

# Maintaining Protection: Fire and Smoke Dampers

**Rich Walke, Consultant to the FCIA**

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**FCIA Virtual 'DIIM' Firestop & Effective  
Compartmentation in Existing Buildings  
Symposium Middle East**

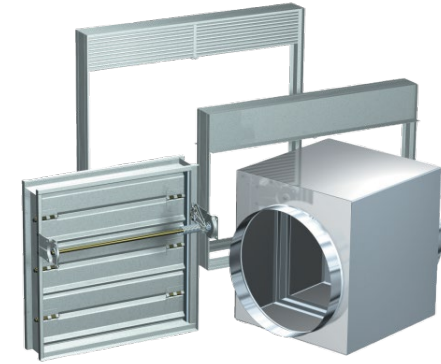
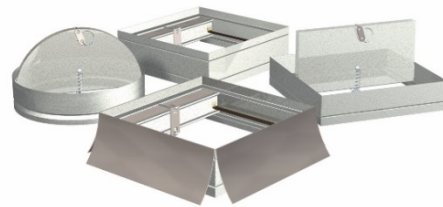


**CREATIVE TECHNOLOGY INC.  
FIRE PROTECTION  
CONSULTING AND TRAINING**

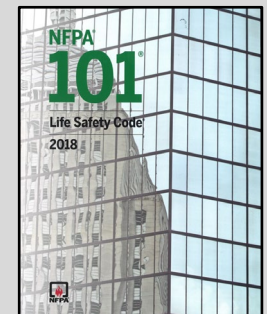
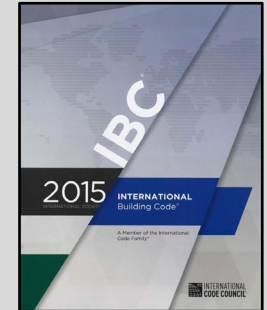
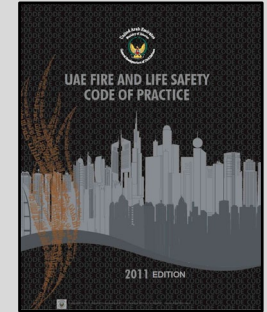
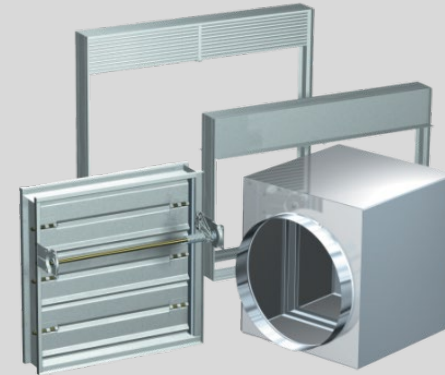
# Damper Types

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



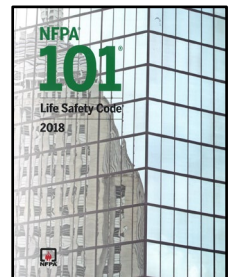
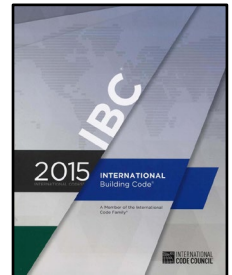
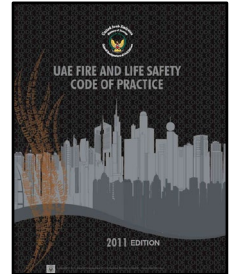
# Code Requirements



# Building & Fire Code Requirements

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- UAE Fire and Life Safety Code
  - New and Existing Buildings – Chapter 1
  - Existing Building Maintenance – Chapter 1, Section 21
- International Codes
  - New and Existing Buildings – International Building Code – Chapter 7
  - International Fire Code – Chapter 7
- NFPA
  - New and Existing Buildings – NFPA 5000 & 101 – Chapter 8
  - Fire Code – NFPA 1 – Chapter 12
- ***Minimum requirements - Construction & Maintaining Protection***



# IBC Fire and Smoke Protection Features

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- Fire-resistance-rated assemblies:
  - *Structural Members*
  - *Exterior Walls*
  - *Fire Walls*
  - *Fire Barriers*
  - *Fire Partitions*
  - *Smoke Barriers*
  - *Horizontal Assemblies*
  - *Shaft Enclosures*
- Smoke-resistant assemblies:
  - *Smoke Barriers* – Intended to “... restrict movement of smoke”
  - *Smoke Partitions* – Intended to “... limit the transfer of smoke”

# Code Referenced Test Standard

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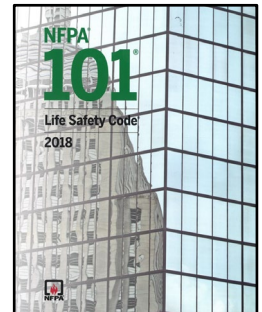
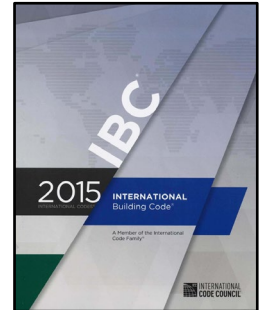
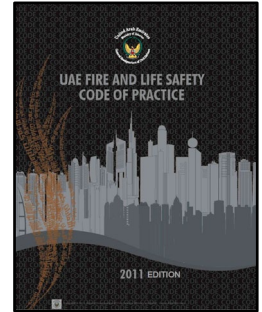
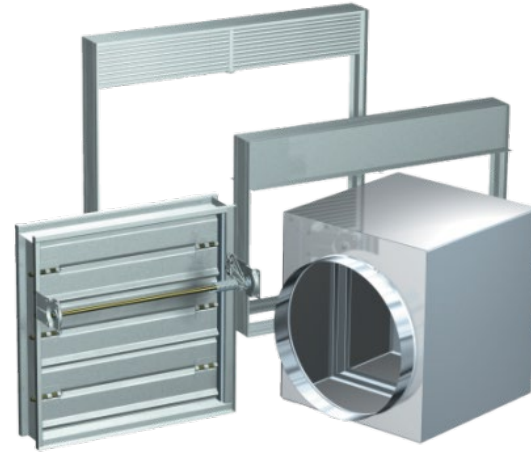
- **Referenced Test Standards**

- **Structural Elements & Assemblies** – ASTM E119 / UL 263, ISO 834 Series, EN 1365 Series, BS 476 Series
- **Fire & Smoke Barriers** – ASTM E119 / UL 263, ISO 834 Series, EN 1365 Series, BS 476 Series
- **Firestopping** – ASTM E814 / UL 1479, ISO 10295-1, EN 1366-3, ASTM E1966 / UL 2079, ISO 10295-2, EN 1366-4, ASTM E2307, E2837, E3037, ...test method...”
- **Swinging/Rolling Fire Doors** – UL 10B, 10C, NFPA 252, ISO 3008-1, EN 1634-1
- **Fire Rated Glazing** – NFPA 257 / UL 9, ASTM E119 / UL 263, ISO 3009
- **Fire/Smoke/Ceiling Radiation Dampers** – UL 555, UL 555S, UL 555C, ISO 21925-1 & 2, EN 1366-2, EN 1366-10

# Fire Dampers

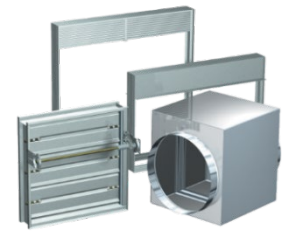
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## Code Requirements



# Code Requirements – Fire Dampers

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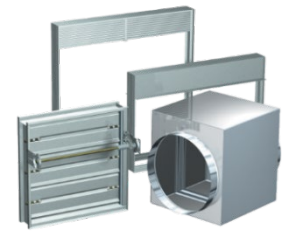


- All three codes require for fire dampers to be installed where ducts pass through fire-resistance-rated assemblies. Fire dampers covered in:
  - Chapter 1, Section 22 and Chapter 10, Section 19 of the UAE Fire & Life Safety Code
  - Section 717 of the IBC
  - Sections 8.3 and 8.6 of NFPA 101



# Code Requirements – Fire Dampers Cont.

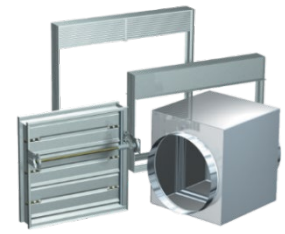
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- Required rating is based on rating of barrier penetrated
  - Min 1-1/2 hr for dampers in floors, walls and partitions with a rating of less than 3 hr
  - Min 3 hr for dampers in floors, walls and partitions with a rating of 3 hr or greater

# Code Requirements – Fire Dampers Cont.

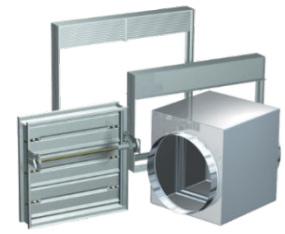
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- Requirements and method of stating requirements vary somewhat between the three codes
- Both the UAE code and NFPA 101 require HVAC ductwork to be installed in accordance with NFPA 90A and 90B

# Code Requirements – Fire Dampers Cont.

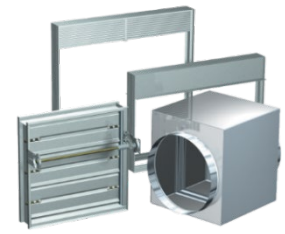
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- Fire damper listings differentiate between static and dynamic dampers. Only dynamic dampers shall be used in HVAC systems designed to operate with fan on during a fire.
  - Static – For use in HVAC systems designed to shutdown upon detection of fire or smoke
  - Dynamic – For use in HVAC systems designed to remain operational during a fire situation. All combination fire / smoke dampers are dynamic.

