Fire & Smoke Rated Damper and Diffuser Products

Manitoba Building Officials

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Fire & Smoke Rated Dampers

1. Product Descriptions
   - Fire Dampers
   - Smoke Dampers
   - Combined Fire & Smoke Dampers
   - Ceiling Radiation Dampers
   - Fire Rated Diffusers (“Fire Rated Air Terminals”)
2. Installation
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Fire & Smoke Rated Dampers
Product Descriptions

Product Descriptions
Fire Dampers

- Device used to protect ductwork and air transfer openings in fire rated partitions
- Tested to UL 555 (US) or ULC S112 (Canada)
- In-plane dampers are most common
  - Damper blades are in the plane of the partition when closed – frame does not need to be entirely in plane
- Out-of-wall dampers
  - Dampers designed for use where the damper needs to be offset from the wall plane
- No generic listings are available for wood joist floors

Product Descriptions

Fire Dampers

- 1½ and 3 hour fire ratings are the most common
- The rating of the separation may allow a damper of lower hourly rating to be used:

Fire-Resistance Rating of Fire Separation	Required Fire-Protection Rating of Closure
45 minutes	45 minutes
1 hour	45 minutes
1½ hours	1 hour
2 hours	1½ hours
3 hours	2 hours
4 hours	3 hours

National Building Code of Canada, Table 3.1.8.A
Always refer to local codes, as applicable

Product Descriptions

Fire Dampers

- Static system = Fans shut down in a fire event
- Dynamic system = Fans continue to operate

- Dynamic dampers, therefore have been designed and tested to close under flow
- Dynamic dampers are generally rated for flows of 2000 fpm and static pressure of 4 in.w.g.

Product Descriptions
Fire Dampers

- Dynamic closure test – consider:
  - 72”x48” damper, made in 2 sections
    - Both sections open – 55,000 cfm (2290 fpm)
    - 1 section open – 49,300 cfm (4100 fpm)
  - 72”x48” damper, made in 4 sections
    - All sections open – 55,000 cfm (2290 fpm)
    - 1 section open – 30,340 cfm (5060 fpm)
- This is why dynamic damper size limits are absolute – cannot put together multiple dampers in the field with oversize mullions to get larger overall sizes, as flow rates exceed certifications

Product Descriptions

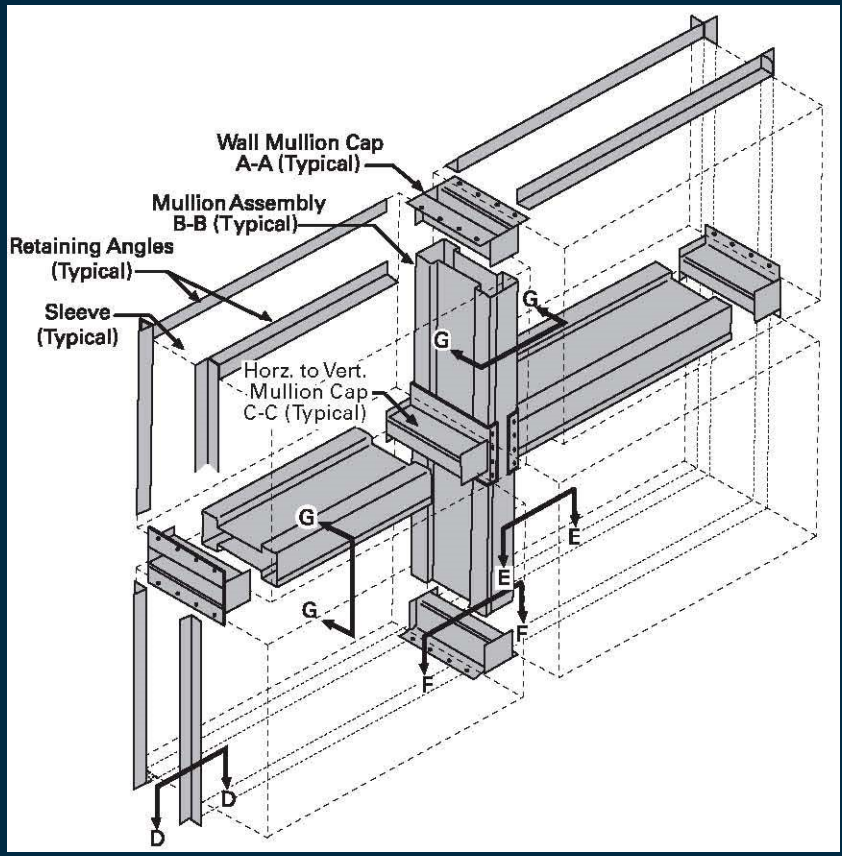
Fire Dampers

- Dampers larger than the maximum listed size may be accomplished with oversized mullions ("AMCA Mullions"), but

