

Application

The FSD-141 combination fire smoke damper employs triple-V blades for point-of-origin control of fire and smoke in static and dynamic smoke management systems. The FSD-141 is qualified to 2,000 ft/min (10.2 m/s) and 4 in.wg. (1.0 kPa) and may be installed in vertical walls or partitions, or horizontally in floors or assemblies with fire resistance ratings up to 2 hours.

Standard Construction

Frame: 5" x 1" (127 x 25) galvanized steel hat channel with interlocking corner gusset. Equivalent to 13 gauge (2.4) channel frame. Low profile head and sill are used on sizes less than 13" (330) high.

Blades: 6" x 16 gauge (152 x 1.6) galvanized steel — triple-V.

Sleeve: 16" x 20 gauge (406 x 1.0) galvanized steel.

Axles: ½" (13) diameter plated steel hex.

Linkage: Concealed in frame.

Bearings: Stainless steel oilite, sleeve-type.

Seals: Silicone blade edge seals and flexible metal jamb seals.

Actuator: 120 VAC, power-open, spring-close, external mount.

Fire Closure Device: HS-10 (electric actuators)
PFV (pneumatic actuators)

Fire Closure Temperature: 165°F (75°C).

Minimum Size: 6" x 6" (152 x 152)

Maximum Size: Single section: 36" x 48" (914 x 1219)
Vertical mount: 144" x 96" (3658 x 2438)
Horizontal mount: 108" x 48" (2743 x 1219)

Options

- Alternate actuator:
 - Internal mount (actuator in air-stream).
 - 24 VAC 230 VAC Pneumatic
- DRS-30 — Two temperature fire closure device.
- PI-50 — Dual position indicator switch package.
- Alternate factory installed sleeve:
 - Gauge: 18 (1.3) 16 (1.6) 14 (2.0) 10 (3.4)
 - Length: 20" (508) 24" (610) Other _____
 - Side Plate No Sleeve (Actuator must be internally mounted)
- Transitions: Flanged
 - Round Oval
 - Duct connections: 1" (25) S-clip 1½" (38) S-clip
 - DM25 DM35 S & Drive Ward
- Retaining angle systems:
 - Gauge: 20 (1.0) 16 (1.6)
 - Picture frame: SSPF (single-side) DSPF (2-sided)
 - Individual angle sets: SS (single-side) DS (2-sided)
- Alternate fire closure temperature:
 - 212°F (100°C) 250°F (121°C)
 - 286°F (141°C) 350°F (177°C).
- Duct smoke detector factory mounted and wired:
 - DH-100 (100-3,000 fpm [2.0-15.2 m/s])
 - 2151 (0-3,000 fpm [0-15.2 m/s])
- Duct access door factory mounted in common sleeve.
- Remote control stations:
 - RCP-1 (single) RCP-1K (single, key controlled)
- Generic mullion for oversized masonry or concrete wall openings.

Ratings

UL 555 Fire Resistance Rating: 1½ hour (vertical and horizontal)

UL 555S Leakage Class: 1 [8 cfm/sq.ft. @ 4 in.wg.]
[(0.04 m³/s/m² @ 1.0 kPa)]

UL HNLJ.V-5: Ventilation Duct Assemblies

Maximum Dynamic Closure Velocity: 2,000 fpm (10.2 m/s)

Maximum UL555S Rated Pressure: 4 in.wg. (1.0 kPa)

Maximum Temperature: 350°F (177°C)