# Code Requirements – Fire Dampers Cont.

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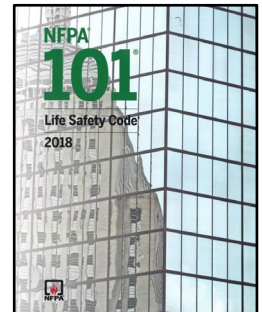
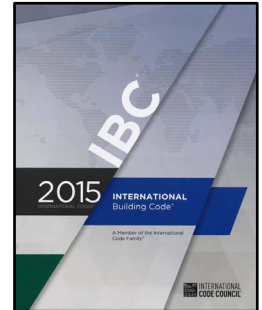
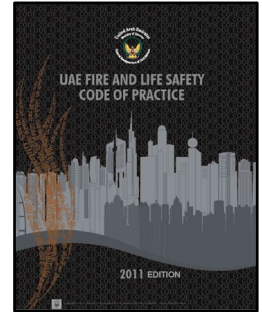
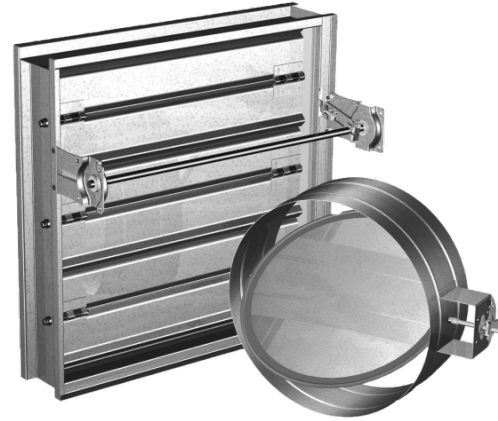


- Installation:
  - Fire dampers shall be installed in accordance with the requirements of code, the manufacturer's instructions and the listing

# Smoke Dampers

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## Code Requirements



# Code Requirements – Smoke Dampers

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- All three codes require for smoke dampers to be installed where ducts pass through assemblies designed to resist the passage of smoke. Smoke dampers covered in:
  - Chapter 1, Section 23 and Chapter 10, Section 19 of the UAE Fire & Life Safety Code
  - Section 717 of the IBC
  - Sections 8.4 and 8.5 of NFPA 101

# Code Requirements – Smoke Dampers Cont.

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- Requirements and method of stating requirements vary somewhat between the three codes
- Required Leakage Rating – Leakage rating shall be Class I or II at a temperature rating of not less than 250°F (140°C) based on UL 555S, or 200 m<sup>3</sup>/(h-m<sup>2</sup>) as per EN 1366-10 at a temperature rating of not less than 250°F (140°C)

# Code Requirements – Smoke Dampers Cont.

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- Both the UAE code and NFPA 101 require HVAC ductwork to be installed in accordance with NFPA 90A and 90B
- Actuation:
  - Damper shall close upon actuation of listed smoke detectors



# Code Requirements – Smoke Dampers Cont.

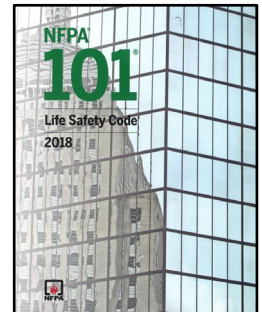
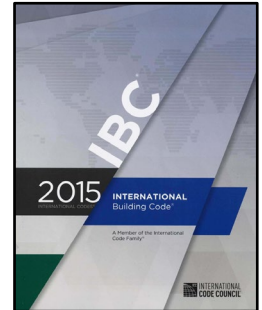
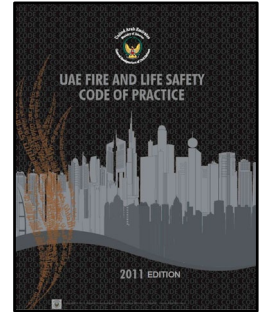
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- Installation:
  - Smoke dampers shall be installed in accordance with the requirements of code, the manufacturer's instructions and the listing
  - Also used to control pressure differentials in smoke control systems
- Smoke dampers shall be listed and labeled in accordance with UL 555S or EN 1366-10 in the UAE

# Combination Fire / Smoke Dampers

## Code Requirements



# Code Requirements – Combination Fire/Smoke Dampers

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- All three codes require for combination fire/smoke dampers to be installed where ducts pass through fire-resistance-rated assemblies which are also required to resist the passage of smoke. Combination fire / smoke dampers covered in:
  - Chapter 1, Section 23 and Chapter 10, Section 19 of the UAE Fire & Life Safety Code
  - Section 717 of the IBC
  - Sections 8.3, 8.4, 8.5 and 8.6 of NFPA 101

# Code Requirements – Combination Dampers Cont.

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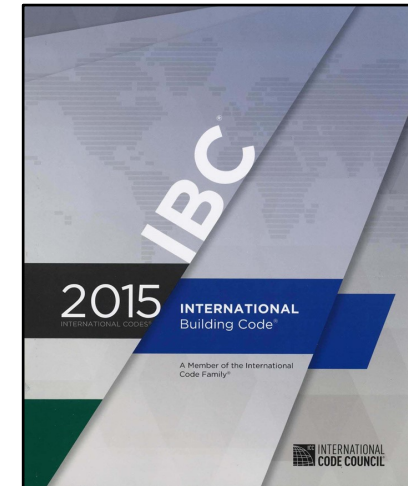


- Requirements and method of stating requirements vary somewhat between the three codes
- Combination fire / smoke dampers shall meet the requirements for both fire dampers and smoke dampers

# Corridor Dampers

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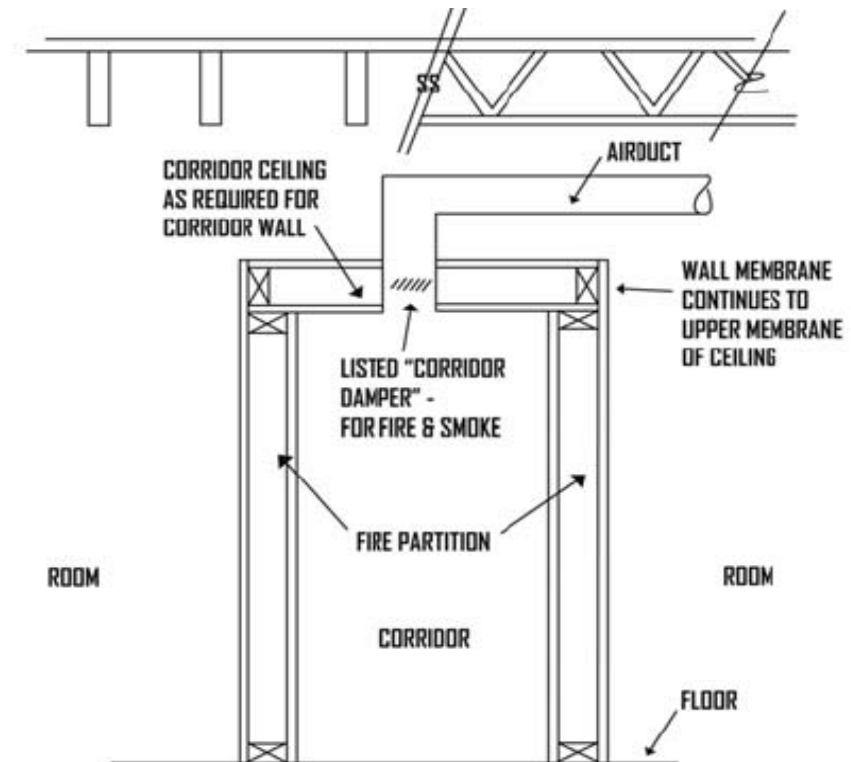
## Code Requirements



# Code Requirements – Corridor Dampers



- Only specified in IBC, although are commonly used and approved in jurisdictions using other codes
  - Used in ceilings of exit corridors where ceiling is constructed as required for corridor walls per Section 708.4, Exception 3
  - Designed to be installed in horizontal “wall”



# Code Requirements – Corridor Dampers Cont.

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- 717.2 – Installation:
  - Corridor dampers shall be installed in accordance with the requirements of code, the manufacturer's instructions and the listing
- 717.3.1 – Corridor dampers shall be listed and labeled in accordance with UL 555 and UL 555S. Corridor dampers shall also demonstrate acceptable closure under air flow conditions.



# Code Requirements – Corridor Dampers Cont.

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- 717.3.2.4 – Rating requirements:
  - Shall meet the rating requirements for both fire and smoke dampers
    - 1 hr fire rated
    - Leakage rating shall be Class I or II with a temperature rating of not less than 250°F (121°C)
- 717.3.3.5 – Actuation:
  - Damper actuation shall be as required for fire and smoke dampers



# Code Requirements – Corridor Dampers Cont.

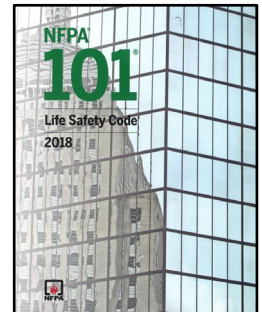
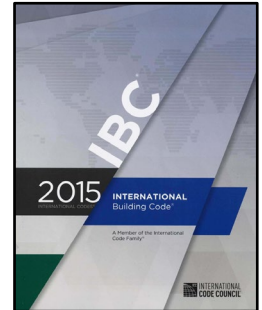
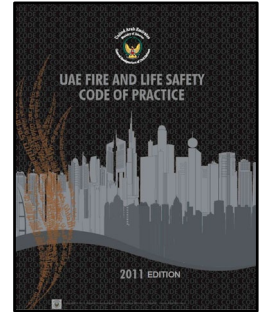
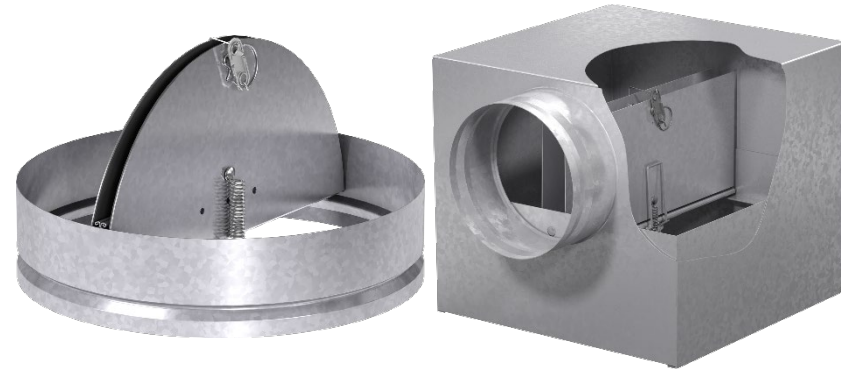
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- 717.5 – Penetrations of corridor ceilings where constructed as walls shall be protected by a corridor damper

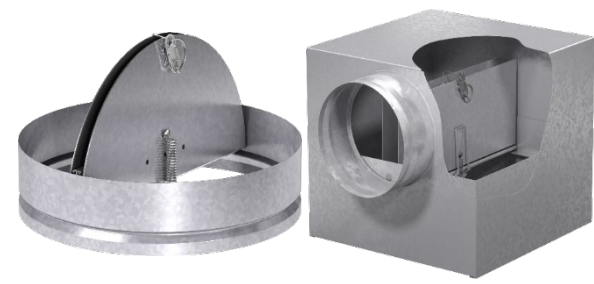
# Ceiling Radiation Dampers

## Code Requirements



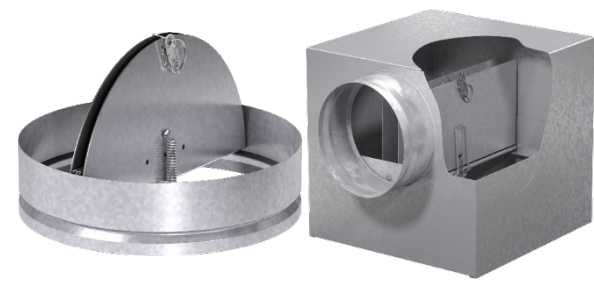
# Code Requirements – Ceiling Radiation Dampers