  ONLY if the system is a static system

- May be used on

  Fire / Smoke dampers, but also only if in a static system



Product Descriptions

Smoke Dampers

- Damper rated for leakage at elevated temperature (250°F or 350°F)
- Protects openings in smoke barriers, or in engineered smoke control systems
- Tested to UL 555S (US) or ULC S112.1 (Canada), leakage classifications are:
  - Class I – rated for 8 cfm / ft^2 at 4 in.w.g.
  - Class II – rated for 20 cfm / ft^2 at 4 in.w.g.
  - Class III – rated for 80 cfm / ft^2 at 4 in.w.g.

Product Descriptions

Combined Fire & Smoke Dampers

- Meets the listing requirements for both fire dampers and smoke dampers
- ALL combined fire & smoke dampers are dynamic rated (listing requirment)
- May also be used in static systems

Product Descriptions

Damper Actuators

- Fire damper release mechanisms:
  - Fusible link – melts and releases a closure spring
    - Used on all curtain style dampers
    - May be used on multiblade dampers, but size limited
    - Closure is very rapid
  - Disc thermostat – switch cuts power to actuator, internal spring drives actuator to close damper
    - Actuators must failsafe to closed
  - Combination fusible link and electric actuator
    - Actuator may failsafe to open, as fusible link will allow closure if elevated temperatures are reached
    - Size limitations as with fusible links on multiblade dampers
  - Pneumatic actuators – fusible valves, switches, etc.

Product Descriptions

Damper Actuators

- Smoke dampers:
  - Always driven by actuators
  - Failsafe to open or closed, as required by system design – operation signal is from building controls
- Combined fire & smoke dampers:
  - Always driven by actuators
  - Contain thermal response device - will close in response to temperature rise, will operate as signalled by building controls up to that point

Product Descriptions

Ceiling Radiation Dampers

- Act as a heat barrier in membrane ceilings of specific floor / ceiling designs
- Tested to UL 555C (US) or ULC S112.2 and / or ULC S101 (Canada)
- Listed as “ceiling firestop flaps” in Canada

Product Descriptions

Fire Rated Diffusers

- Designed for use with acoustical ceilings but independently supported
- Tested to UL 263 (US) or ULC S101 (Canada)
- Also may be listed under “Fire Rated Air Terminal Units” in UL listings
- Not permissible to use plaster frames to mount in drywall ceilings
- Some models use ceiling radiation dampers as components, but this does not mean the assembly is listed as a ceiling damper

Product Descriptions

UL Listing Information

- For the UL listing to be valid:
  - Product is tested, listed, and labelled as complying with the appropriate standard
  - Used in a design as described by the UL listing
  - Installed according to the installation instructions
- The damper being labelled on its own does not make the damper compliant

Fire & Smoke Rated Dampers Installation Guidelines

Installation Guidelines

General Notes

- This section primarily applies to fire dampers and combined fire & smoke dampers
- For smoke dampers and ceiling dampers see relevant installation instructions
- Always consult the installation instructions specific to the manufacturer and model being used

Installation Guidelines

Opening Preparation

- In-plane dampers – blades are within the wall plane when the damper is closed
- Opening size:
  - Height and width are larger than sleeved damper by ⅛” per linear foot (¼” minimum, 1½” maximum)
  - With no angles installation, maximum is ½”
  - Clearance does not need to be evenly distributed, damper may be shifted to one side of opening – the important thing is that there is room for thermal expansion

Installation Guidelines

Opening Preparation

- Drywall construction is permissible for vertical installation only (walls)
- Note that wood stud walls require drywall facing on inner surface, metal studs do not

