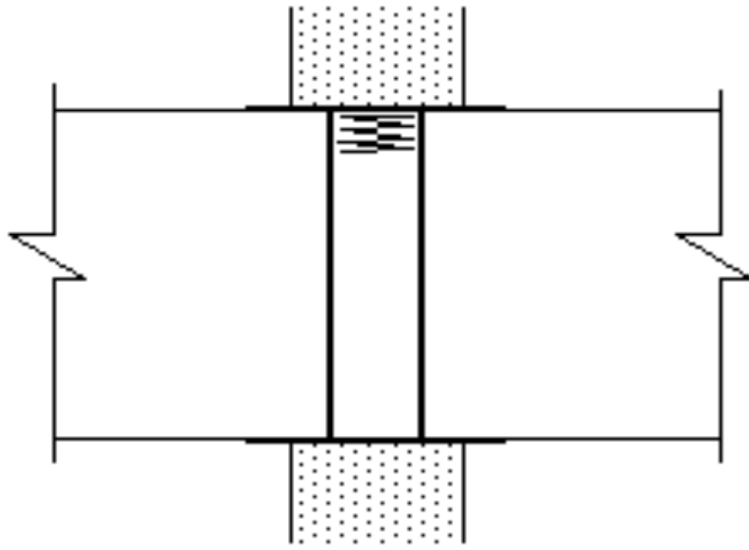
# Fire Damper Selection

## ▶ System Requirements

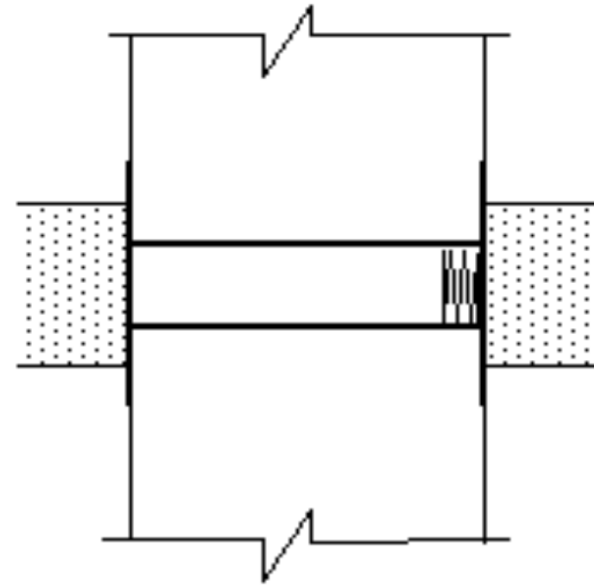
- Dynamic vs Static
- Temperature
- Velocity/Pressure
- Size
- Mounting



# Mounting



Vertical

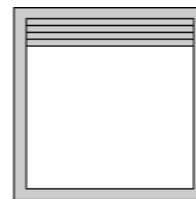


Horizontal

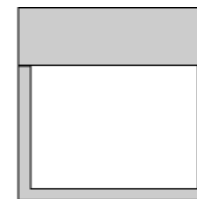
# Fire Damper Selection

## ▶ Performance

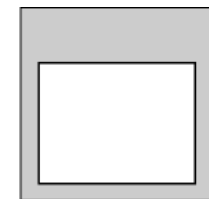
- Closure Device
- Controls
- Free Area
- Pressure Loss



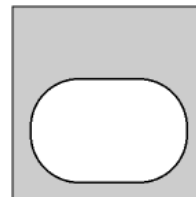
**Type A**  
Blades In Airstream



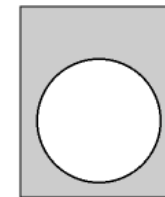
**Type B**  
Blades Out Of  
Airstream



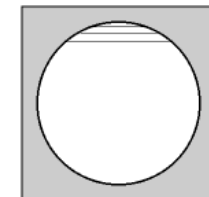
**Type C**  
100% Free Area



**Type CO**  
100% Free Area



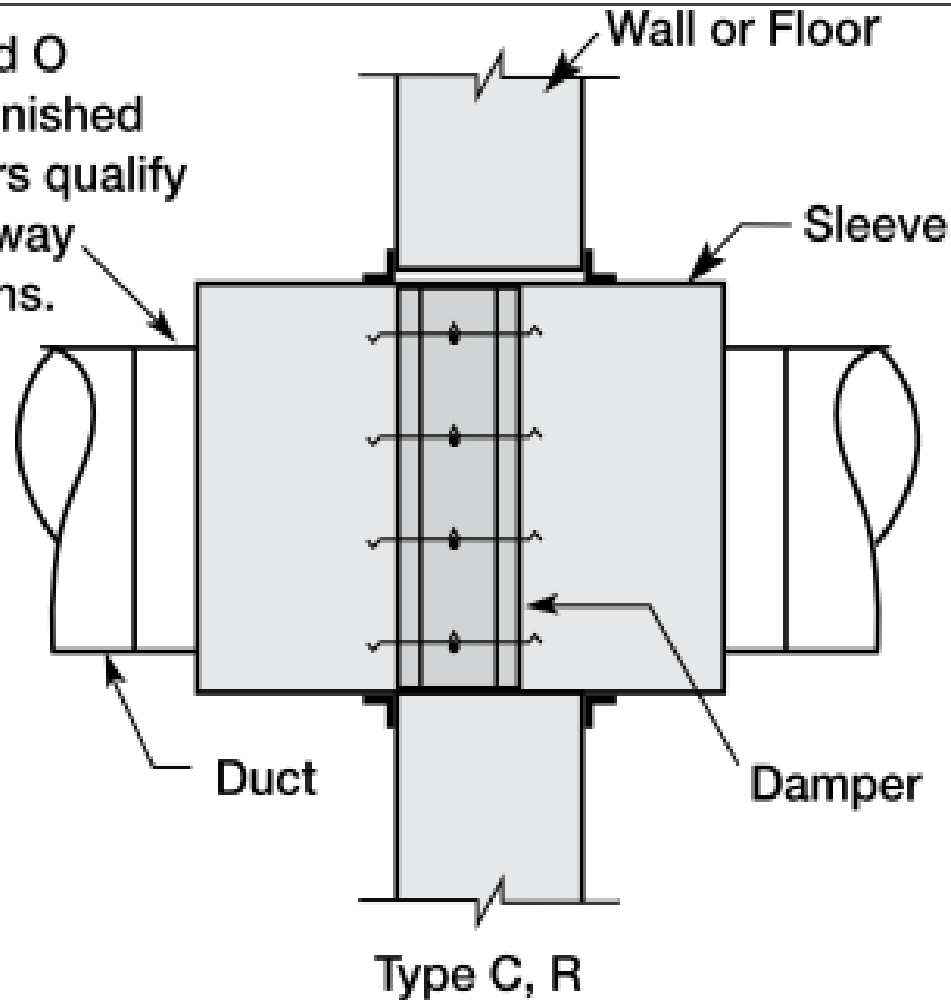
**Type CR**  
100% Free Area



**Type R**  
High Free Area

# Transitions

Type R and O  
factory furnished  
duct collars qualify  
as breakaway  
connections.