Listings

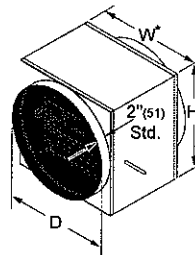
UL 555 and 555S listing: R11767

CSFM listing: 3225-0368:110 and 3230-0368:111

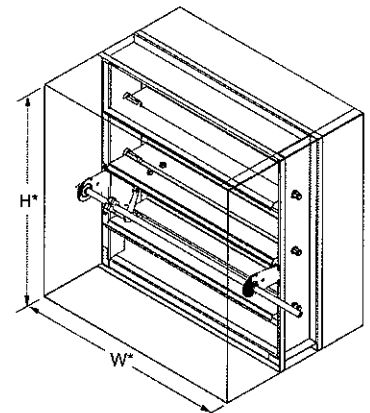
New York City MEA listing: 295-98-E

Meets NFPA Standards: 90A, 92A, 92B and 101

Meets Building Code Standards: IBC, NBC, NFPA, SBC and UBC

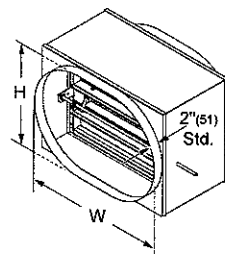


Type R (optional)
Round duct transitions are standard with D=W=H. (available with D<W and H)



Model FSD-141
(standard)

*Damper dimensions furnished approximately 1/4" (6) undersize. (sleeve thickness not included)



Type O (optional)
Oval duct transitions are standard with W and H equal to damper width and height dimensions. (available with W and H smaller than damper width and height)



Air Performance

Pottorff certifies that the model FSD-141 shown herein is licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings only.

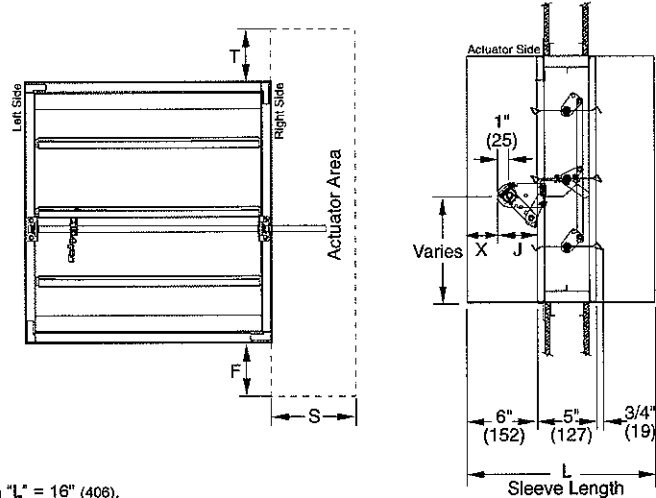
Information is subject to change without notice or obligation.

NOTE: Dimensions in parentheses () are millimeters.

Actuator and Sleeve Dimensional Data

The drawings and corresponding table illustrate the position of the damper when mounted in a factory sleeve and the relative space required for a given actuator. The standard mounting locations provide enough space for installation of retaining angles and duct connections.

Damper Height	Actuator Model						
	FSLF120 FSLF24	FSNF120 FSNF24	GGD224 GGD121	ML4115 ML8115	331-4826	331-2998	
F	6"-7" 8"-9" 10-11" 12"-13" 14" 15"-16" 17" 18" and 23" 19"-20" and 25" 21"-22" and 24" 26"-27" >27"	5" 4" 1" 0" 0" 0" 0" 0" 0" 0" 0" 0"	7" 7" 4" 3" 2" 1" 0" 0" 0" 0" 0" 0"	9" 8" 6" 5" 4" 3" 2" 0" 0" 0" 0" 0"	5" 4" 1" 0" 0" 0" 0" 0" 0" 0" 0" 0"	9" 8" 5" 4" 4" 3" 2" 0" 0" 0" 0" 0"	13" 12" 9" 8" 7" 9" 3" 2" 0" 1" 0" 0"
T	6" and 10" 7" and 11"-12" 8", 13"-14" and 21" 9", 15"-17", and 20" 18"-19" 22"-23" and >24" 24"	3" 2" 1" 0" 0" 0" 0"	3" 2" 1" 0" 0" 0" 0"	3" 2" 1" 0" 0" 0" 0"	3" 2" 1" 0" 0" 0" 0"	3" 2" 1" 0" 0" 0" 0"	3" 2" 1" 1" 1" 1" 1"
S	All	4-1/2"	4-1/2"	4-1/2"	4-1/2"	5" 7-1/4"	
X	<8" ≥8"	4" 2-5/8"	4" 2-5/8"	4" 2-5/8"	4" 2-5/8"	4" 2-5/8"	
J	<8" ≥8"	2" 3-3/8"	2" 3-3/8"	2" 3-3/8"	2" 3-3/8"	2" 3-3/8"	