Fig. 1: Metal Stud/Gypsum Wall Design

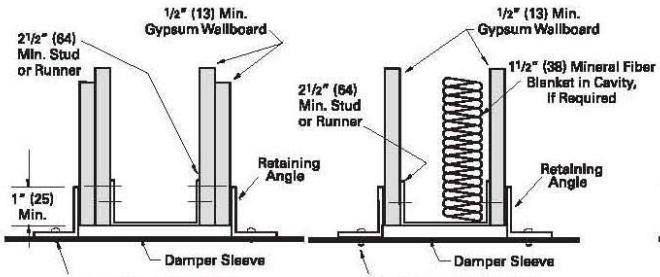


Fig. 2: Wood Stud/Gypsum Wall Design

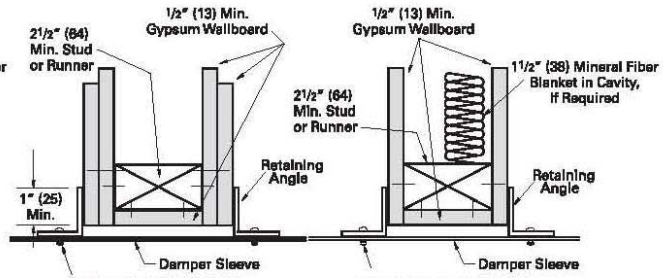
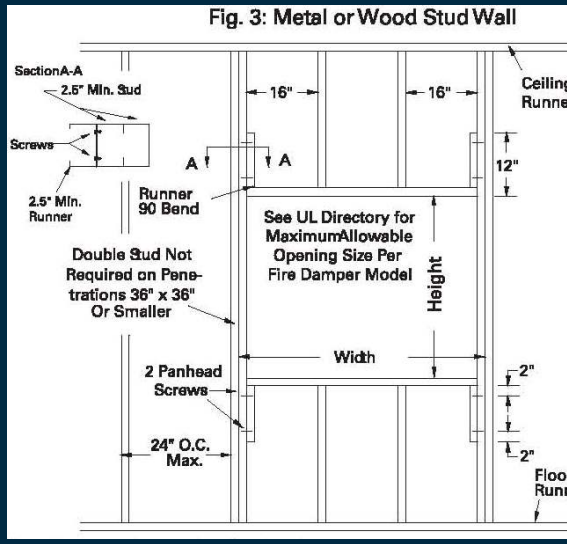
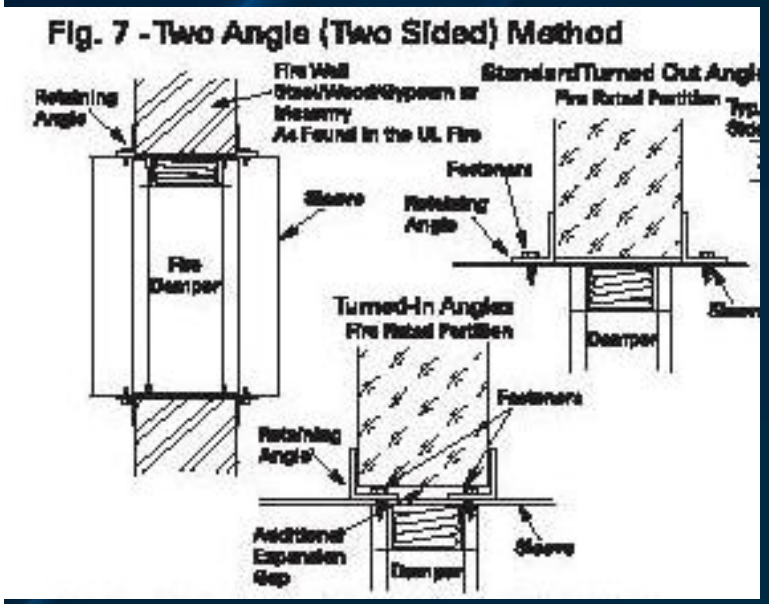