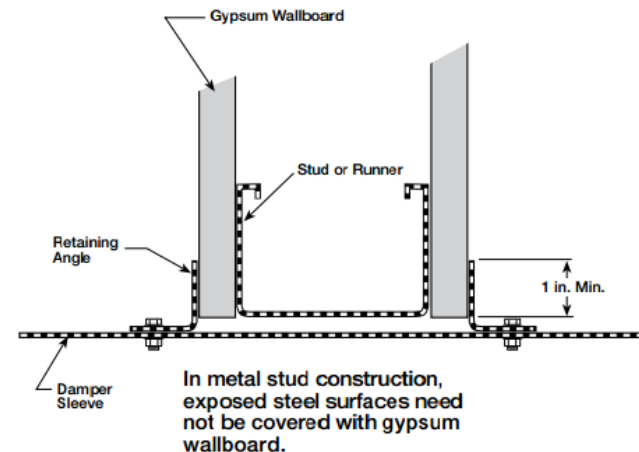
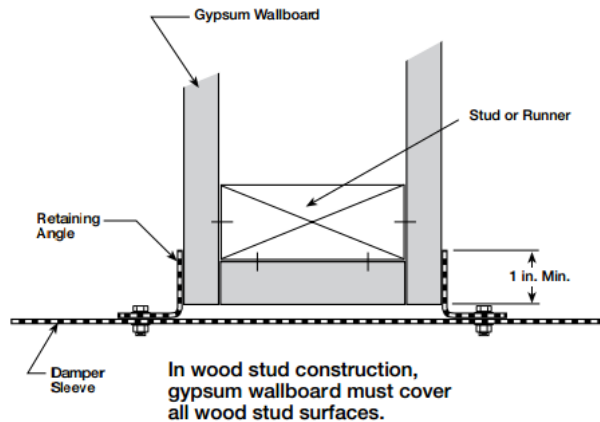
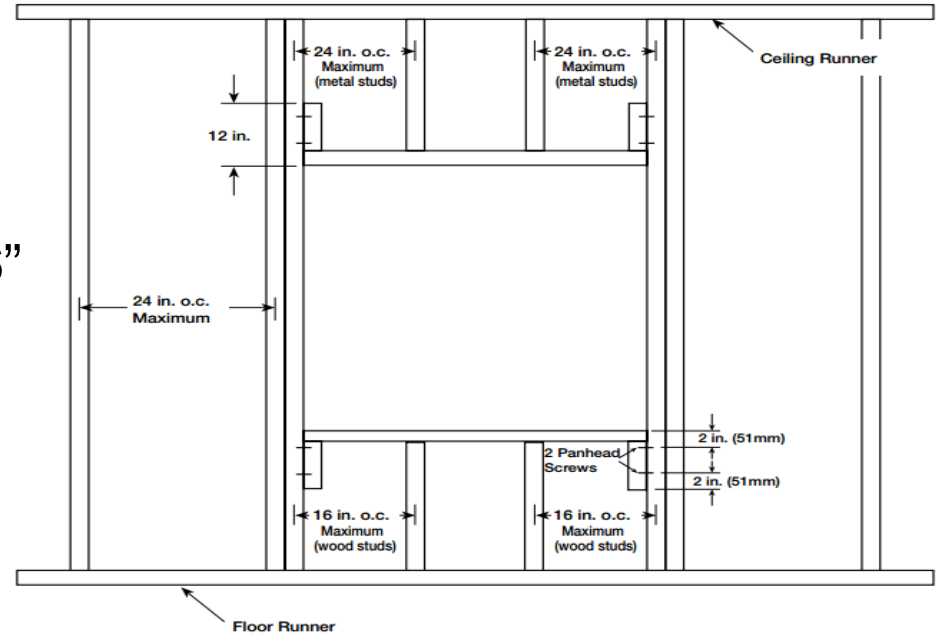


# Installation Requirements

## Fire and Fire Smoke Dampers

### Framing of Opening

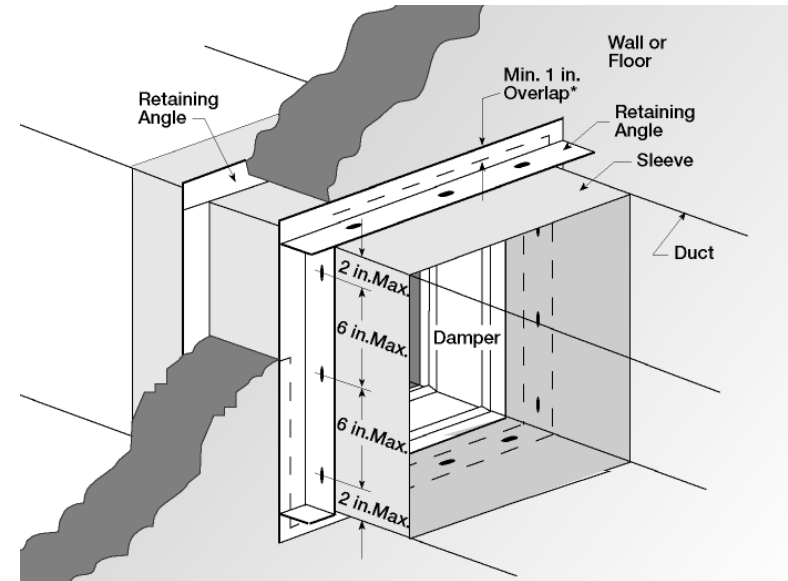
- Vertical studs must run floor to ceiling
- Double vertical studs over 36" x 36"
- Wood studs must be covered with sheet rock
- Steel studs do not need to be covered with sheet rock



# Fire Damper Installation

## ► Installed with sleeves

- factory or field mounted
- sleeve requirements

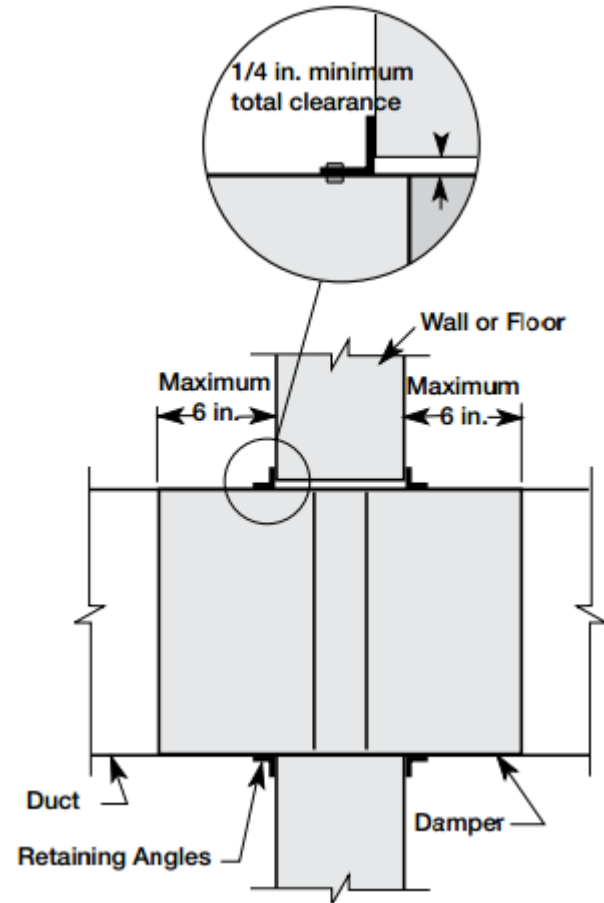


# Installation Requirements

## Fire and Fire Smoke Dampers

### Traditional Installation

1. The centerline of the damper frame must be in the plane of the wall/floor
2. Annular Space Requirements



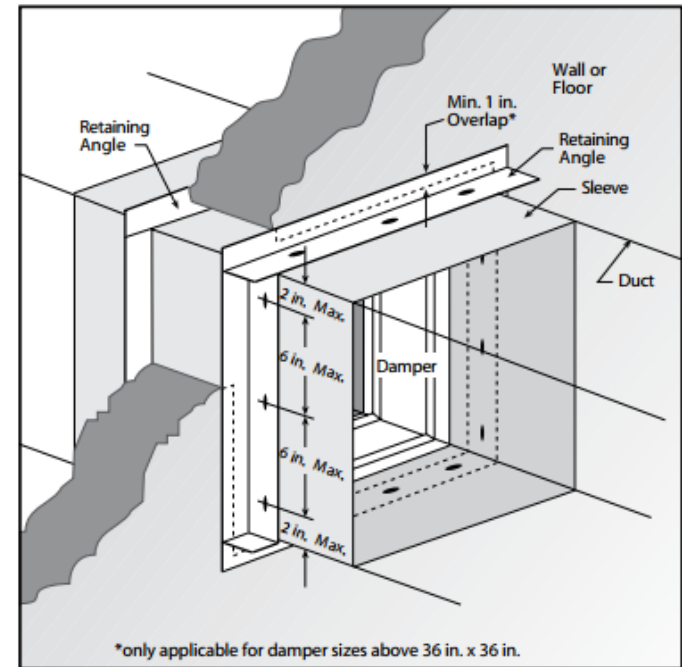
# Installation Requirements

## Fire and Fire Smoke Dampers

### Traditional Installation

#### 3. Retaining Angle Installation

- Angles must be fastened to the sleeve (not to the barrier)
- Attachments 2" from corners then 6" O.C.
- Angles must overlap barrier by at least 1"
- Angles are continuous with no gaps