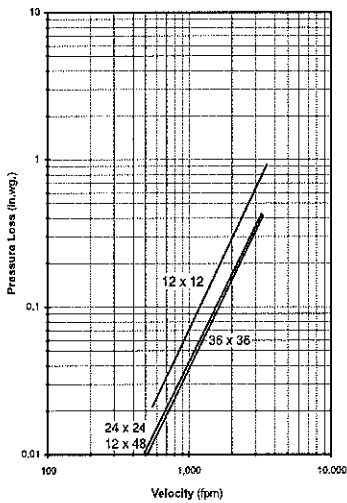


- NOTE:
- Sleeve length "L" = wall/floor thickness + 10" (254). Standard sleeve length "L" = 16" (406).
 - Damper may be rotated 180° to position actuator area on the left side.
 - The entire damper frame is not required to be installed within the wall, partition or floor. However, the closed plane of the damper blades must be inside the wall, partition or floor.
 - Dimensions for ML4115/ML8115 apply to MS4209/MS8209.
 - For dimensions on actuators not shown above, contact factory.

Airflow Performance Data

Pressure Loss vs. Velocity

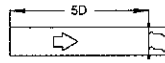
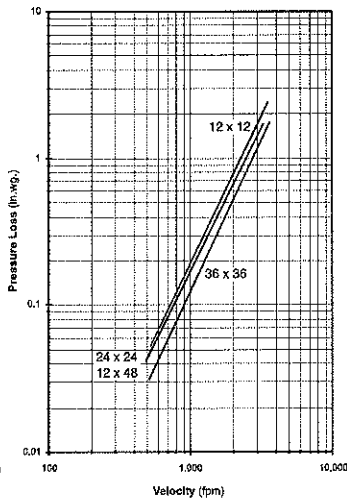
Figure 5.3 — Ducted Inlet and Outlet



Ducted Inlet and Outlet

AMCA Figure 5.3 illustrates a fully ducted damper. This configuration represents the lowest pressure drop of the three test configurations because entrance and exit losses are minimized by straight duct runs upstream and downstream of the damper.

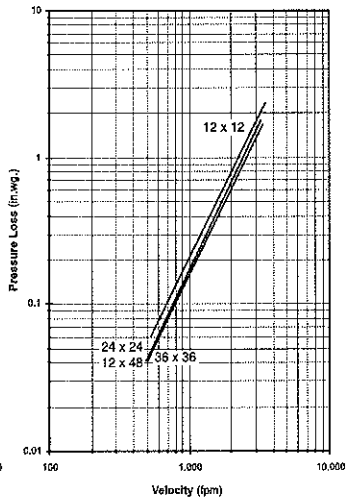
Figure 5.2 — Ducted Inlet



Ducted Inlet

AMCA Figure 5.2 illustrates a ducted damper exhausting air into an open area. This configuration has a lower pressure drop than Figure 5.5 because entrance losses are minimized by a straight duct run upstream of the damper.

Figure 5.5 Plenum Mount



Plenum Mount

AMCA Figure 5.5 illustrates a plenum mounted damper. This configuration has the highest pressure drop because of extremely high entrance and exit losses due to the sudden changes of area in the system.