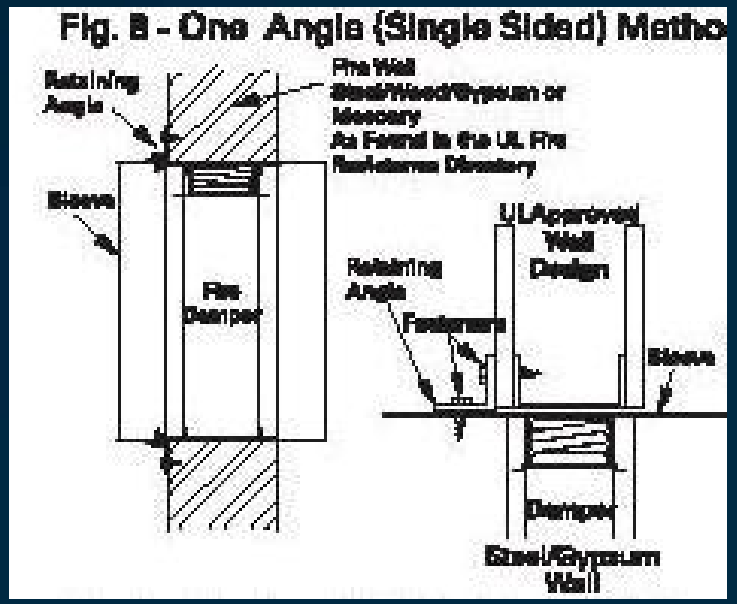
Fig. 3: Metal or Wood Stud Wall

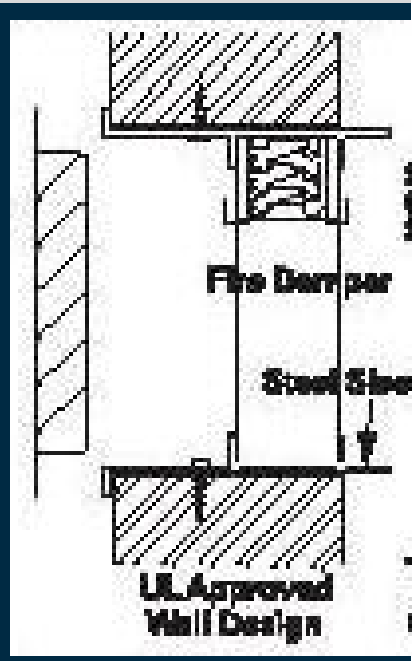


Installation Guidelines

Mounting Methods





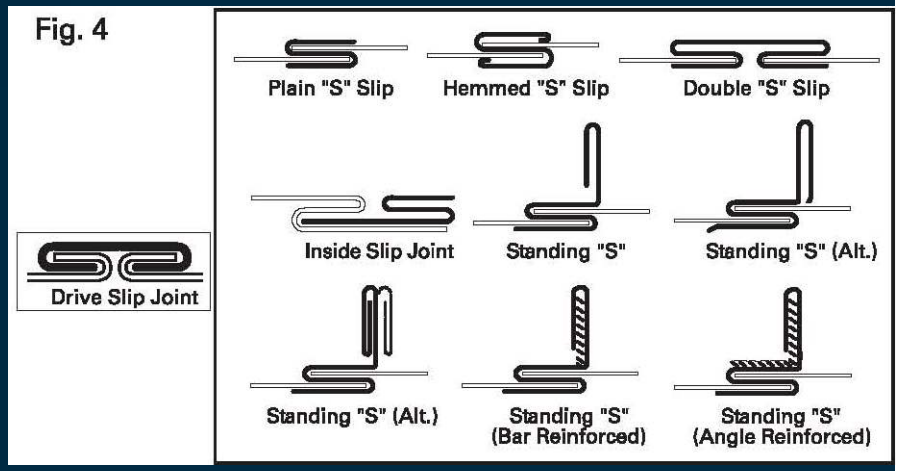


- Note that instructions contain limitations on fire rating, construction type, and mounting orientation
- Two Angle Method is the most common, and most versatile

Installation Guidelines

Sleeves

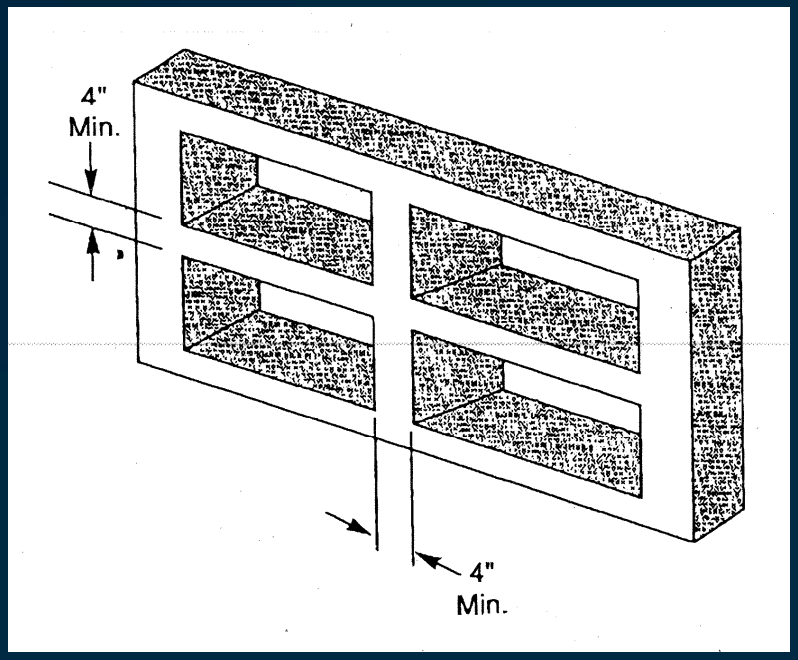
- Sleeve gauges – see instructions
- Breakaway connections
  - For round or oval ducts
    use sheet metal screws
    per instructions
  - Duct sealant may be
    applied to breakaway joints in accordance with SMACNA recommendations
- Install dampers square and free of racking
- Actuators must be operable and accessible