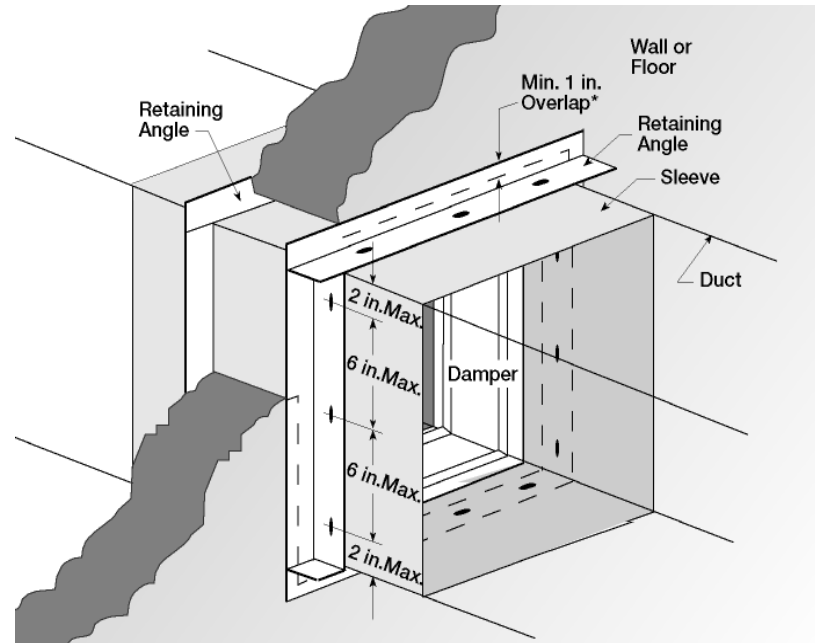
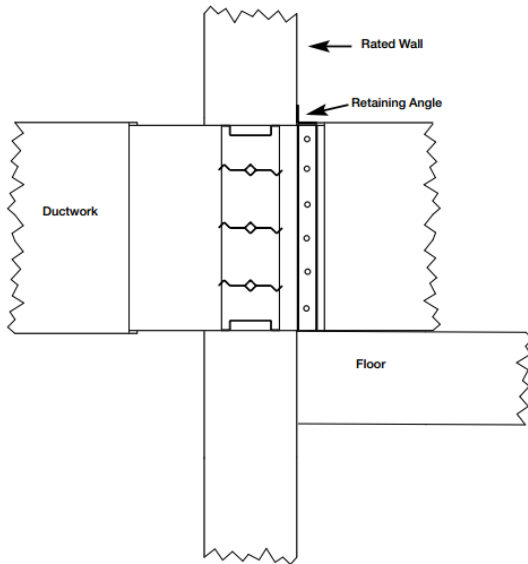


# Installation Requirements

## Fire and Fire Smoke Dampers

### Alternate Installation

1. Single Side Angle
2. 3 Sided Angle



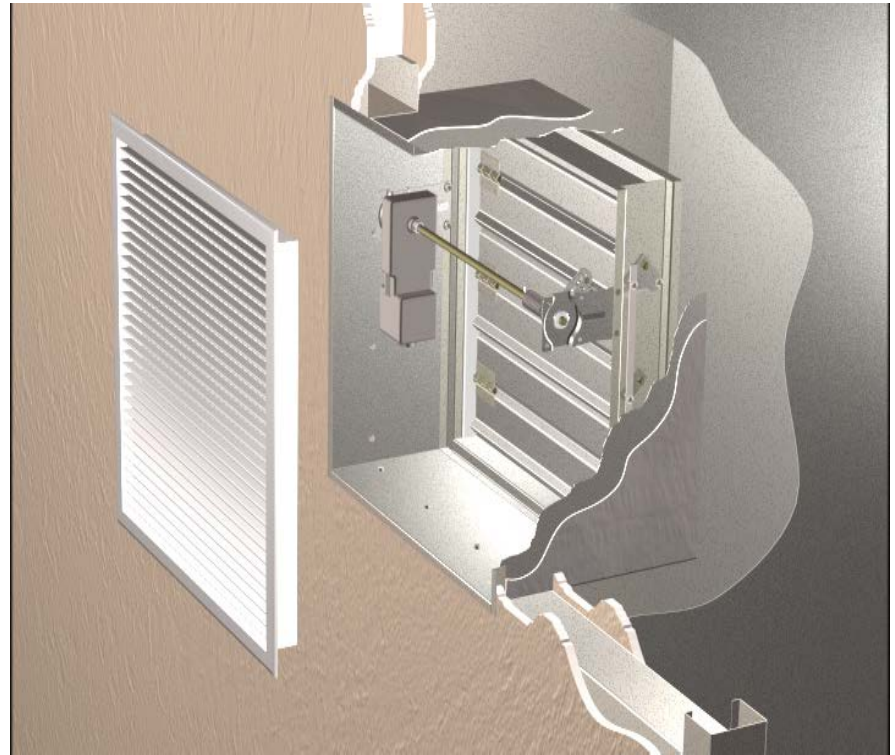
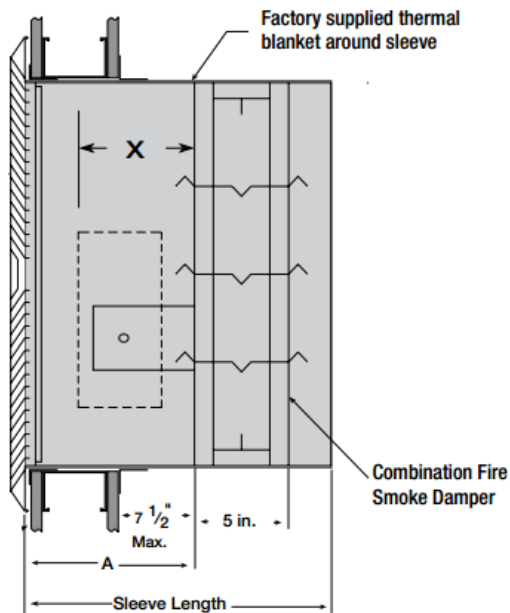


# Installation Requirements

## Fire and Fire Smoke Dampers

### Out-Of-Wall Installations

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



# Out-of-Wall Fire and Fire Smoke Dampers





# Out-of-Wall Fire and Fire Smoke Dampers



# Over-Sized Opening

- ▶ **Objective** - Protect a 160 x 94 ventilation penetration in a 2 hr rated barrier
- ▶ **Challenge** - The largest tested and listed damper system in the world for this application is 144 x 96
- ▶ **Solution** -



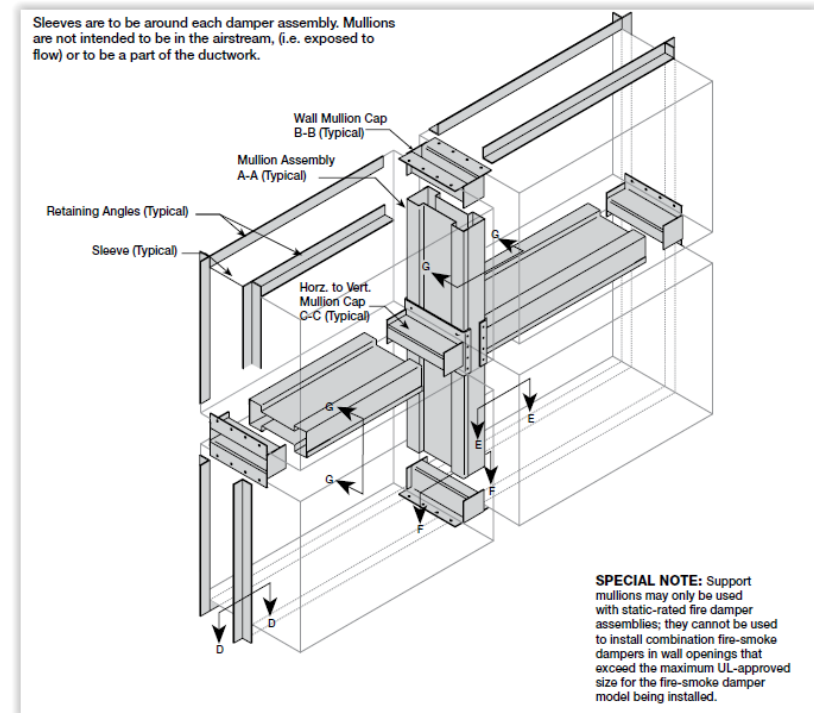
# Over-Sized Opening

## ▶ Static

- For use in HVAC systems that shut off in case of a fire emergency.