Air Performance

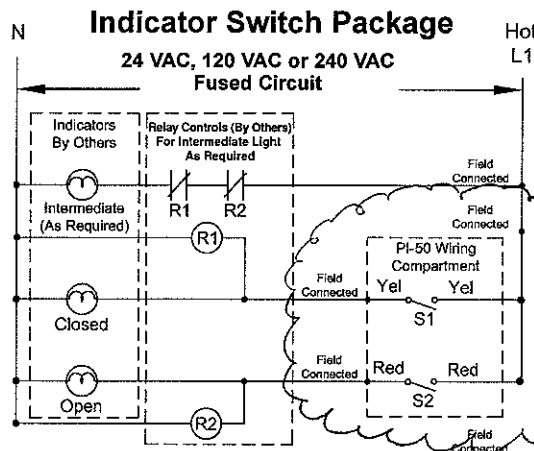
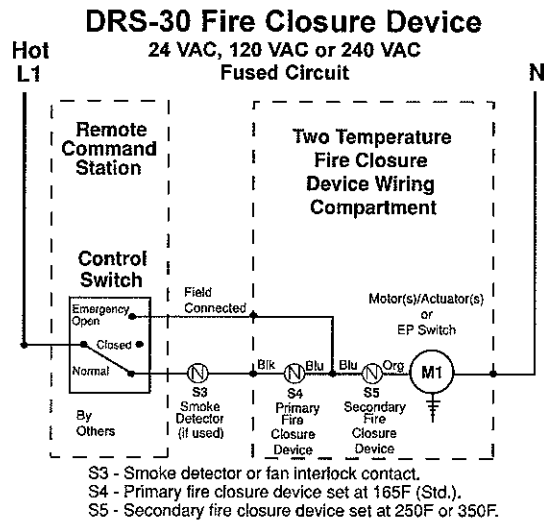
Pottorff certifies that the model FSD-141 shown herein is licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings only.

Pressure drop testing was performed in accordance with AMCA Standard 500-D using the three configurations shown. All data has been corrected to represent air density of 0.075 lb/ft. Actual pressure drop in any ducted HVAC system is a combination of many elements. This information, along with analysis of other system influences, should be used to estimate actual pressure losses for a damper installed in a given HVAC system.

Application

The DRS-30 fire closure device employs a two-temperature, manually resettable, electric thermostat sensor to interrupt the electrical power to actuators used on fire/smoke dampers. The DRS-30 permits testing of the damper closure by applying direct heat to the one or both of the sensor's discs or by physically depressing one of the discs from the inside of the damper sleeve. The damper can be reopened by manually resetting the sensor from the exterior side of the damper sleeve, once the disc has cooled down below its set temperature. In addition to the fire closure device, the DRS-30 is factory equipped with an indicator switch package that employs an in-jamb assembly plate consisting of two single pole, double throw micro switches to provide full open and full closed blade indication from a remote location. The indicator switch package is factory installed directly to a damper blade.

Wiring Diagrams



Verify continuity before final wiring.

- S1 & S2** - Damper position indicator switches.
S1 - Closes when damper is closed.
S2 - Closes when damper is open.
R1 - Relay control for intermediate position indication.
R2 - Relay control for intermediate position indication.

Information is subject to change without notice or obligation.

Ratings

125/250 VAC, 12A
250 VAC, 1/3HP; 125 VAC, 1/6HP
250 VDC, 1/4A; 125 VDC, 1/2A
Max. ambient temp. 257°F (125°C)

Listings

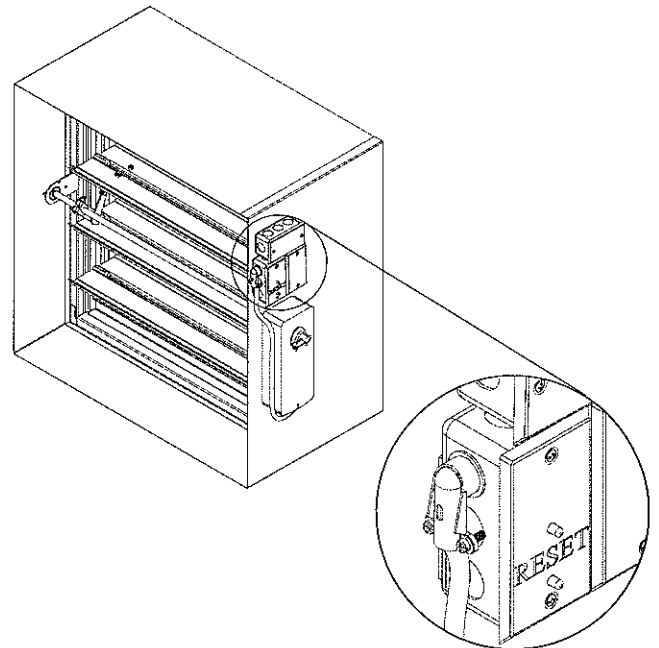
UL 555 listing: R11767

CFSM listing: 3225-0368:110, 3225-0368:111,
3225-0368:112, 3225-0368:113,
3225-0368:115, and 3225-0368:116.