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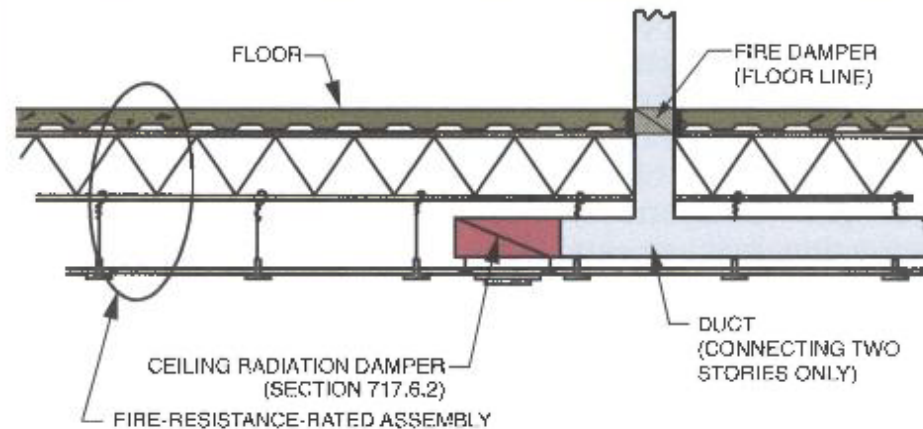


- All three codes require for ceiling radiation dampers to be installed where ducts pass through the ceiling of fire-resistance-rated floor-ceiling or roof-ceiling assemblies. Ceiling radiation dampers covered in:
  - Chapter 1, Section 23 and Chapter 10, Section 19 of the UAE Fire & Life Safety Code
  - Section 717 of the IBC
  - Sections 8.3 and 8.6 of NFPA 101

# Code Requirements – Ceiling Radiation Dampers Cont.

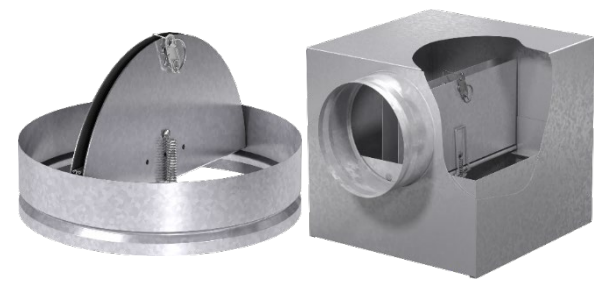


- Used in fire resistive floor-ceiling and roof-ceiling assemblies where duct penetrates membrane ceiling
- Intent is to minimize heat transfer into concealed space



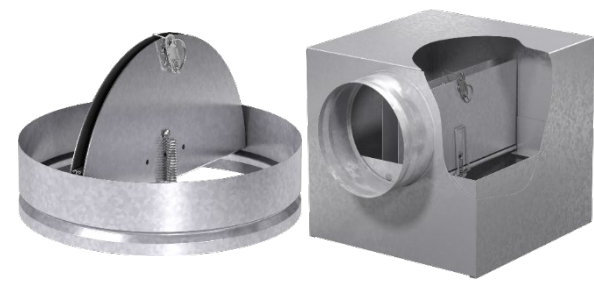
# Code Requirements – Ceiling Radiation Dampers Cont.

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- Requirements and method of stating requirements vary somewhat between the three codes
- Both the UAE code and NFPA 101 require HVAC ductwork to be installed in accordance with NFPA 90A and 90B

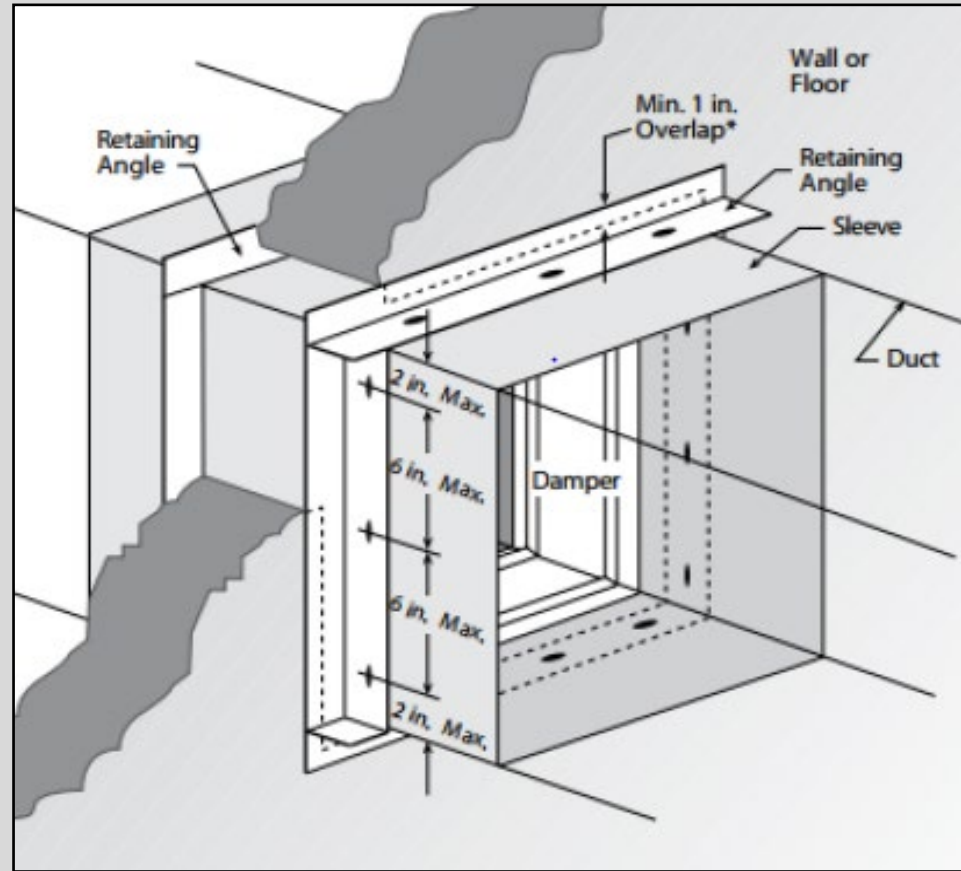
# Code Requirements – Ceiling Radiation Dampers Cont.



- Installation:
  - Ceiling radiation dampers shall be installed in accordance with the requirements of code, the manufacturer's instructions and the listing
- Ceiling radiation dampers shall be listed and labeled, and tested in accordance with UL 555C or as part of a floor/ceiling or roof/ceiling assembly in accordance with UL 263 or ASTM E119, or ISO 834 Series, EN 1365 Series or BS 476 Series

# Listing Considerations

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# Static Fire Damper

## Summary of Available Listings

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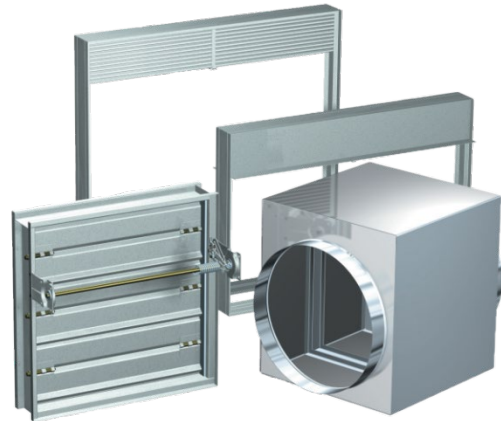
<b>Fire Dampers</b>	
<b>Hourly Fire Rating</b>	1-1/2 Hr or 3 Hr
<b>Mounting Orientation</b>	Horizontal or Vertical



# Dynamic Fire Damper Ratings

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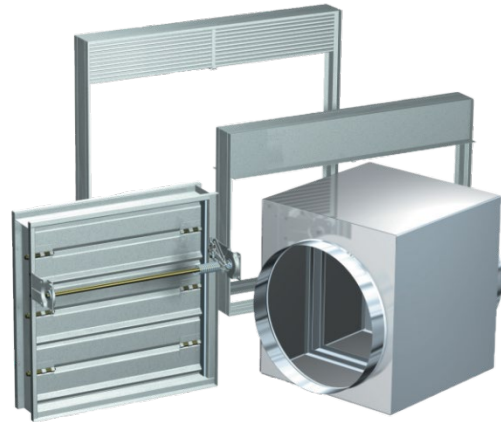
- Velocity Ratings:
  - Minimum Rating: 2,000 fpm (610 m/min)
  - Extended ratings available in 1,000 fpm (305 m/min) increments



# Dynamic Fire Damper Ratings Cont.

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- Pressure Ratings:
  - Minimum Rating: 4 in. WC (988 Pa)
  - Extended ratings available in 2 in. WC (494 Pa) increments



# Dynamic Fire Damper

## Summary of Available Listings

---

<b>Fire Dampers</b>	
<b>Hourly Fire Rating</b>	1-1/2 Hr or 3 Hr
<b>Mounting Orientation</b>	Horizontal or Vertical
<b>Velocity Rating (Dynamic Fire Dampers Only)</b>	2,000, 3,000, 4,000 or 5,000 fpm (610, 914, 1219 or 1524 m/min)
<b>Pressure Rating (Dynamic Fire Dampers Only)</b>	4, 6, 8 or 10 in. WC (988, 1482, 1976 or 2470 Pa)

# Smoke Damper Ratings

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## Velocity Ratings:

- Minimum Rating: 2,000 fpm (610 m/min)
- Extended ratings available in 1,000 fpm (305 m/min) increments

## Pressure Ratings:

- Minimum Rating: 4 in. WC (988 Pa)
- Extended ratings available in 2 in. WC (494 Pa) increments

# Smoke Damper Ratings Cont.

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## Operational and Temperature Ratings:

- Minimum Temperature Rating: 250°F (121°C)
- Extended ratings in increments of 100°F (56°C)

# Smoke Dampers

## Summary of Available Listings

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<b>Smoke Dampers</b>	
<b>Leakage Rating</b>	Class I, II or III
<b>Temperature Rating</b>	250 or 350°F (121 or 177°C)
<b>Mounting Orientation</b>	Horizontal or Vertical
<b>Velocity Rating</b>	2,000, 3,000 or 4,000 fpm (610, 914 or 1219 m/min)
<b>Pressure Rating</b>	4, 6 or 8 in. WC (988, 1482 or 1976 Pa)

# Corridor Dampers

## Summary of Available Listings

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<b>Corridor Dampers</b>	
<b>Hourly Fire Rating</b>	1 Hr
<b>Leakage Rating</b>	Class I or II
<b>Temperature Rating</b>	250 or 350°F (121 or 177°C)
<b>Mounting Orientation</b>	Horizontal
<b>Velocity Rating</b>	2,000 fpm (610 m/min)
<b>Pressure Rating</b>	4 in. WC (988 Pa)

# Ceiling Radiation Dampers

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## Two Variations:

1) Dampers tested to UL 555C – Testing has shown the damper performs equal or better than a generic “hinged blade damper” specified in many UL designs. Damper substituted for “hinged blade damper”.