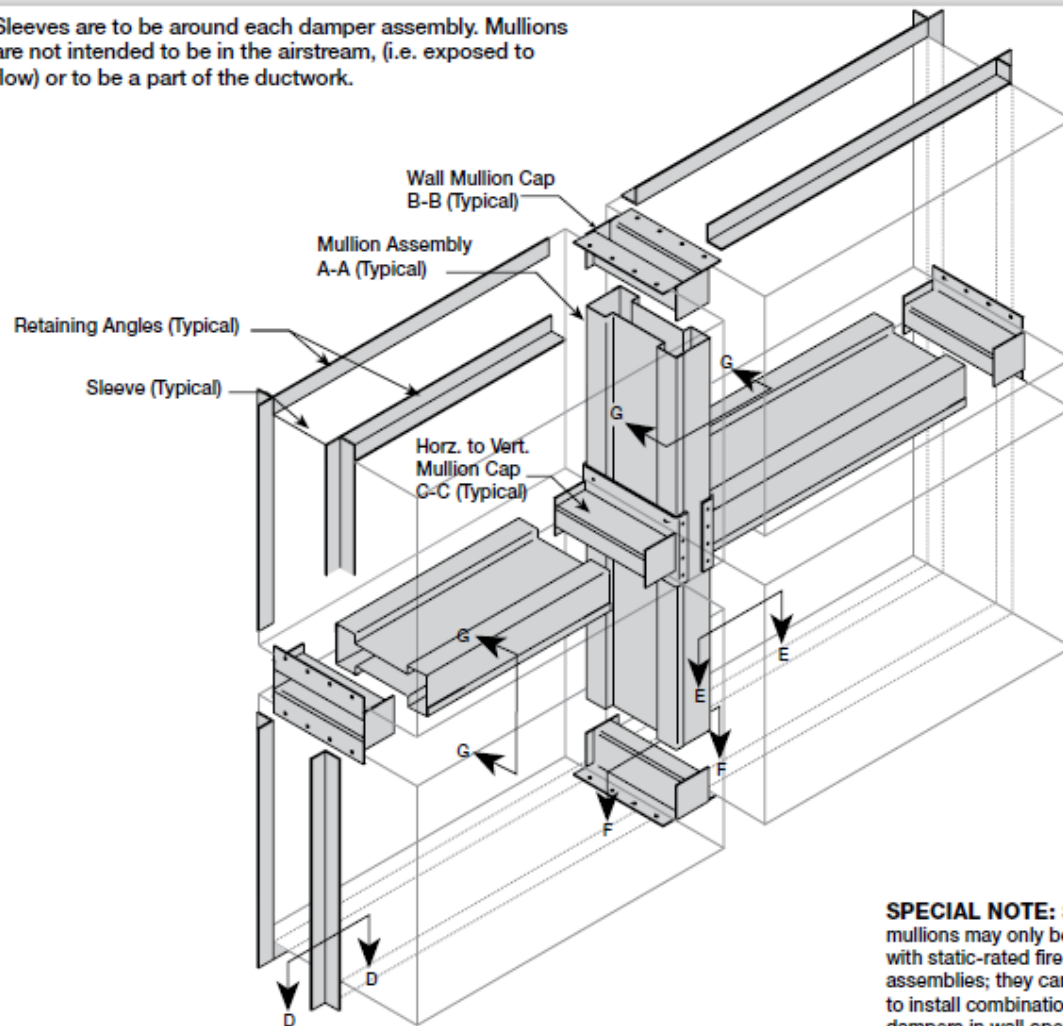
## ▶ Solution(s)

- Make smaller openings
- ▶ Same construction as barrier
- ▶ Mullion



These installation instructions apply to the fabrication and construction of generic support mullions. Support mullions are necessary whenever static fire dampers are installed into a vertical opening that is larger than the largest UL rated size for that damper. The mullions allow construction of a fire barrier that is larger than the maximum available size.

Sleeves are to be around each damper assembly. Mullions are not intended to be in the airstream, (i.e. exposed to flow) or to be a part of the ductwork.



**SPECIAL NOTE:** Support mullions may only be used with static-rated fire damper assemblies; they cannot be used to install combination fire-smoke dampers in wall openings that exceed the maximum UL-approved size for the fire-smoke damper model being installed.



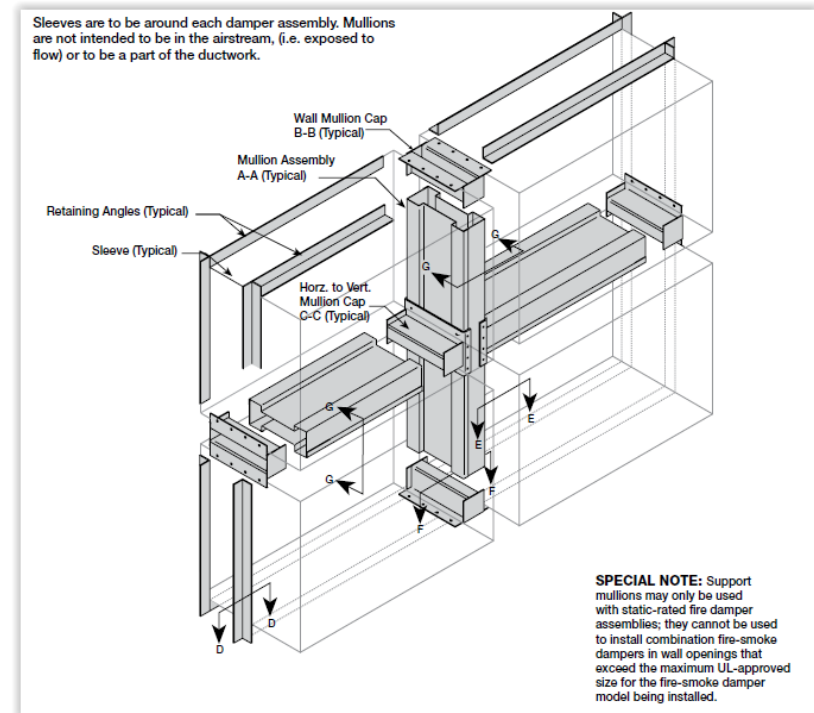
# Over-Sized Opening

## ▶ Static

- For use in HVAC systems that shut off in case of a fire emergency.

## ▶ Solution(s)

- Make smaller openings
- ▶ Same construction as barrier
- ▶ Mullion
- ▶ AHJ Approved





# Over-Sized Opening

## ▶ **Dynamic**

- For use in HVAC systems that continue running during a fire emergency.
- Dynamic airflow test
- Increments of 1000 fpm