Installation Guidelines

Openings for Multiple Dampers

- How much space is needed between two fire damper openings?



SMACNA Fire Damper Guide, Figure 3-2

Installation Guidelines

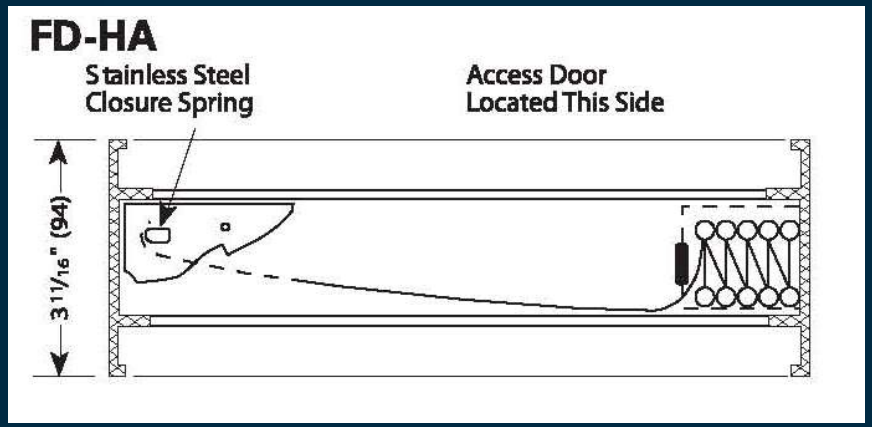
General Information

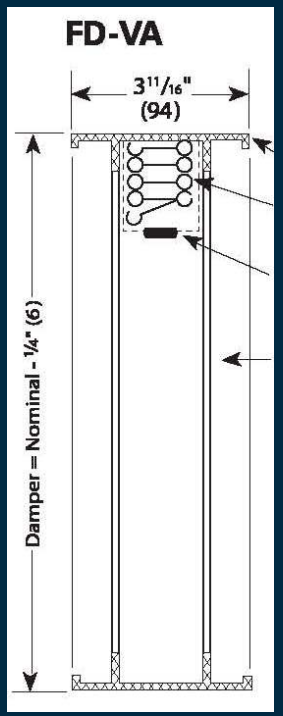
- Expansion gap around the damper is not to be filled with other materials, including mineral wool, ceramic fibre, or sealants
- Screws or fasteners must not interfere with damper operation (not to be located in the blade track, etc.)
- Insulation, wiring, or other obstructions must not pass through the damper
- Additional sealants are not required by UL

Installation Guidelines

General Information

- Damper orientation is marked on the damper – install as marked to maintain UL rating
- Access door on top side of horizontal dampers, to allow damper to be reset
- Ceiling dampers are horizontal mount only





Installation Guidelines

General Information

- Treat the damper installation with respect – not reverence or indifference. A significant number of field problems are due to either completely ignoring the instructions or trying to apply requirements that aren't in the instructions. For best results follow the middle path.
- Tolerances are not marked on instructions nor stated in UL requirements, and may vary depending on construction type, etc. In most cases 1/16" is reasonable, but judgement is needed