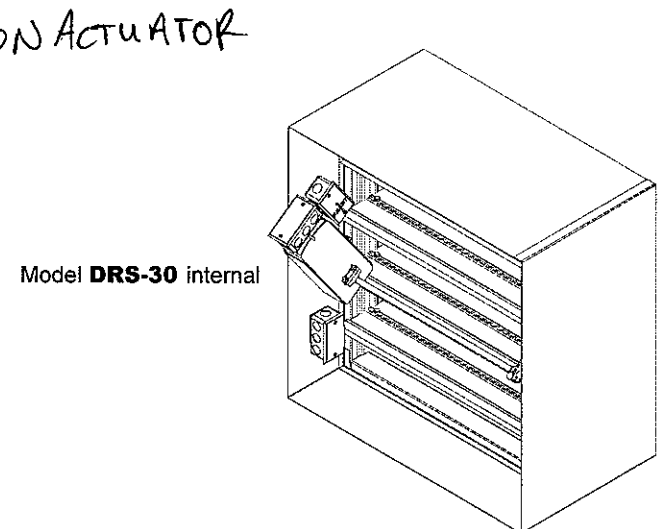
New York City MEA listing: 295-98-E

Meets NFPA Standards: 90A, 92A, 92B and 101

Meets Building Code Standards: IBC, NBC, NFPA, SBC and UBC



Model **DRS-30** external



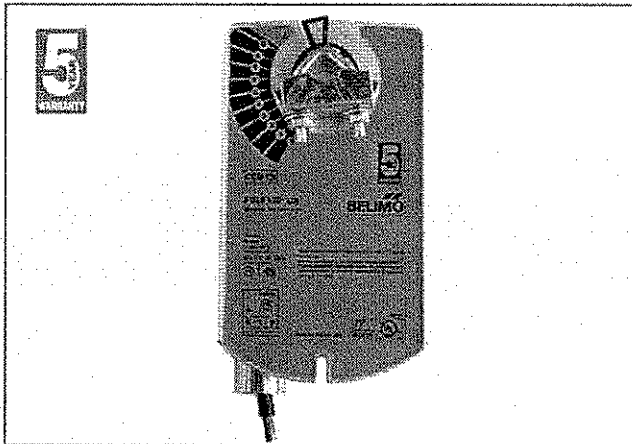
Model **DRS-30** internal

NOTE: Dimensions in parentheses () are millimeters.

FSLF120 (-S) US, FSLF24 (-S) US



Fire and smoke actuator, 30 in-lb, [3.5 Nm], spring return, 350°F [177°C] for half hour, 15 sec. operation.



Technical Data	FSLF120(-S) US	FSLF24(-S) US
Nominal voltage	120 VAC 50/60 Hz	24 VAC 50/60 Hz
Nominal voltage range	108 - 132 VAC	21.6 - 26.4 VAC
Power consumption	Running: 24 VAC, 50/60 Hz: 5.0 VA 120 VAC, 60 Hz: 18 VA (120 VAC, 50 Hz: 20 VA) Holding: 24 VAC, 50/60 Hz: 3.5 VA 120 VAC, 60 Hz: 6.5 VA (120 VAC, 50 Hz: 12 VA)	
Transformer sizing 24 VAC	Safety note: Connect via safety isolating transformer, Class 2 supply.	
Electrical connection	2 ft, 18 ga, 3 color coded leads (120 V) 2 ft, 18 ga, 2 color coded leads (24 V) 2 ft, 18 ga, appliance cable (Aux switches)	
Overload protection	Electronic throughout 0 to 95° rotation Auto-restart after temporary overload	
Electrical protection motor	FSLF120 US grounded enclosure	
Electrical protection	Double insulated <input type="checkbox"/>	
Auxiliary switches		
Angle of rotation	95°	
Torque	30 in-lb [3.5 Nm] minimum from 32°F to 350°F [0°C to 177°C]	
Direction of rotation	Spring return can be selected by CCW/CW mounting	
Position indication	Visual indicator, 0° to 95°	
Running time	Motor: < 15 sec at rated voltage and torque, 32°F to +122°F [0°C to +50°C] Spring: < 15 sec	
Auxiliary switches FSLF120-S US/24-S US	2 x SPST 0.5 A inductive @ 120/250 V, 1 mA @ 5 VDC, 3 A resistive @ 120/250 V, UL listed, 10° and 85°	
Humidity	5 to 95% RH noncondensing	
Ambient temperature		
- Normal operation	32°F to +122°F [0°C to +50°C]	
- Safety operation	3 On/Off cycles after 30 minutes at ambient temperature of 350°F [177°C]	
Storage temperature	-40°F to +176°F [-40°C to +80°C]	
Housing	NEMA type 1, zinc coated steel	
Type of action	Type 1.B	
Software class	A	
Gears	Permanently lubricated	
Agency listings	cULus listed acc. to UL 60730-1	
Servicing	Maintenance free	
Quality standard	ISO 9001	
Weight	3.7 lbs [1.7 kg]	