# UL 555C Fire Exposure Test Sample

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# Ceiling Radiation Dampers Cont.

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Two Variations:

2) Dampers tested to UL 263 – Damper has been tested in one or more specific UL designs and is specified in design(s)



# UL 263 Fire Exposure Test Sample

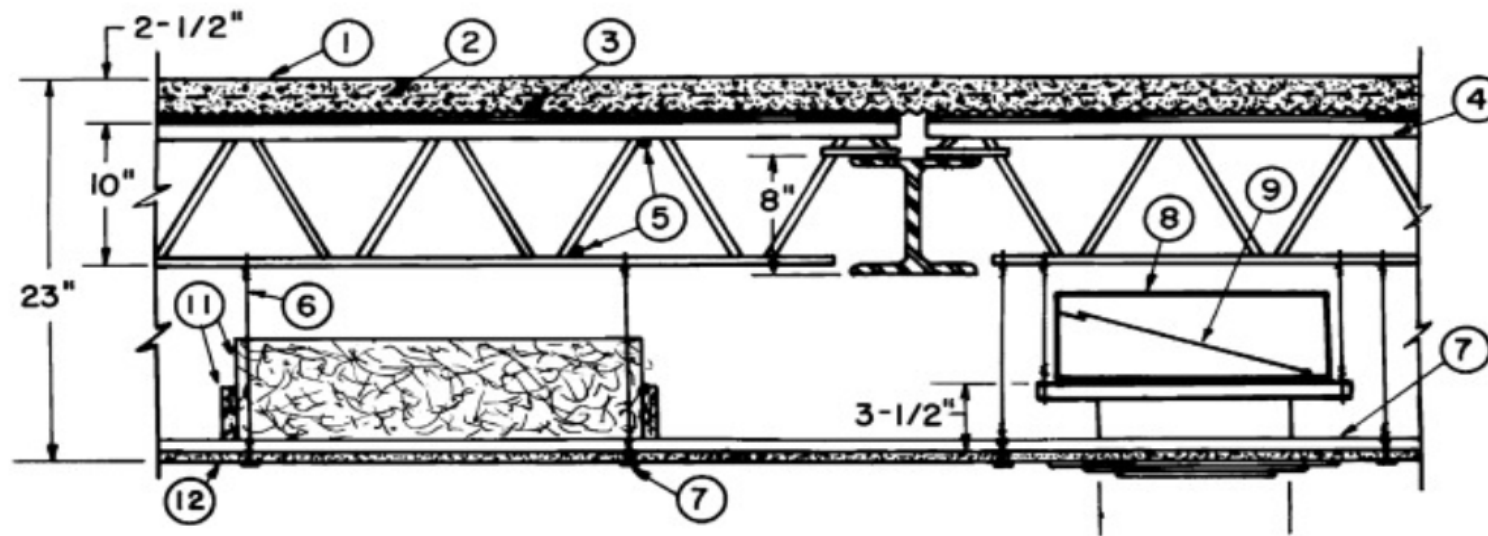
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# Dampers Tested to UL 555C

## When can I use them?

In UL floor/ceiling and roof/ceiling designs which specify a generic “hinged blade damper”



9. **Damper** — No. 16 MSG galv steel, sized to overlap duct outlet by 1 in. min. Protected on both surfaces with 1/16 in. thick ceramic fiber paper and held open with **Fusible Link** (Bearing the UL Listing Mark).

# Dampers Tested to UL 555C Cont.

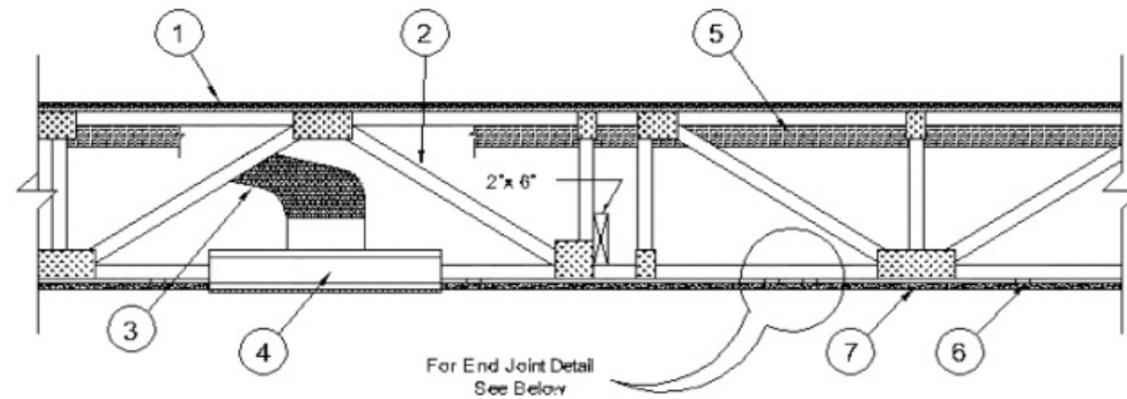
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- Listings permits substitution of listed ceiling radiation damper for the generic “hinged blade damper” specified in the design
- If “hinged blade damper” is not specified in design, ceiling radiation damper may not be added into the design
- *Generally* these dampers are used in acoustical ceilings
- *Generally* substitution is one for one

# Dampers Tested to UL 263

## When can I use them?

In UL floor/ceiling or roof/ceiling designs which were tested with specific ceiling damper models (i.e. proprietary designs)



4. **Damper\*** — (Optional, to be used with Air Duct Item 3) For use with min 18 in. deep trusses. Max nom 21 in. long by 18 in. wide, fabricated from galvanized steel. Plenum box max size nom 21 in. long by 18 in. wide by 14 in. high (inner dimension) fabricated from either galvanized steel or min 1 in. thick Listed Duct Board bearing the UL Listing Marking having a min R-Value of 4.3. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 180 sq in. per 100 sq ft of ceiling area.

**GREENHECK FAN CORP** — Model CRD-1WT

4A. **Damper\*** — (Optional, to be used with Air Duct Item 3) For use with min 18 in. deep trusses. Max nom 12 in. long by 12 in. wide with an 8 in. diameter damper, fabricated from galvanized steel. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 72 sq in. per 100 sq ft of ceiling area.

**GREENHECK FAN CORP** — Model CRD-2WT

# Dampers Tested to UL 263 Cont.

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- Ceiling radiation dampers were tested as part of floor-ceiling or roof-ceiling assembly in accordance with UL 263 or ASTM E119
- Ceiling radiation damper may be used only if specified in the design

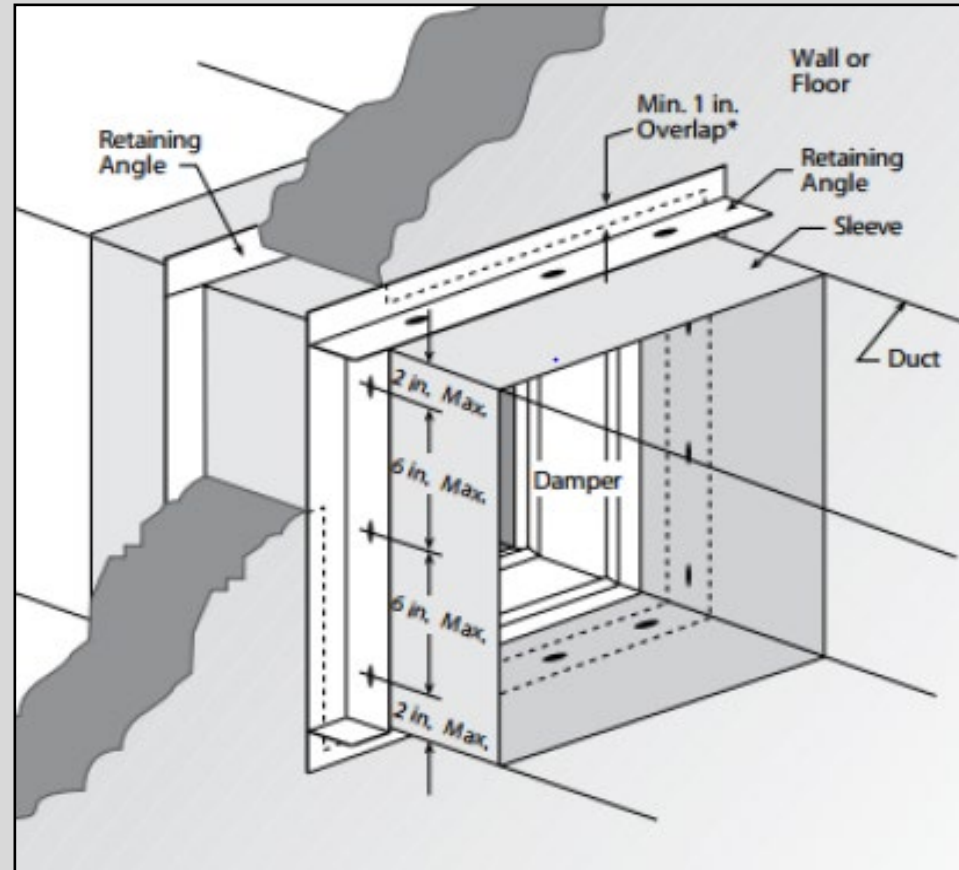
# Dampers Tested to UL 263 Cont.