Fire & Smoke Rated Dampers
Example Installations

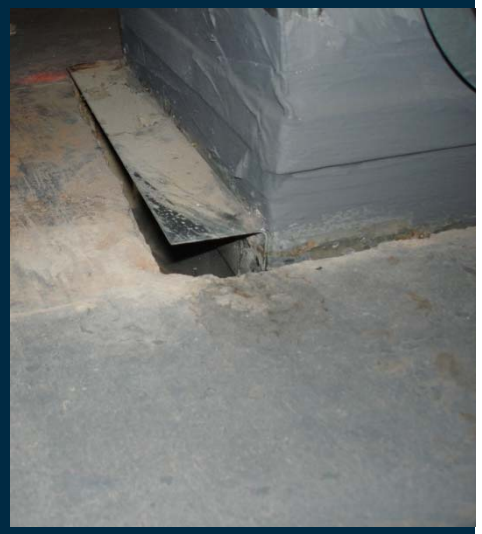
Example Installations

Opening Clearances

- Opening with incorrect shape and clearances
- Damper is not mounted within the floor plane
- No mounting angles
- No breakaway joints

Example Installations

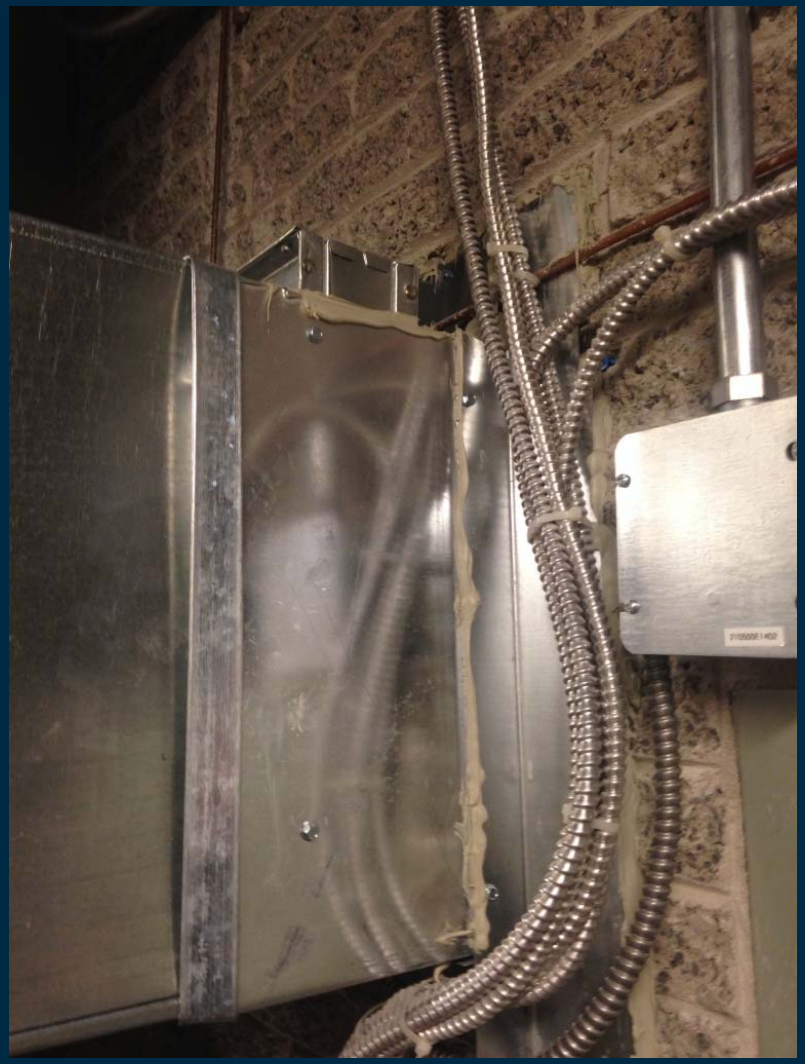
Mounting Methods



- Mounting angles not on all 4 sides
- Dampers not mounted in the floor plane
- Excessive opening clearances
- Angles do not overlap the openings