Application:

The type FSLF spring-return actuator is intended for the operation of smoke and combination fire and smoke dampers in ventilation and air-conditioning systems. The actuator will meet requirements of UL555 and UL555S when tested as an assembly with the damper and will meet requirements of UBC for 15 second opening and closing.

Square footage of damper operated will depend on make and model and the temperature required.

Operation

Mounting of the actuator to the damper axle shaft or jackshaft is via a cold-weld clamp. Teeth in the clamp and V-bolt dig into the metal of both solid and hollow shafts maintaining a perfect connection. The specially designed clamp will not crush hollow shafts. The bottom end of the actuator is held by an anti-rotation strap or by a stud provided by the damper manufacturer.

The actuator is mounted in its fail safe position with the damper blade(s) closed. Upon applying power, the actuator drives the damper to the open position. The internal spring is tensioned at the same time. If the power supply is interrupted, the spring moves the damper back to its fail-safe position.

Replacement applications

When actuators fail on existing dampers, the local authority having jurisdiction sets the code requirements for replacement actuators. The local inspector or fire marshal should be consulted. In some jurisdictions, a product meeting current codes may be required.

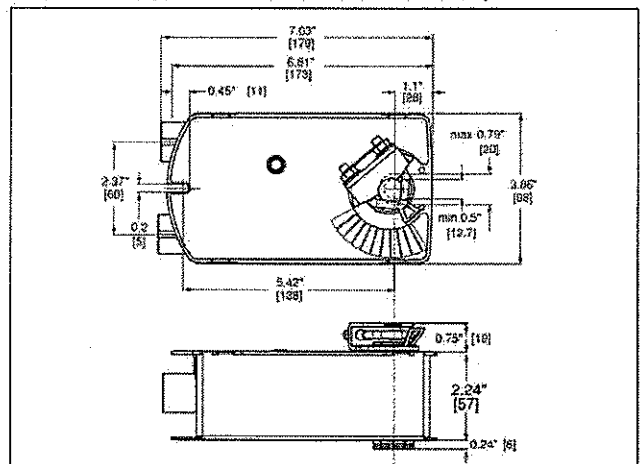
The FSLF will meet or exceed requirements.

Caution must be used when replacing failed motors with new Belimo actuators. Many old motors did not have internal springs and depended on external springs on the side of the damper or wrapped around the damper shaft to close the damper.

In some cases, the damper must be replaced because the damper would have to undergo major modifications to replace an actuator.

Most codes require that "equal or better" actuators be used to replace defectives.

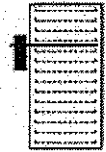
Dimensions [All numbers in brackets are in millimeters.]



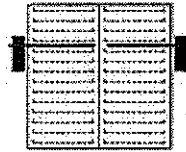
Fire and smoke actuator, 30 in-lb, [3.5 Nm], spring return, 350°F [177°C] for half hour, 15 sec. operation.