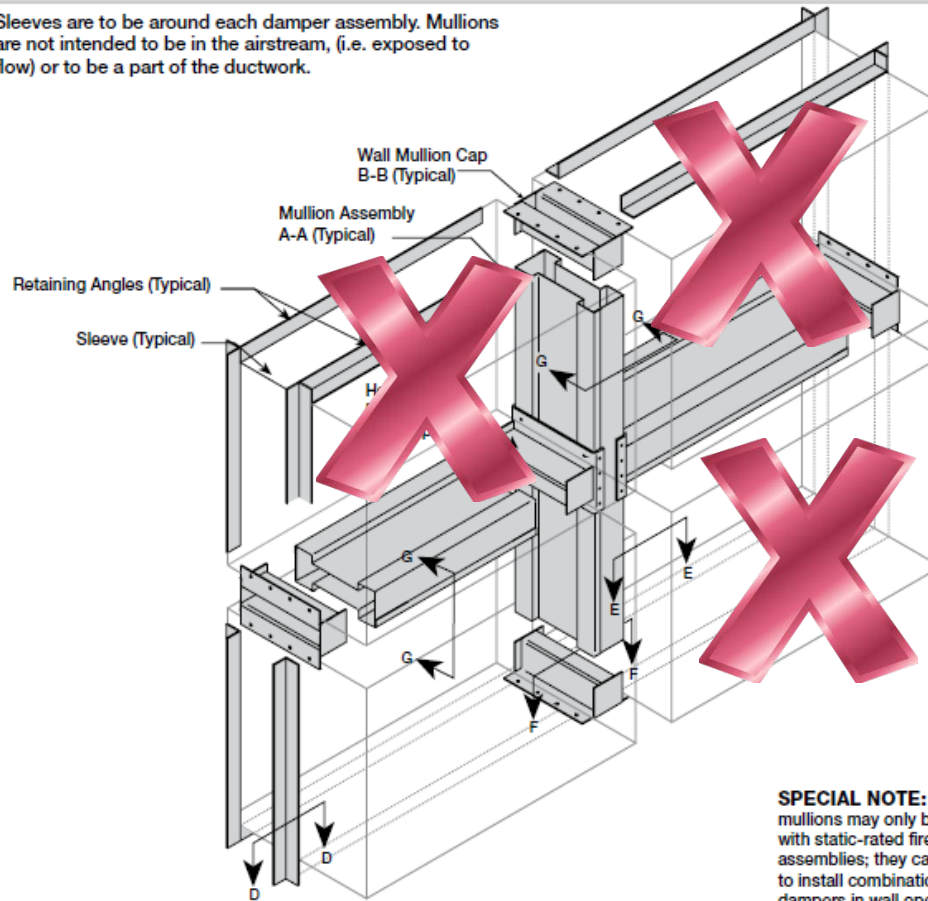
## ▶ **Solution(s)**

- Much harder

- ▶ *Cannot exceed the velocity rating of the tested and listed system*

# 2,000 FPM (23 MPH)

Sleeves are to be around each damper assembly. Mullions are not intended to be in the airstream, (i.e. exposed to flow) or to be a part of the ductwork.



**SPECIAL NOTE:** Support mullions may only be used with static-rated fire damper assemblies; they cannot be used to install combination fire-smoke dampers in wall openings that exceed the maximum UL-approved size for the fire-smoke damper model being installed.

# 8,000 FPM (92 MPH)

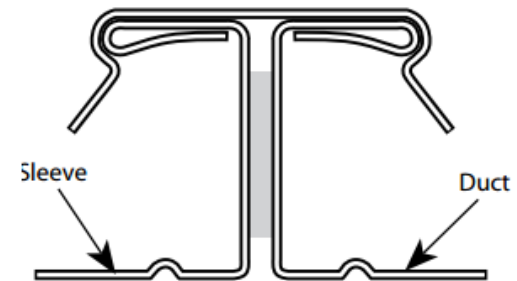
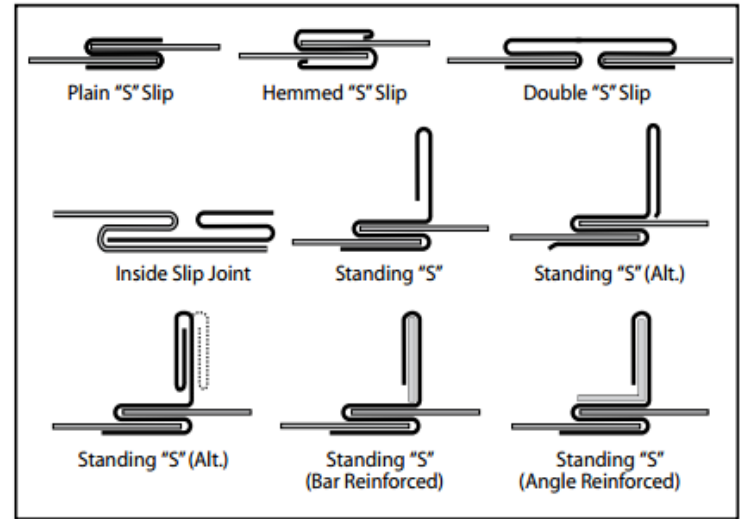
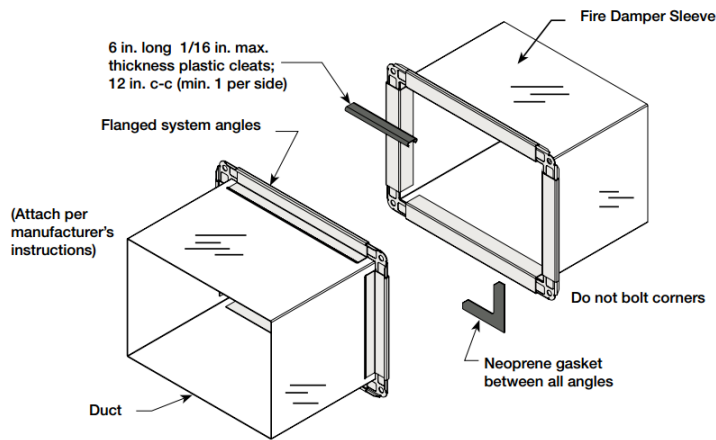
# Installation Requirements

## Fire and Fire Smoke Dampers

### Traditional Installation

#### 4. Duct to Sleeve Connections

- Transverse Joints
- TDC/TDF
- Manufactured Systems
- Rigid Connection (when allowed)



Typical TDC/TDF joint

# **Greenheck Connect-All Breakaway Test**

# Installation Requirements

## Access and Identification

### Section 716.4 of the IBC

- *Fire and smoke dampers shall be provided with an approved means of access, which is large enough to permit inspection and maintenance of the damper and its operating parts.*
- *Access points shall be permanently identified on the exterior by a label having letters not less than ½” in height reading: Fire/Smoke Damper, Smoke Damper or Fire Damper.*



# UL 555S: Smoke Dampers





# Smoke Damper Construction

## ▶ Type

- multi-blade
- 3-V or airfoil blade

## ▶ Construction

- blade and jamb seals
- *always* with a UL-approved actuator





# Smoke Damper Actuators

## ▶ Mounting

- must be factory mounted
- internal or external

## ▶ Operation

- spring return
- two position or modulating



# UL 555S Classifications

## ▶ 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)

## ▶ IBC 716.3.2

- Smoke damper leakage ratings shall not be less than Class II.

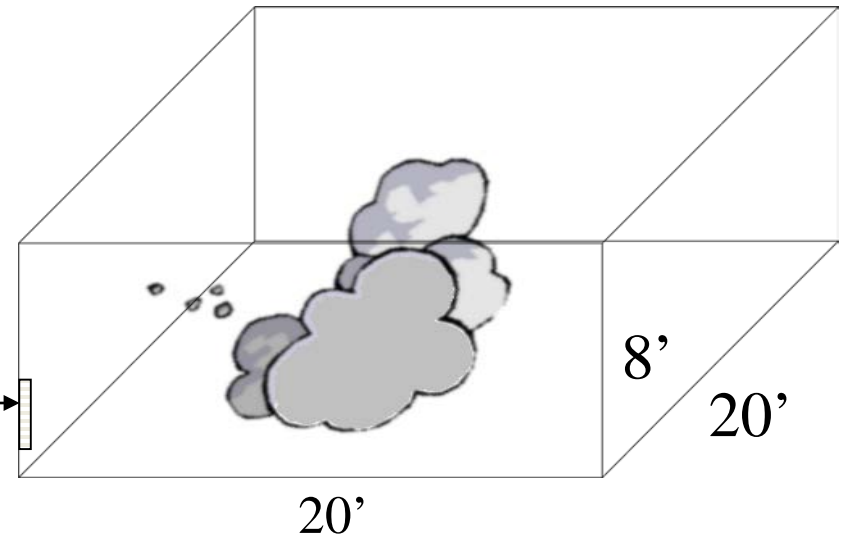
## ▶ Operational Temperature

- Maximum operating temperature for damper
- 250° F
- 350° F

# Amount of Time to Fill a Room with Smoke Based on Leakage Class

<u>Leakage Class</u>		<u>Length of Time</u>
I	=	100 minutes
II	=	40 minutes
III	=	10 minutes