Example Installations
Mounting Methods

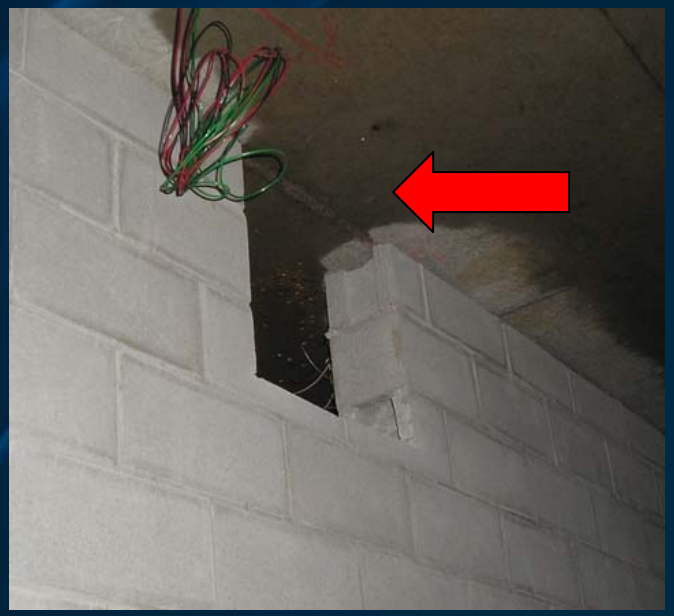
- Dampers not mounted in the wall plane



Example Installations
Mounting Methods

- Improper opening / clearances
- Mounting angle missing from one side
- Damper is out-of-plane (not visible)

Example Installations
Mounting Angles



- Cannot install mounting angles on top of damper using standard method

Example Installations

Opening Preparation

- Each damper should be installed in a separate opening

Example Installations

Opening Preparation

- Sheet metal filler strip between dampers. Each damper should be installed in a separate opening.

Example Installations

Sealants & Expansion Clearances

- Sealant applied in the expansion gap around the damper
- Intumescing sealants expand under elevated temperature, further undermining the intent of the expansion gap

Example Installations

Opening Preparation

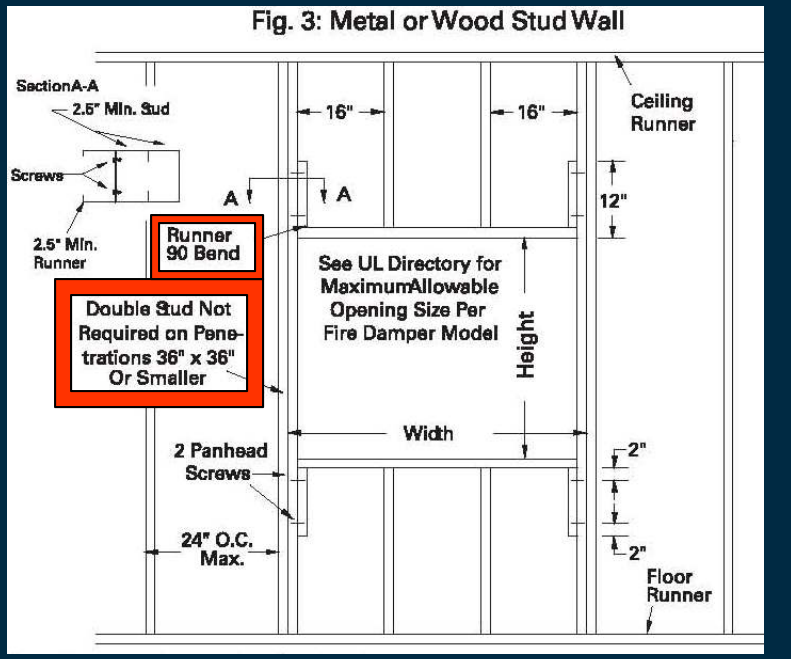
- Too much clearance in the annular space around the damper

Example Installations

Wall Construction

- Mixed masonry / drywall construction. Damper is rated for both, so this shouldn't be a problem

Example Installations
Drywall Framing



- Instructions show 1 stud and a runner
- Actual installation uses 2 studs. This shouldn't be an issue.

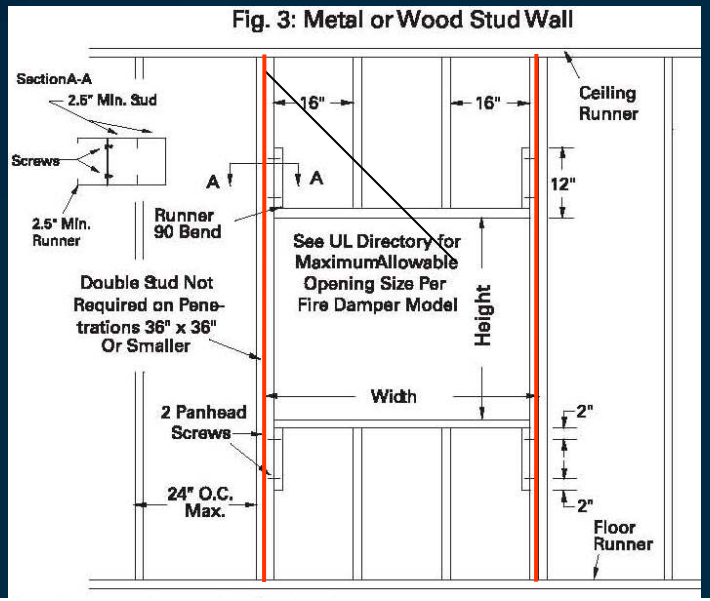
Example Installations

Fastener Interference

- Screw driven through blade track – would prevent the damper closing

Example Installations
Drywall Framing

- Vertical framing on each side of the opening is missing – damper is not properly supported