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- Design will specify manufacturer and designation of the ceiling radiation damper(s) which may be used
- *Generally* these dampers are used in gypsum ceilings



# Damper Installation Considerations



# Installation Standards

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- All three codes reference NFPA 80, Standard for Fire Doors and other Opening Protectives, and NFPA 105, Standard for Smoke Door Assemblies and Other Opening Protectives



# NFPA 80 - Scope

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- This standard regulates the installation and maintenance of assemblies and devices used to protect openings:
  - in walls,
  - in floors,
  - and in ceilings

**“against the spread of fire and smoke”**

# NFPA 80 - Organization

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- 19.1 General
- 19.2 Installation
- 19.3 Operational Tests
- 19.4 Periodic Inspection and Testing
- 19.5 Maintenance

# NFPA 105 - Organization

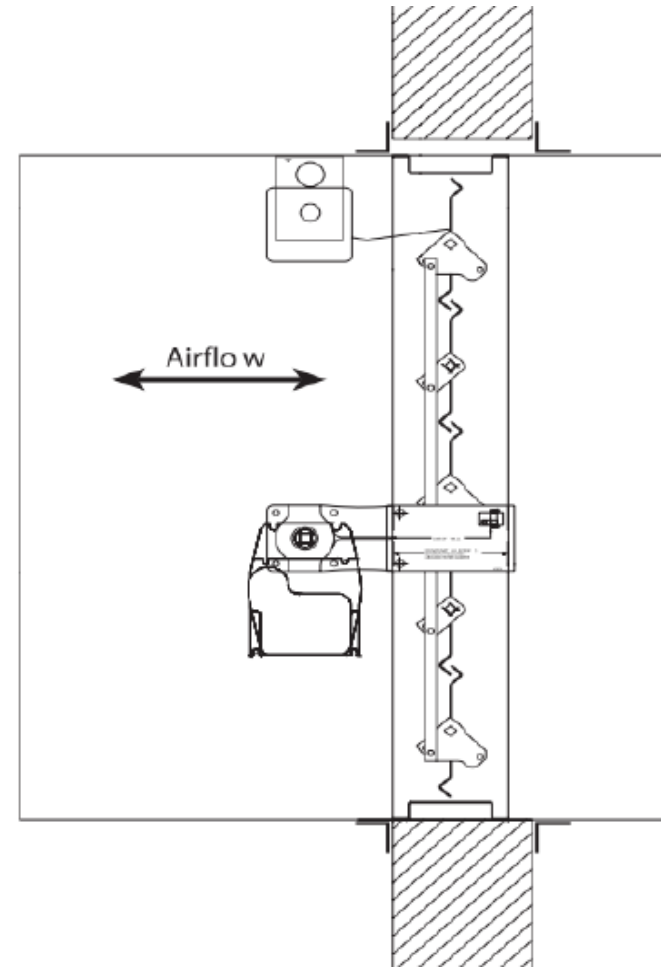
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- 6.1 General
- 6.2 Definitions
- 6.3 Installation
- 6.4 Operational Tests
- 6.5 Periodic Inspection and Testing
- 6.6 Maintenance

# What Makes a Code Compliant Installation?

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- Fire and/or smoke rated barrier
- Correct Listed damper
- Installation in accordance with manufacturer's installation instructions



# What is the Correct Damper? Type

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- Damper Type
  - Fire Damper
  - Smoke Damper
  - Combination Damper
  - Corridor Damper
  - Ceiling Radiation Damper

# What is the Correct Damper? Product Labels

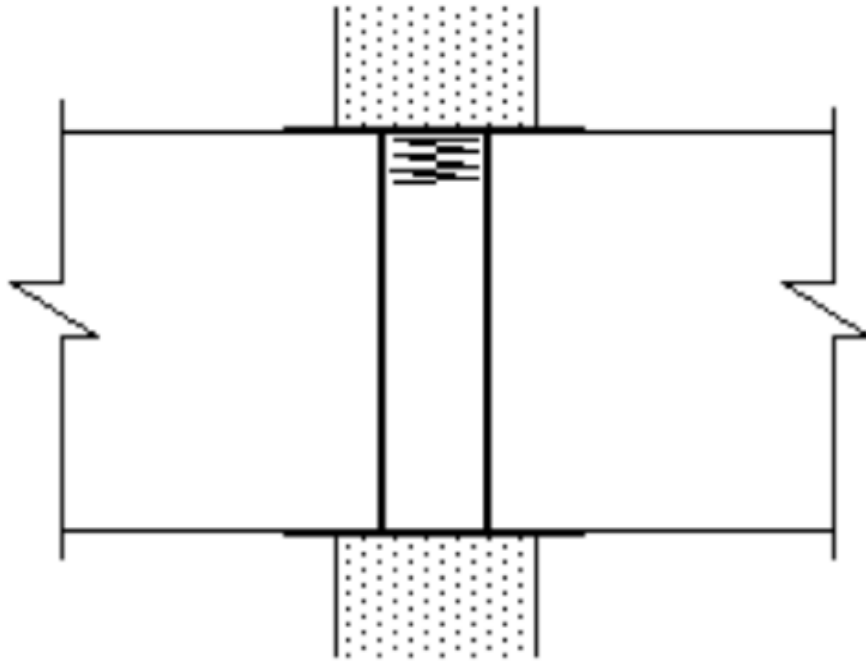




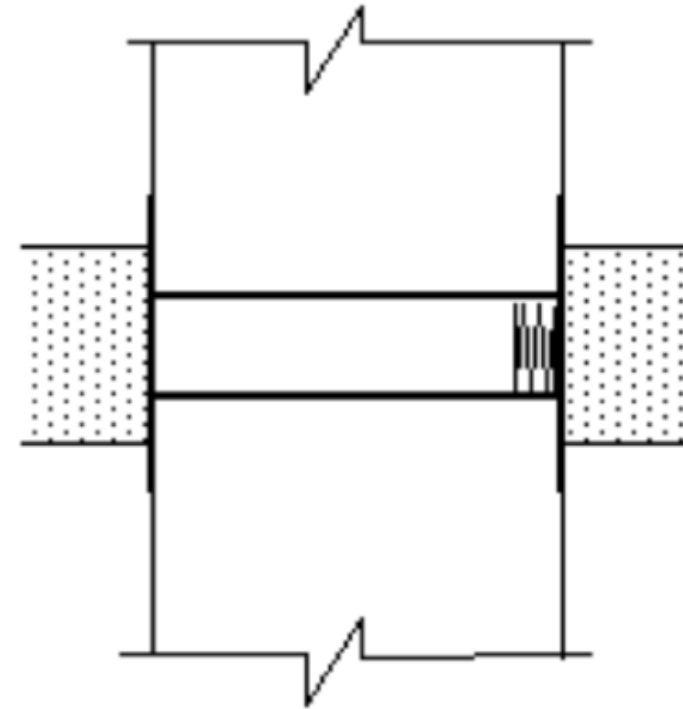
# What is the Correct Damper? Orientation

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## Fire, Smoke and Combination Dampers



Vertical



Horizontal

# What is the Correct Damper?

## Damper Size

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- Listings of fire (static and dynamic), smoke, combination and corridor damper will specify maximum size for a single section and for multiple sections
- Listing of ceiling radiation dampers will specify the maximum size (rectangular or circular) of damper

# What is the Correct Damper?

## Code Compliance Cont.

---

- Static Fire dampers
  - Hourly rating
  - Actuation temperature
    - Approx 50°F (27.8°C) above duct operating temperature, but not less than 160°F (71.1°C) per IBC and NFPA 90A

# What is the Correct Damper?

## Code Compliance Cont.

---

- Dynamic Fire dampers
  - Hourly rating
  - Actuation temperature
    - Approx 50°F above duct operating temperature, but not less than 160°F per IBC and NFPA 90A
  - Listings state maximum air flow and pressure ratings

# What is the Correct Damper?

## Code Compliance Cont.

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- Smoke dampers
  - Leakage rating
    - Class I or II per IBC
    - Elevated temperature rating not less than 250°F (121°C)
  - Actuation conditions
    - Smoke detectors
    - Smoke control system
  - Listings state maximum air flow and pressure ratings

# What is the Correct Damper?

## Code Compliance Cont.

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- Combination dampers
  - In accordance with requirements of dynamic fire and smoke dampers

# What is the Correct Damper?

## Code Compliance Cont.

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- Corridor dampers
  - 1 hr fire rating
  - Leakage rating
    - Class I or II
    - Elevated temperature rating of not less than 250°F (121°C)
  - Must close when subjected to 150 fpm (46 m/min) velocity across the face of the damper during fire exposure

# What is the Correct Damper?

## Code Compliance Cont.

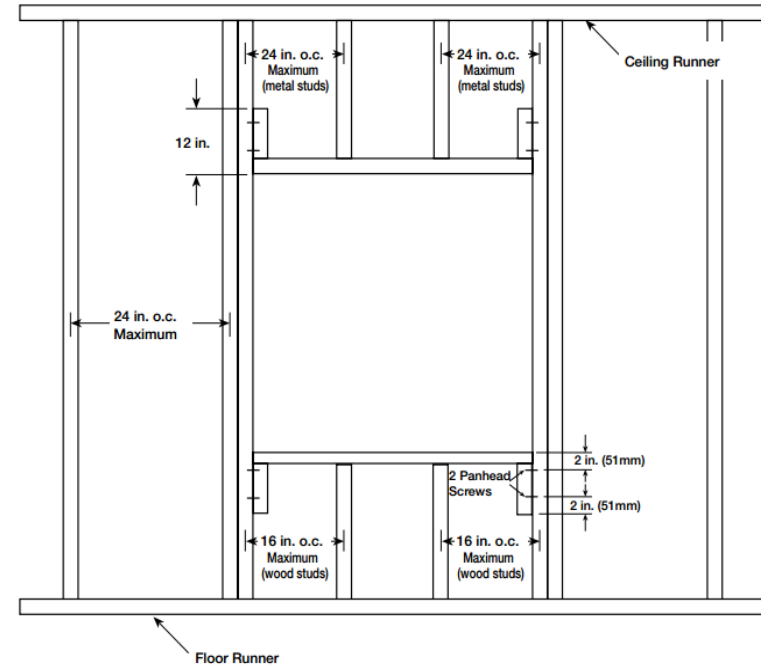
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- Ceiling radiation dampers
  - Hourly rating
  - Actuation temperature
    - 50°F (27.8°C) above duct operating temperature, but not less than 160°F (71.1°C) per IBC and NFPA 90A