24"x 24"  
(610mm x 610mm)  
Damper



# Smoke Damper Installation

## ▶ Installed in ductwork

- with sleeve
- without sleeve

## ▶ Location

- Centerline within 24" of the barrier

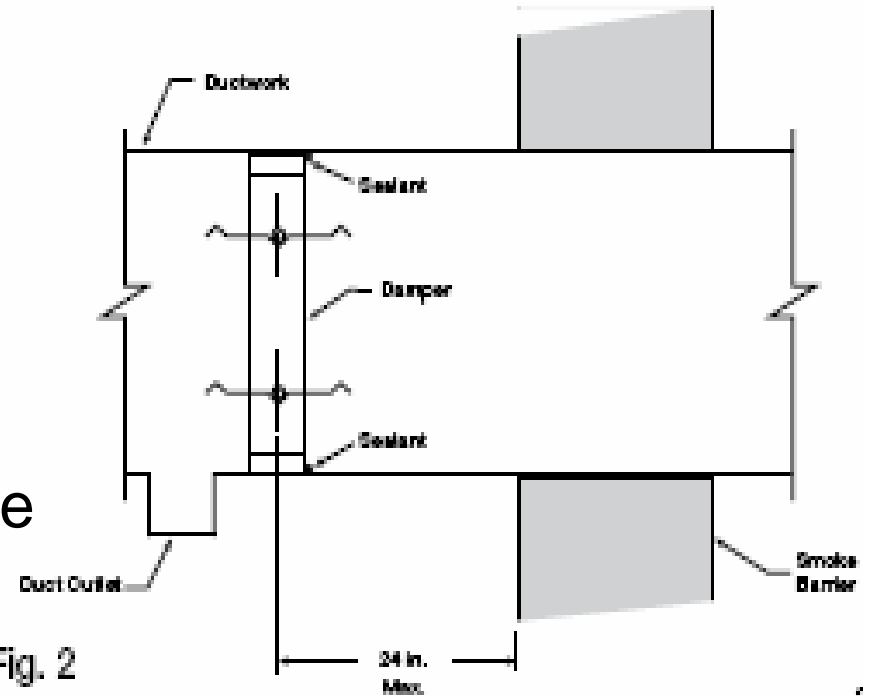
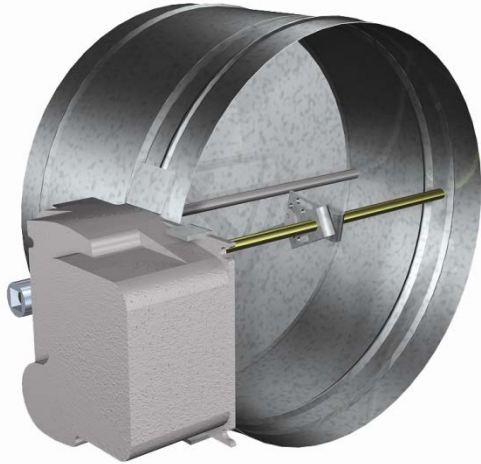


Fig. 2

# Smoke Damper Installation

- ▶ **In Accordance with Manufacturer's IOMs**
- ▶ **Sealing Damper**
  - It is acceptable to seal damper frame and duct with approved sealants.
- ▶ **Actuator Requirements**
  - Wire actuator in compliance with local wiring codes.
  - Refer to wiring diagrams for each actuator.

# Combination Fire/Smoke Dampers





# Purpose of Fire/Smoke Damper

- ▶ Provide the same level of protection as individual fire and smoke dampers.
- ▶ Installation guidelines of fire and smoke dampers apply.





# Fire Smoke Installation

## ▶ Actuators

- UL-certified actuators
- installed at factory

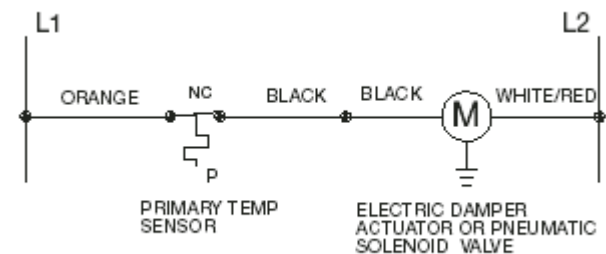
## ▶ Operation

- spring return
- two position or modulating



# Fire/Smoke Damper Closure Devices

- ▶ **Fuse Link**
- ▶ **Electronic Link**
  - bi-metallic sensor
  - wired in series with actuator
  - cuts power to actuator when temperature is reached
  - resettable