Multi-section damper assemblies – typical applications

The typical fire and smoke damper requires from 5-15 in-lb of torque per square foot at 250°F - 350°F under dynamic load (2400 fpm velocity). The FSLF is a single section damper actuator. For the multi section dampers, use the FSNF series.



Single section for one FSLF actuator



Two section for two FSLF actuators



Maximum area one actuator



Maximum area for two actuators

This is a direct coupled actuator. If linkages are needed use the FSNF series. Square shaft adaptors are available: 22153-00002, 22153-00003, 22513-00004 for the 8mm, 10mm, and 12mm, form fit respectively.

Safety note:

The actuator contains no components which the user can replace or repair.

FSLF120 or FSLF24(-S) Typical specification

All smoke and combination fire and smoke dampers shall be provided with Belimo FSLF US or FSNF US actuators. No substitutions allowed.

Damper and actuator shall have UL555S Listing for 250°F (350°F) and shall drive open in 15 seconds and spring closed in 15 seconds as required by UBC.

Where auxiliary switches are required for signaling, starting fans, or position indication, -S model actuators, damper blade, or proximity switches shall be provided.

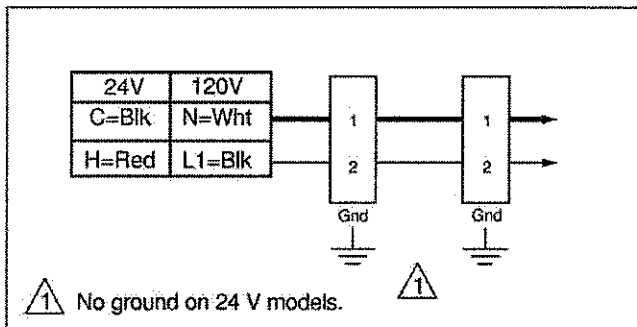
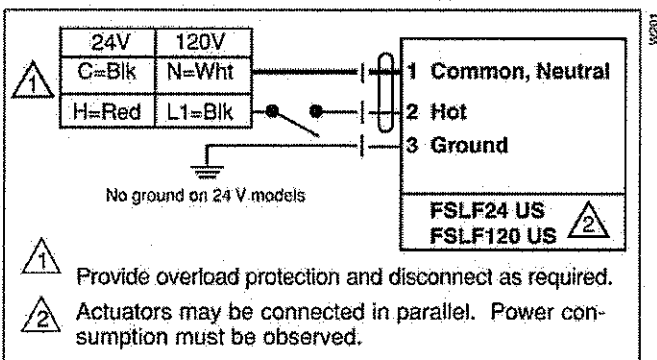
Safety note:

Screw a conduit fitting into the actuator's metal bushing. Jacket the actuators input and output wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