# Typical Installation Details Fire and Fire Smoke Dampers

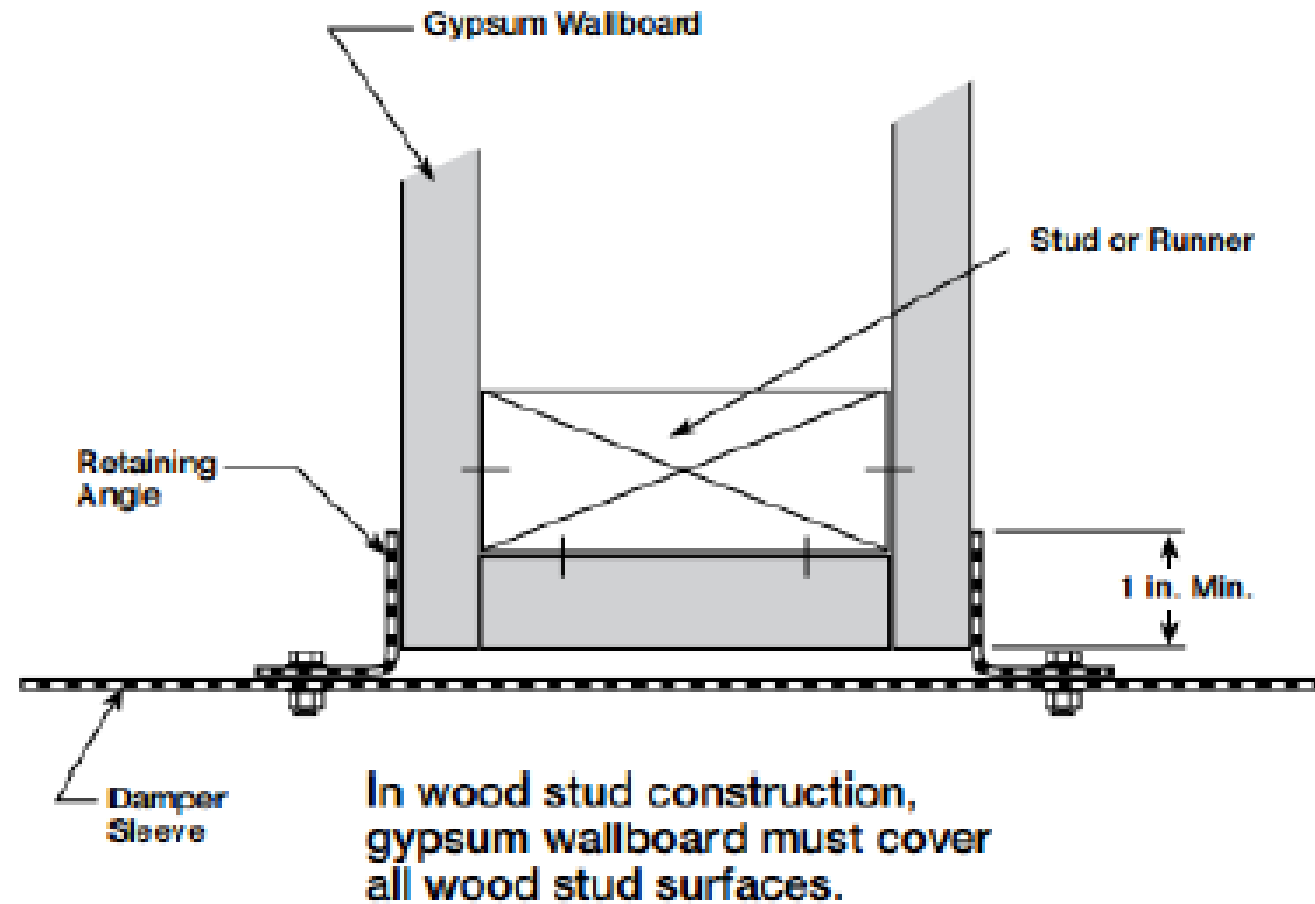
- Opening framing
  - Vertical studs must run floor to ceiling
  - Double vertical studs required for dampers over 36" x 36" (91 x 91 cm)



# Typical Installation Details

## Wood Stud Walls

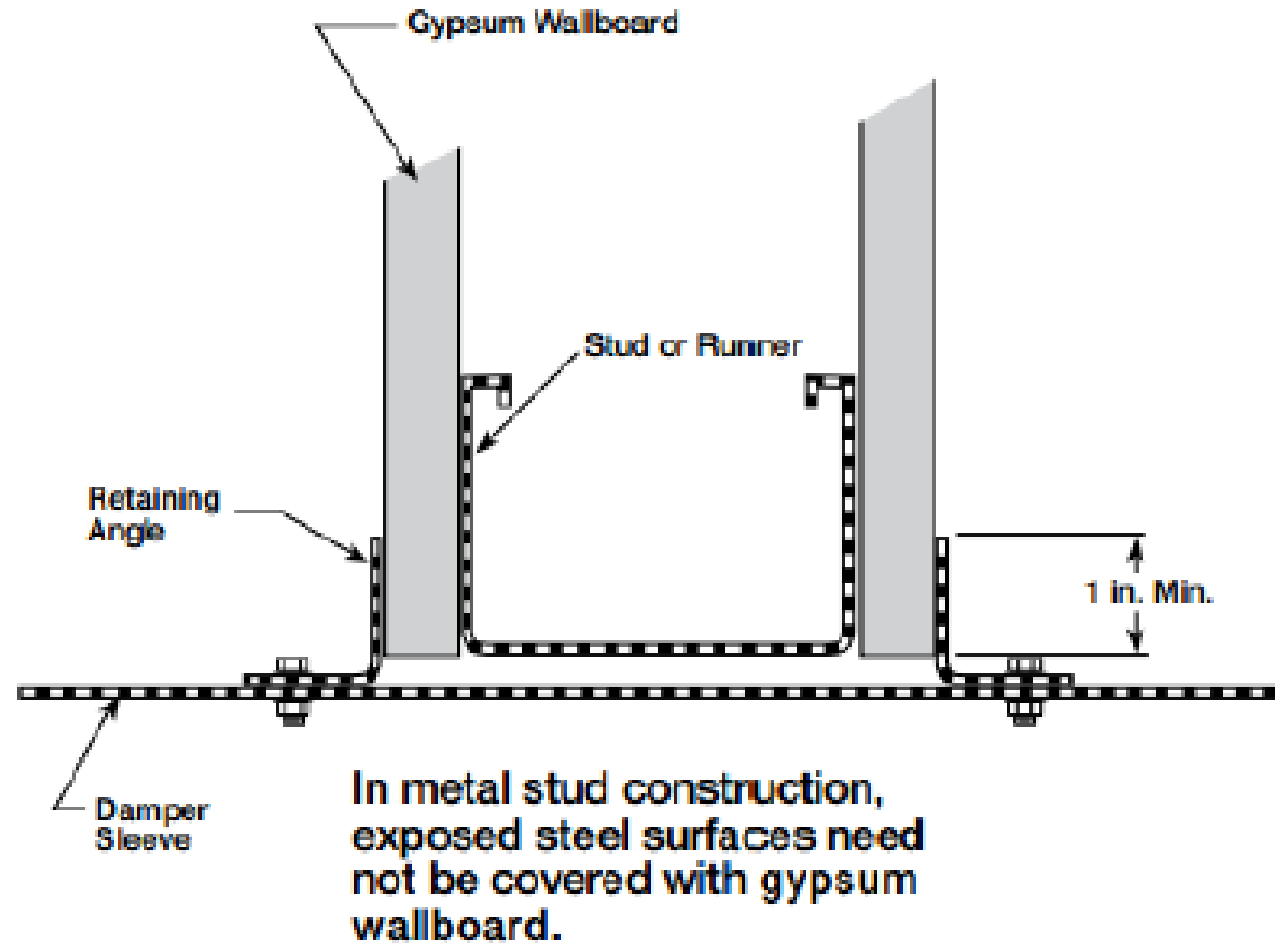
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# Typical Installation Details

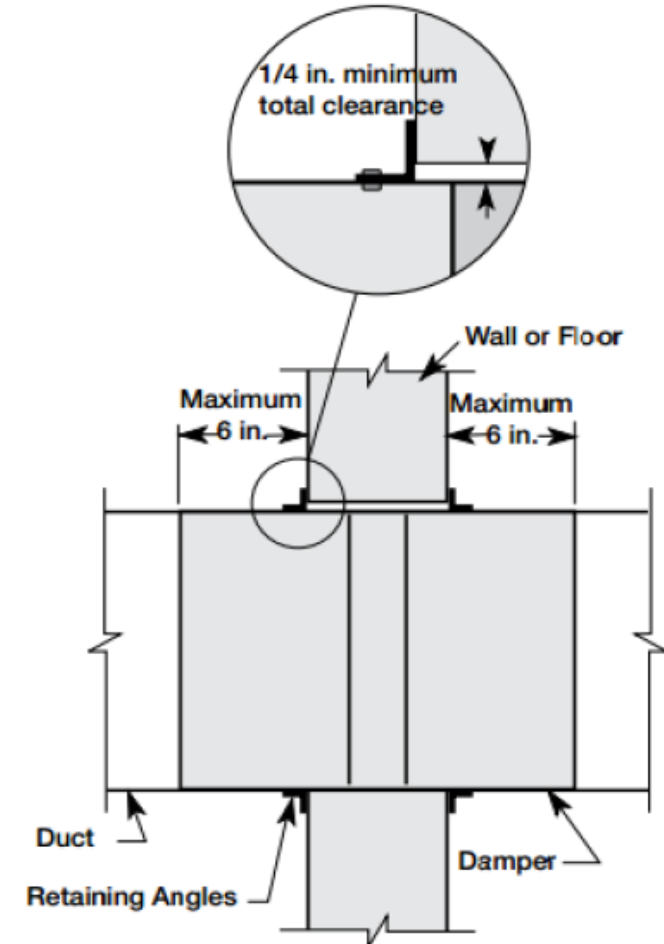
## Steel Stud Walls

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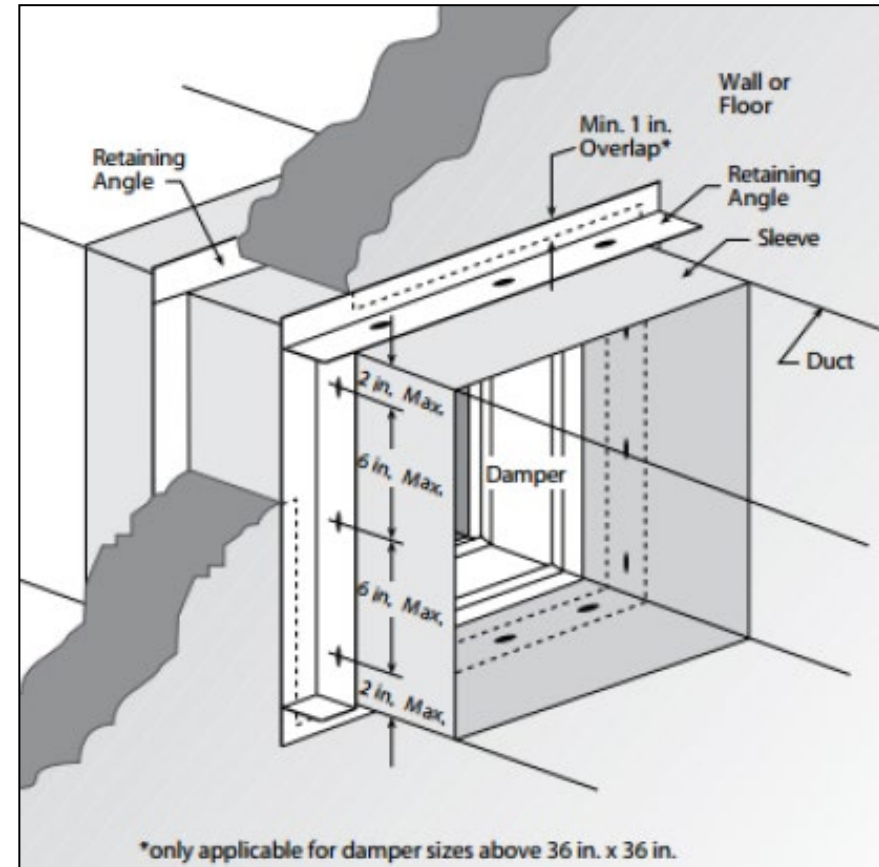
# Traditional Installation