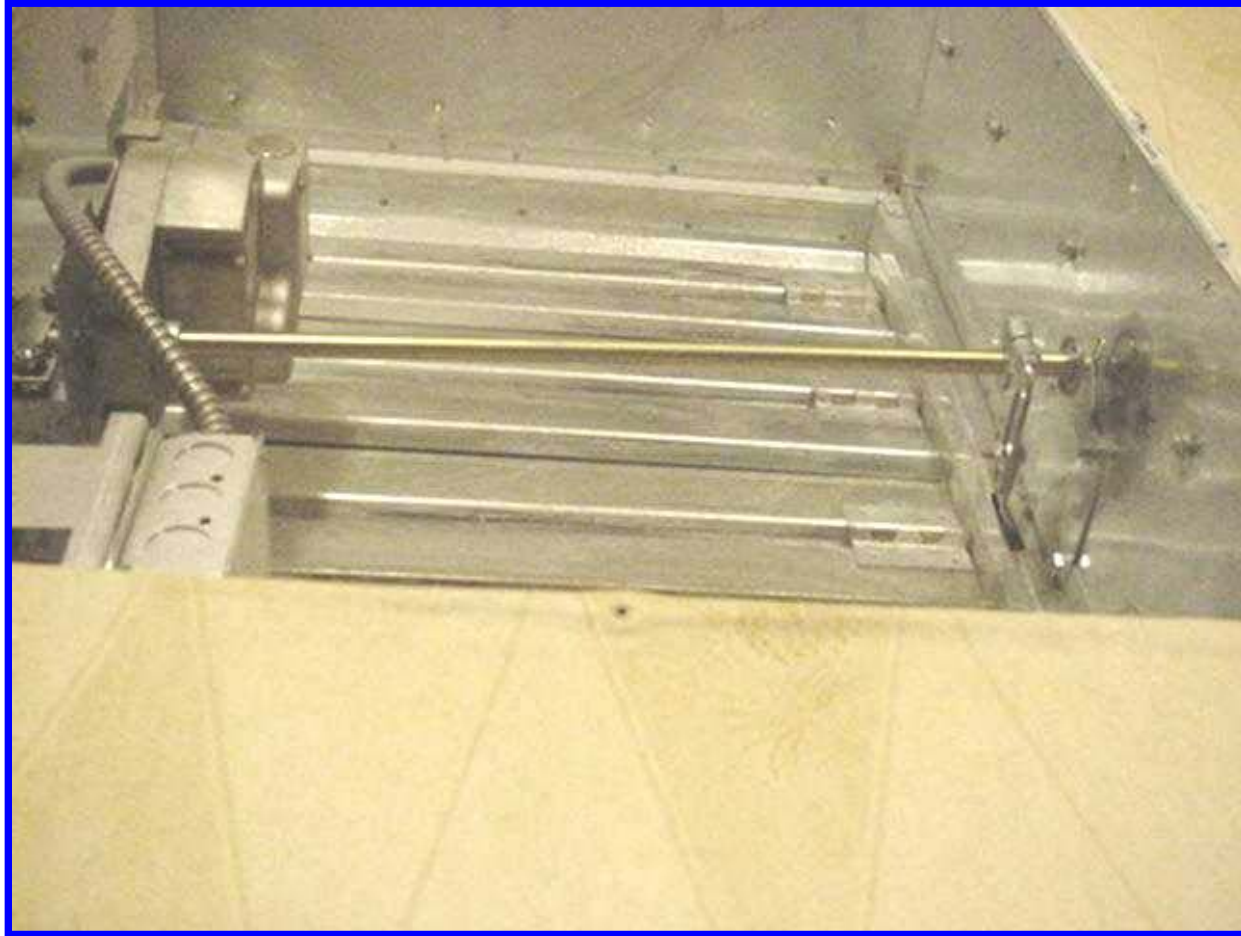
# Operational Test/Inspection

# Importance of Inspection



**Damper installed racked.**

# Importance of Inspection



**Misaligned jackshaft on damper.**

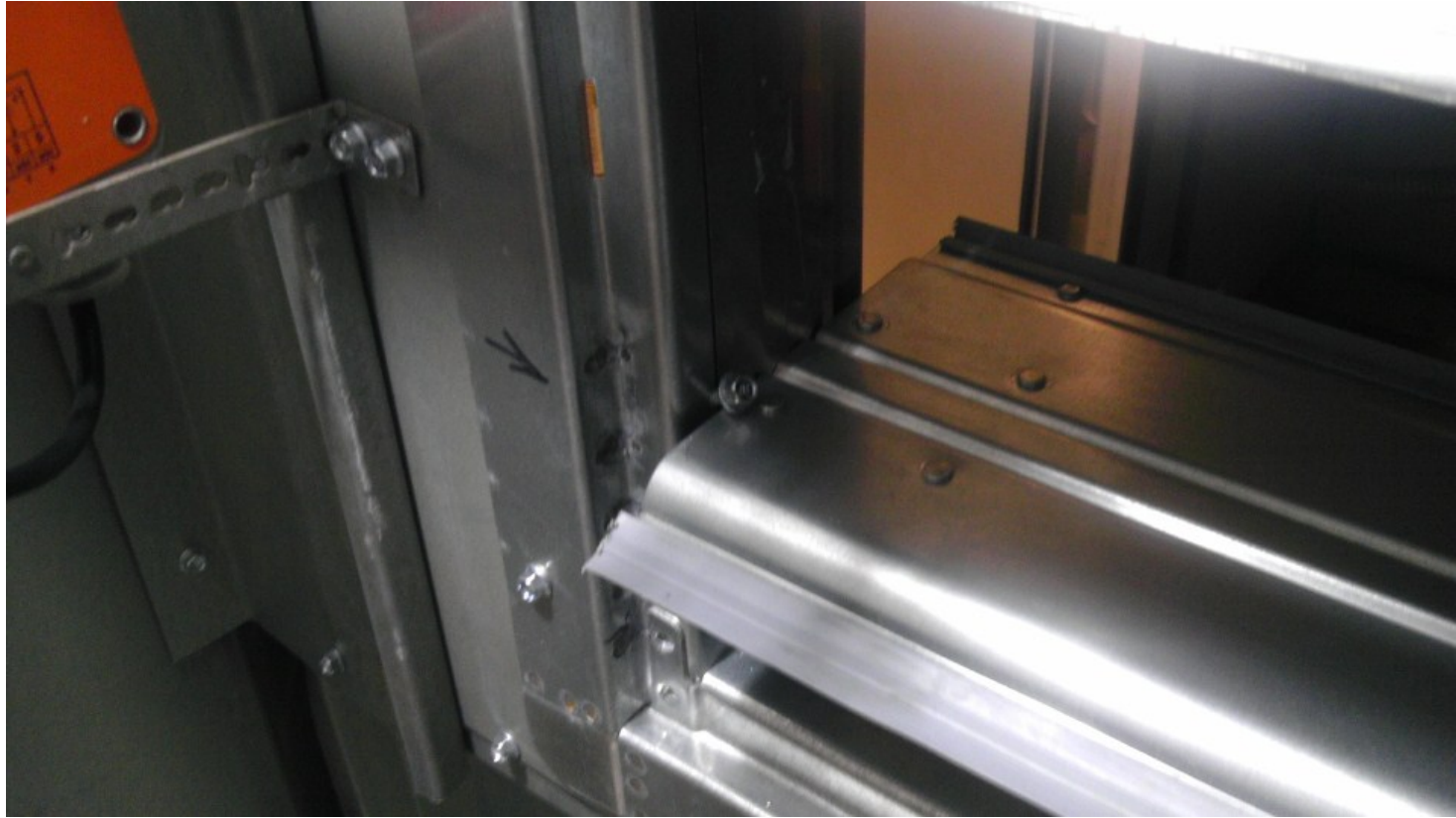


# Importance of Inspection



**Actuator in the barrier.**

# Importance of Inspection





# Operational Test

## NFPA 80

### Standard for Fire Doors and Other Opening Protectives

#### Frequency

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

#### Test Method

“The damper shall fully close from the open position.”

“The operational test shall verify that there is full and unobstructed access to the fire damper and all listed components.”

“All indicating devices shall be verified to work and report to the intended location.”

“The operational test shall be conducted under non-fire HVAC airflow conditions as well as static flow conditions.”



# Operational Test

## NFPA 105

### Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives

#### Frequency

“An operational test shall be conducted after the building’s HVAC system has been balanced.”

#### Test Method

“The operational test shall be conducted under normal HVAC airflow conditions as well as static flow conditions. The damper shall fully close/seal under both test conditions.”

“All indicating devices shall be verified to work properly and report to the intended location.”

“Combination fire/smoke dampers shall also meet the testing requirements contained in NFPA 80.”

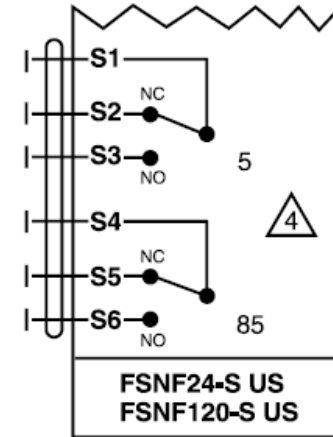


# Notification Options

## Position Indication



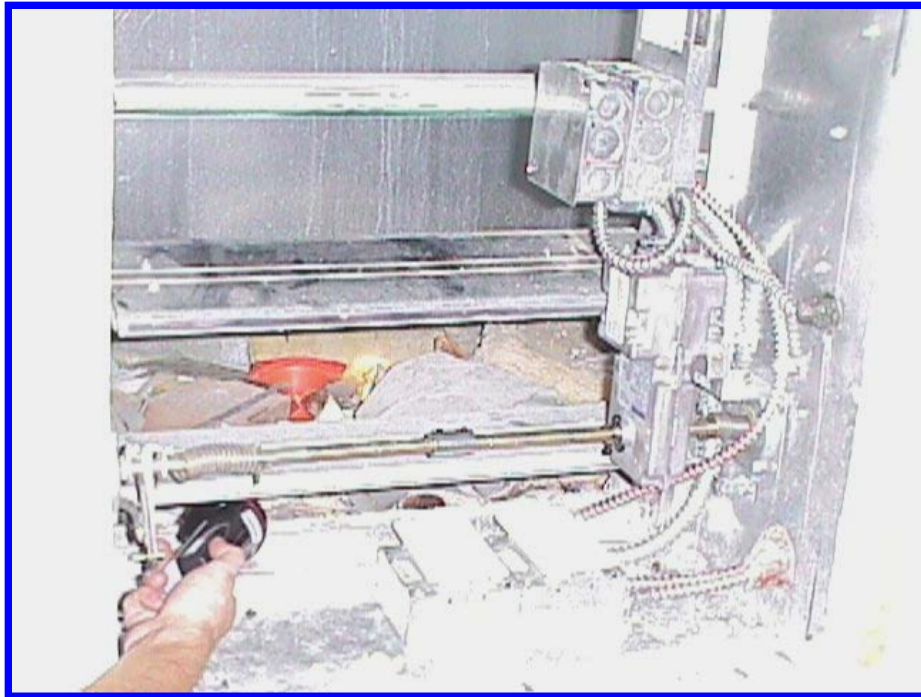
**On-Blade**



**Built-In to Actuator**

# **Period Tests/Maintenance**

# Importance of Maintenance



**Garbage placed inside of damper.**



# Periodic Testing Requirements

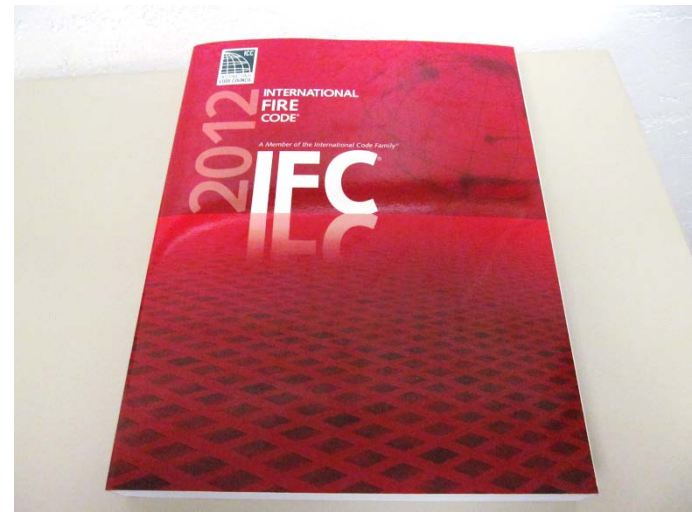
## International Fire Code (IFC)

### Smoke Dampers

“All openings protected with approved smoke barrier doors or smoke dampers shall be maintained in accordance with NFPA 105.”