Example Installations
Drywall Framing

- No framing around the damper at all

Example Installations
Obstructions

- Watch out for obstructions being added in the ductwork which would prevent proper damper functioning
  - Especially common during renovations – electrical or network wiring, cable trays, piping, etc.
- Also don’t overlook external obstructions to actuators, access doors, etc.

Example Installations
Floor Level Dampers

- Opening at left does not allow retaining angles
- Dampers at floor level – may wish to protect dampers from damage (grilles)

Example Installations

Security Bars

- Sleeve gauge is within installation instruction requirements, but barrier bars are not specifically shown

Example Installations

General Notes

- Installation of *fire* dampers by attaching directly to grilles is sometimes requested, with the damper only being fastened to the grille (for ceiling dampers – see installation instructions)
- Such installations are not approved. This is especially dangerous on aluminum grilles (Fire test – 1300°C. Aluminum melts at ~660°C)
- The installation instructions – which require a sleeve and mounting angles – should be followed (note – for VCS4 installation instructions see submittal 222073)

Example Installations
VCS4 damper

- Poor inspection and maintenance – badly corroded and an incorrect replacement link used
- Attached directly to an aluminum grille - not an acceptable installation
- Damper has been damaged – open, despite link being loose

Example Installations
Thermal Blanket

- SCD-FR fire rated diffuser
- The ridge in the blanket is acceptable – does not need to be tight to the t-bar (purpose is to stop radiant heat)

Example Installations
Fusible Links

- Fusible link release can be caused by:
  - Elevated temperatures during shipping, or on site prior to system start-up
  - May also be experienced during daily start-up, or during changes in operating conditions

Temperature Rating	Maximum Ambient Temp.
125°F - 130°F	90°F
135°F - 170°F	100°F
175°F - 225°F	150°F
250°F - 300°F	225°F
325°F - 375°F	300°F

UL33 Table 6.1 and ULC S505 Table 1

Example Installations
Fusible Links

- National Building Code, section 3.1.8.9

  (3) Heat-actuated devices “shall have a temperature rating approximately 30°C above the maximum temperature that would exist in the system either in operation or shut down”
- Normally this would mean 165°F (74°C) fusible links, sometimes 212°F (100°C)

Fire & Smoke Rated Dampers Questions

Questions
Frequently Asked Questions

- Can I convert a static to a dynamic dampers?
  - Frames and blades are generally similar, but use different springs, locks, blade reinforcement, and other construction details, as well as overall and section size limitations are different
  - Static curtain damper cannot be retrofitted to dynamic
- What are the construction differences between 1½ hour and 3 hour rated dampers?
  - Overall and section size limitations, some minimum construction requirements

Questions

- Engineering support: louversdampers@priceindustries.com

References & Resources

- Price Industries literature:
  - Dampers catalog (available to download from sales office webpage)
  - Installation instructions (included in the catalog)
- National and local building codes
- SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
- Air Movement and Control Association (AMCA)
  - Standard 500D – Laboratory Methods of Testing Dampers for Rating
  - Publication 503 – Fire, Ceiling (Radiation), Smoke and Fire/Smoke Dampers Application Manual

References & Resources

- UL / ULC Standards
  - UL 555 (US) and ULC S112 (Canada) – Fire Dampers
  - UL 555S (US) and ULC S112.1 (Canada) – Smoke Dampers
  - UL 555C (US) – Ceiling Radiation Dampers and ULC 263 (Canada) – Ceiling Firestop Flaps
  - UL 33 (US) and ULC S505 (Canada) – Fusible Links

References & Resources

- UL Fire Resistance Guide & Online Certification Listings
- Article on control of Fire & Smoke Dampers http://hpac.com/fire-smoke/fire_smokedamper_control/
- Firestopping information and training video http://www.ul.com/global/eng/pages/offerings/industries/buildingmaterials/fire/resistance/firestop/
- International Firestop Council http://www.firestop.org