- The centerline of damper must be in plane of wall or floor
- Annular space required to allow room of expansion under fire condition



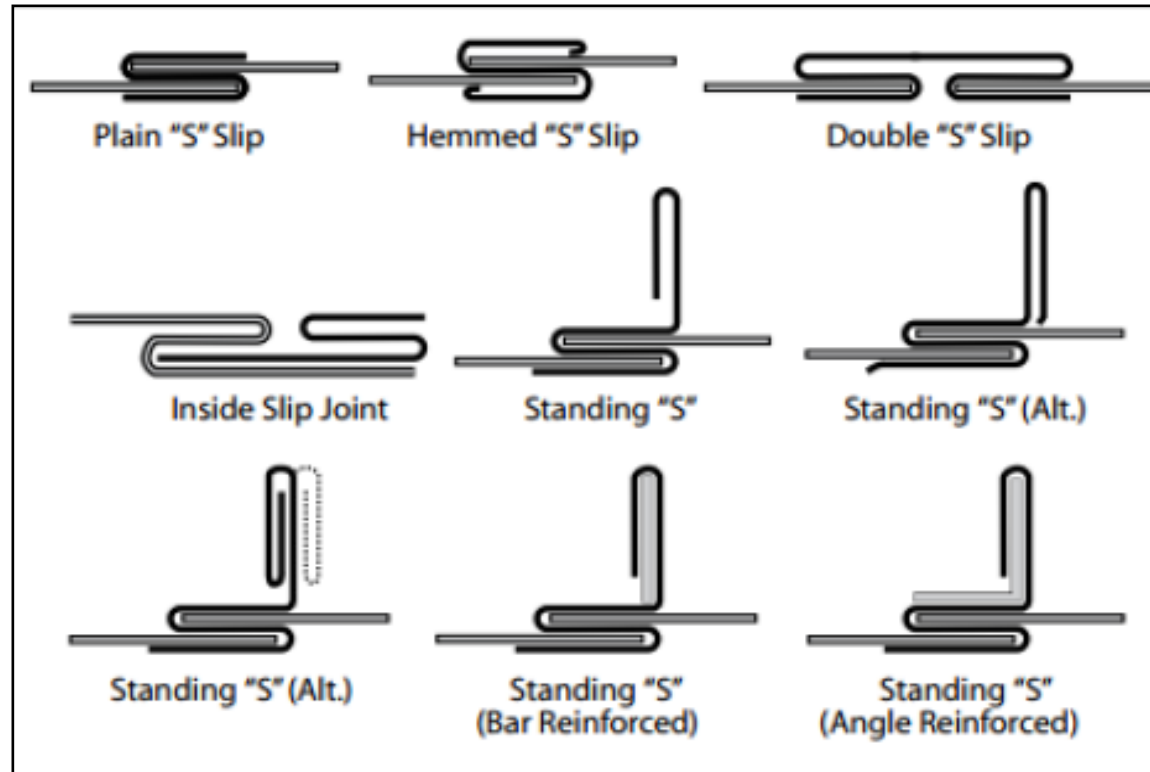
# Traditional Installation Cont.

- Retaining angles
  - Fastened to sleeve
  - Attached 2 in. (5.1 cm) from corners and 6 in. between
  - Overlap 1 in. (2.5 cm) onto barrier
  - Continuous with no gaps
  - No sealants in annular space



# Traditional Installation Cont.

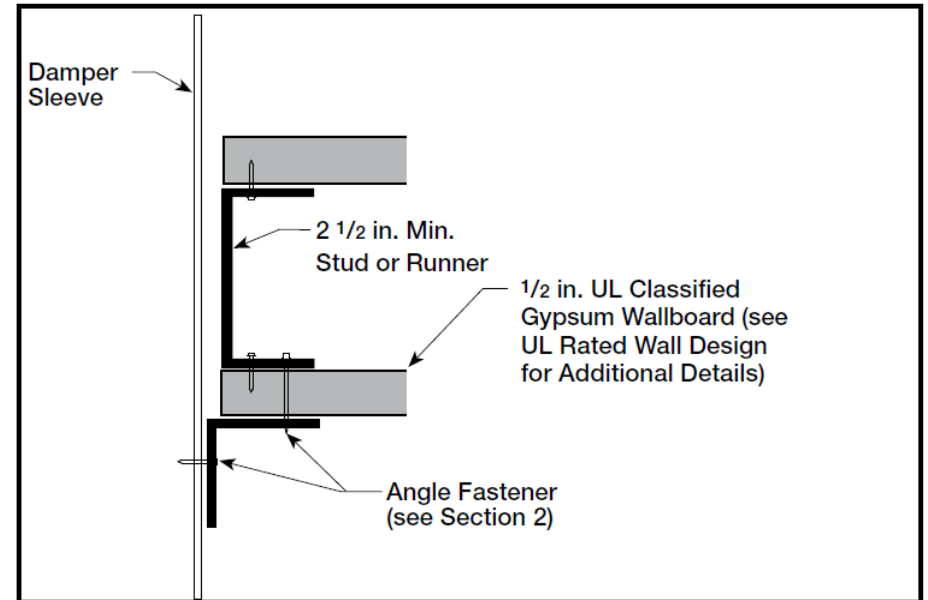
## Break-away duct connections



# Alternate Installations

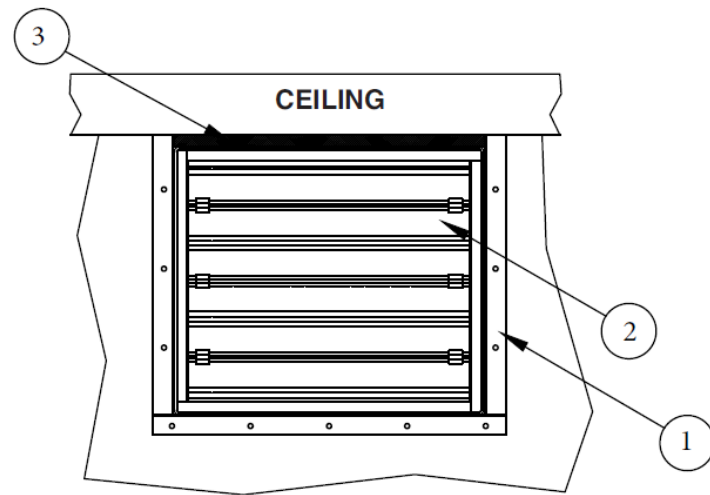
## Single Sided Angles

- No annular space requirements
- Angles must be attached to both the sleeve and the barrier
- Max allowable vertical damper sizes:
  - 80" x 50" (203 x 127 cm)
  - 50" x 80" (127 x 203 cm)
  - 40" x 100" (102 x 254 cm)

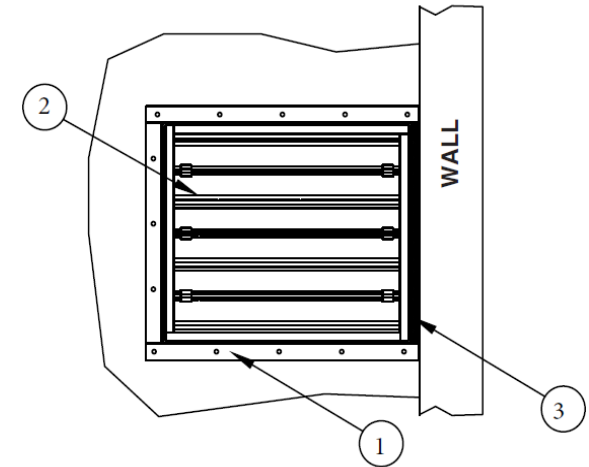
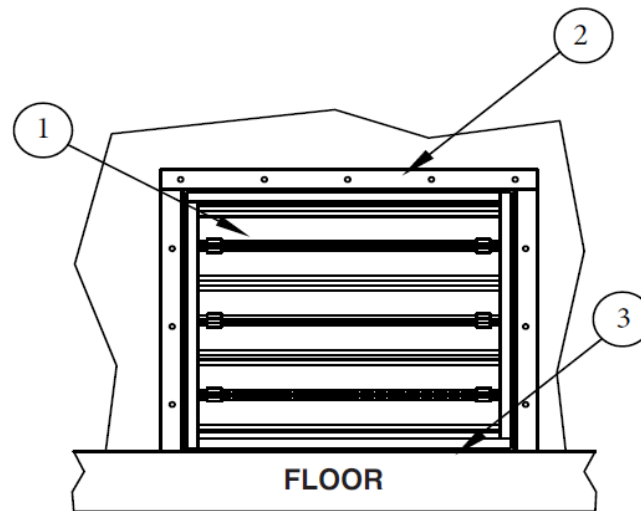


# Alternate Installation Cont. Three Sided Angles

Under ceiling installation.  
Against wall installation.  
On floor installation.