### Fire Dampers

“All openings protected with approved doors or fire dampers shall be maintained in accordance with NFPA 80”.



# Periodic Testing Requirements

## NFPA 80

### Standard for Fire Doors and Other Opening Protectives

#### Frequency

“Each damper shall be tested and inspected 1 year after installation” and then “every 4 years, except in hospitals, where the frequency shall be every 6 years.”

#### Test Method

“If the fire damper is equipped with a fusible link, the link shall be removed for testing to ensure full closure.”

“The operational test of the damper shall verify that there is no damper interference due to rusted, bent, misaligned, or damaged frame or blades.”



# Periodic Testing Requirements

## NFPA 80

### Standard for Fire Doors and Other Opening Protectives

#### Maintenance

“All exposed moving parts of the damper shall be dry lubricated as required by the manufacturer”

“If the damper is not operable, repairs shall begin without delay”

“Following any repairs, the damper shall be test for operation in accordance with Section 19.4(Inspection and Testing)



# Periodic Testing Requirements

## NFPA 105

### Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives

#### Frequency

“Each damper shall be tested and inspected 1 year after installation” and then “every 4 years, except in hospitals, where the frequency shall be every 6 years.”

#### Test Method

“If the fire damper is equipped with a fusible link, the link shall be removed for testing to ensure full closure.”

“The operational test of the damper shall verify that there is no damper interference due to rusted, bent, misaligned, or damaged frame or blades.”



# Periodic Testing Requirements

## NFPA 105

### Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives

#### Maintenance

“All exposed moving parts of the damper shall be dry lubricated as required by the manufacturer.”

“If the damper is not operable, repairs shall begin without delay.”

“Following any repairs, the damper shall be test for operation in accordance with Section 6.5(Inspection and Testing).”





# Periodic Testing Requirements

## New AMCA Maintenance Guide

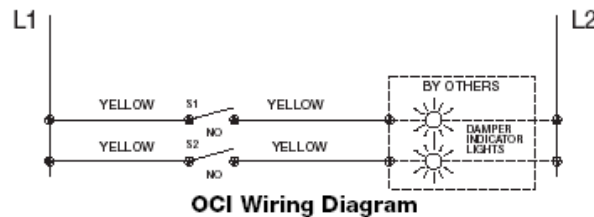


**Guide for Commissioning and  
Periodic Performance Testing  
of Fire, Smoke and Other Life  
Safety Related Dampers**

# Testing Options

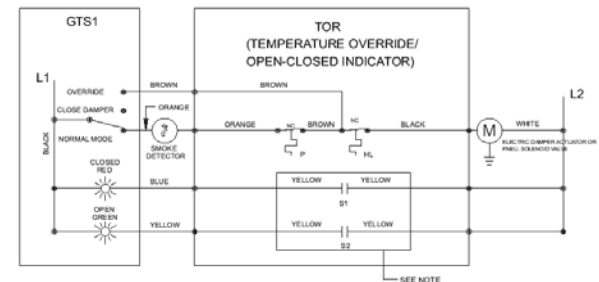
## ▶ Position Switches

- providing positive blade indication



## ▶ Control Modules

- test the operation of damper from a remote location
- multiple configurations



# Testing Options

## Test Stations



Test Switch



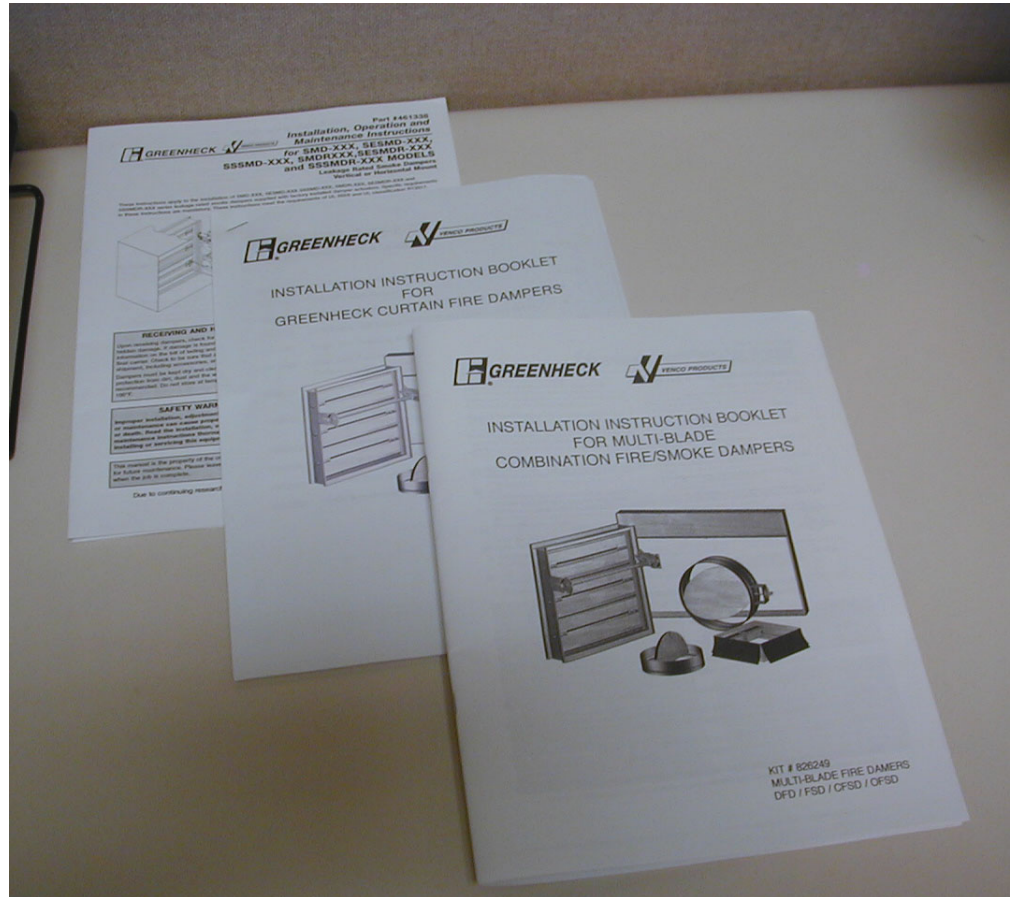
Toggle Switch

Keyed Switch

Momentary Switch

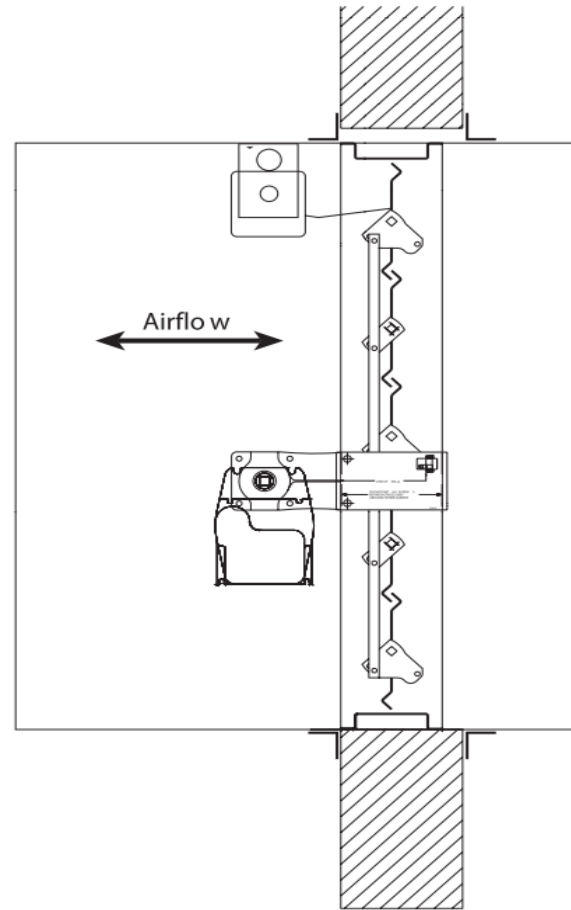
Lights Only

# Installation Books



# What if the barrier isn't rated?

- ▶ ~~Barrier~~
- ▶ Product
- ▶ Installation





# What if the barrier isn't rated?

- ▶ **Consult AHJ**
- ▶ **Determine impact on HVAC**
- ▶ **Determine go forward plan**
  - Leave and maintain
  - Abandon in place
  - Remove



**Thank You**