ANGLES BOTTOM AND BOTH SIDES

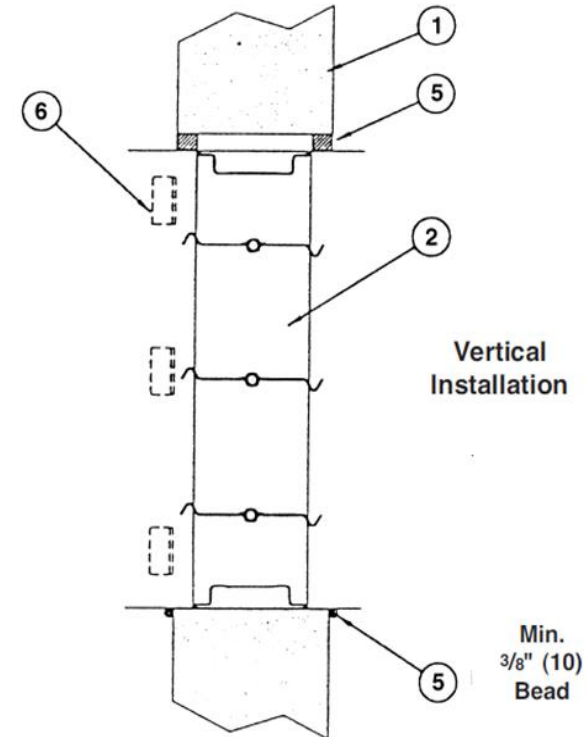
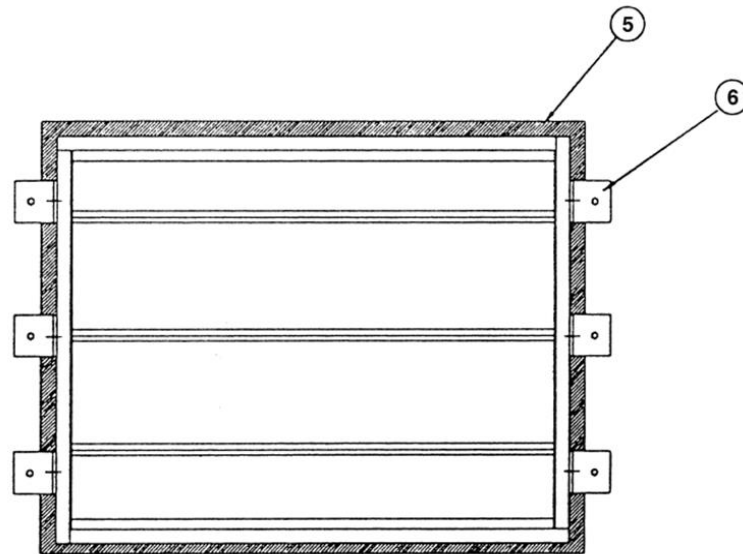


ANGLES TOP, BOTTOM AND ONE SIDE



# Alternate Installation Cont. Firestop Sealant

- Fire, Smoke and Combination Dampers
  - Item 5 – Specific firestop sealant
  - Item 6 – Retaining clips

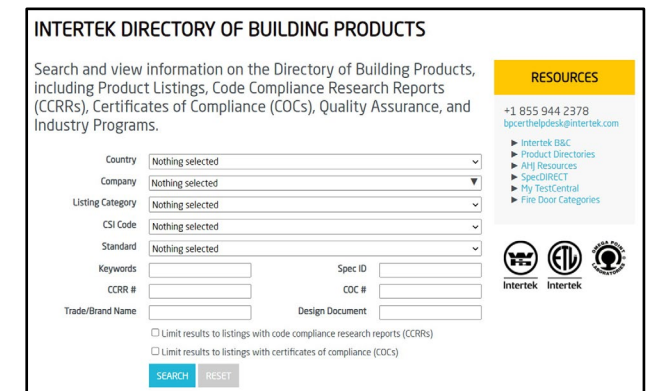
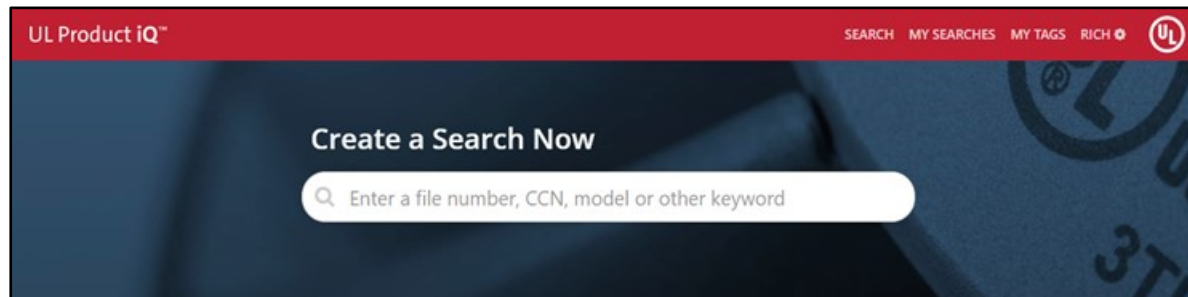


# Available Resources

- Online Directories –
  - FM Approval Guide
  - Intertek Listed Products Directory
  - UL Product iQ Online Directory



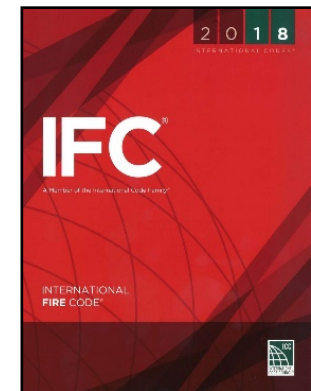
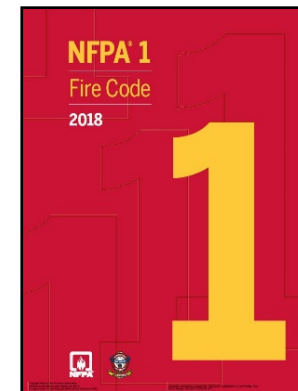
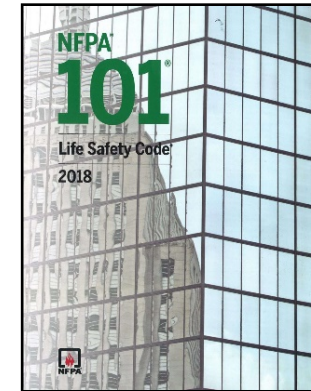
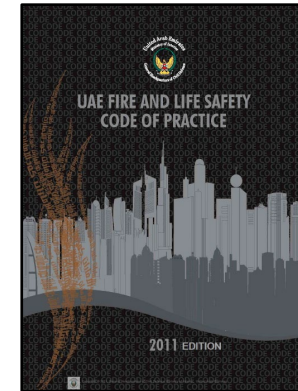
*Systems Selection & Analysis...Not as easy as it looks...*



# Fire Codes Require Maintenance

- UAE Fire & Life Safety Code
- NFPA 101
- NFPA 1
- International Fire Code
- International Property Maintenance Code

- Minimum Requirements Stated
- Frequency
- **What really happens?**



# Periodic Testing Requirements

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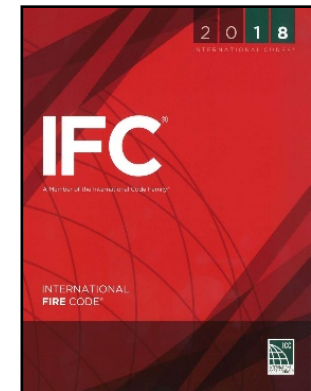
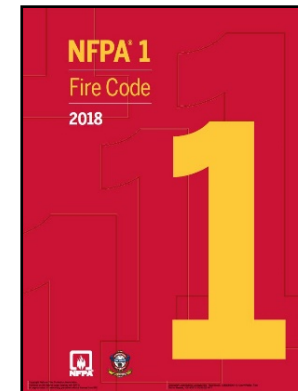
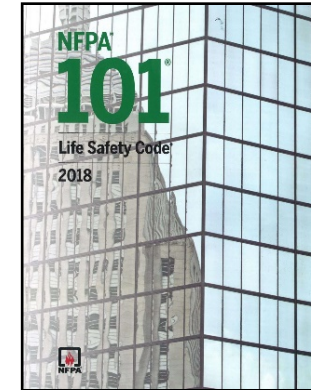
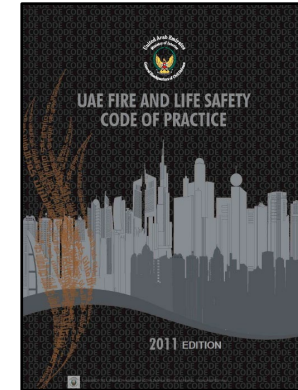
**UAE Fire & Life Safety Code, International Fire Code (IFC), NFPA 101 and NFPA 1 all require dampers be maintained**

## Fire Dampers

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

## Smoke Dampers

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



# Periodic Testing Requirements

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## **NFPA 80**

Standard for Fire Doors and Other Opening Protectives

## **NFPA 105**

Standard for 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”



# Periodic Testing Requirements

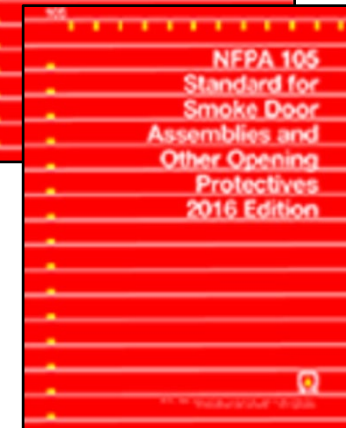
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## NFPA 80 & 105

### Test Method

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

“At the completion of the test, the damper shall be returned to the fully open position, and it shall be verified that the damper is unobstructed and in a fully operational mode.”



# Periodic Testing Requirements

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## NFPA 80 – Fire Dampers with Fusible Links

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

## NFPA 80 & 105 – Smoke & Combination Fire Smoke

- Traditional test method requires visual confirmation of damper operation.
- Remove power from actuator and allow spring return mechanism to close damper, verify complete closure, reapply power to reopen damper, verify damper is unobstructed and fully open.
- 2019 editions of NFPA standards now allow for remote testing
  - Damper position indication (OCI or actuator end switch) can provide confirmation of damper operation





# Periodic Testing Requirements

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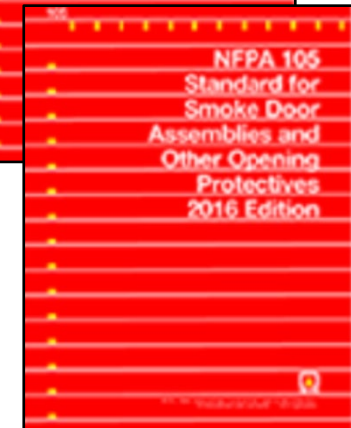
## Changes to the 2019 Editions of NFPA 80 & 105

Periodic Testing for Dampers That Do Not Use a Fusible Link to Operate

### Remote Inspection Method

Requirements for Utilizing the Remote Inspection Method:

1. Shall positively indicate a dampers fully-open and fully-closed position
2. The initial inspection shall include a visual inspection of the damper in accordance with 19.5.2.3.2
3. The visual inspection shall confirm that the position indication method accurately reflects the full-open and fully-closed position of the damper





# Periodic Testing Requirements

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## Changes to the 2019 Editions of NFPA 80 & 105

Periodic Testing for Dampers That Do Not Use a Fusible Link to Operate

### Remote Inspection Method

#### Remote Test Procedure

1. Use the position indication functionality to confirm that the damper is in its intended normal position (typically open)
2. Command the damper to the position opposite its normal position (typically closed). Use the position indication device to confirm that the damper has moved reached that position
3. Command the damper back to its original position and use the position indication device to confirm that it has reached that position
4. If the damper fails to comply with steps 1 thru 3 a visual inspection must be conducted



# Questions??



# Thanks for Attending!!!

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