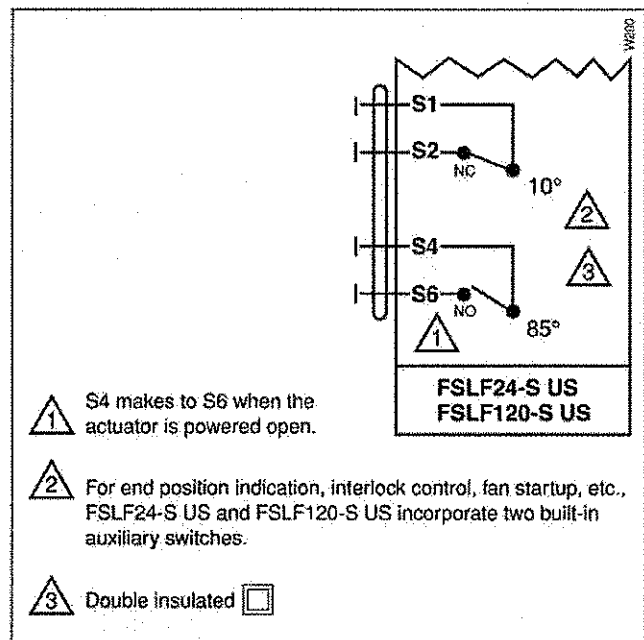
INDICATION SWITCH



Wiring



Parallel actuator wiring

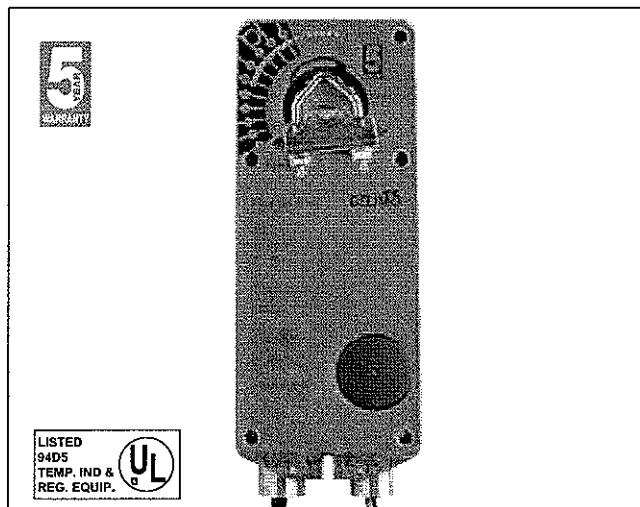


Auxiliary switch wiring for FSLF24-S US, FSLF120-S US

FSNF120 (-S), FSNF24 (-S)



Fire and smoke actuator, 70 in-lb, spring return, 350°F for half hour, 15 sec. cycle time



Technical Data	FSNF120(-S)	FSNF24(-S)
Power supply	120 VAC ± 10% 50/60 Hz	24 VAC ± 20% 50/60 Hz
Power consumption 120 VAC	running: 18 W, .23A holding: 6 W, .09A	
Transformer sizing 24 VAC	27 VA Class 2 power supply	
Electrical connection	3 ft, 18 ga, 3 color coded leads (120V) 3 ft, 18 ga, 2 color coded leads (24V) 3 ft, 18 ga, appliance cable (Aux switches)	
Overload protection	Electronic throughout 0 to 95° rotation Auto-restart after temporary overload	
Electrical protection	Grounded enclosure 120 V Double insulated aux switches	
Angle of rotation	95°	
Torque	70 in-lb [7.9 Nm] minimum from 32°F to 350°F	
Direction of rotation	spring return can be selected by CCW/CW mounting	
Position indication	visual indicator, 0° to 95°	
Running time	between 32°F and 350°F motor: < 15 sec at rated voltage and torque spring: < 15 sec	
Auxiliary switches (FSNF24-S/120-S)	2 x SPDT 7A (2.5A inductive)@ 125/250VAC, UL listed, 5° and 85°	
Humidity	5 to 95% RH noncondensing	
Ambient temperature	32°F to +122°F [0°C to +50°C]	
Storage temperature	-40°F to +176°F [-40°C to +80°C]	
Housing	NEMA type 1, zinc coated steel	
Gears	Steel, permanently lubricated	
Agency listings	UL listed to UL873 and CAN/CSA C22.2 No. 24, New York BEC, CSFM	
Servicing	maintenance free	
Quality standard	ISO 9001	
Weight	6 lbs (2.75 kg.)	

Application:

The type FSNF spring-return actuator is intended for the operation of smoke and combination fire and smoke dampers in ventilation and air-conditioning systems. The actuator will meet requirements of UL555 and UL555S when tested as an assembly with the damper and will meet requirements of UBC for 15 second opening and closing at 350°F.

Square footage of damper operated will depend on make and model and the temperature required.

Operation

Mounting of the actuator to the damper axle shaft (smoke) or jackshaft (combination) is via a cold-weld clamp. Teeth in the clamp and V-bolt dig into the metal of both solid and hollow shafts maintaining a perfect connection. The specially designed clamp will not crush hollow shafts. The bottom end of the actuator is held by an anti-rotation strap or by a stud provided by the damper manufacturer.

The actuator is mounted in its fail safe position with the damper blade(s) closed. Upon applying power, the actuator drives the damper to the open position. The internal spring is tensioned at the same time. If the power supply is interrupted, the spring moves the damper back to its fail-safe position.

Accessories

All AF/NF linkages may be applied.

Replacement applications

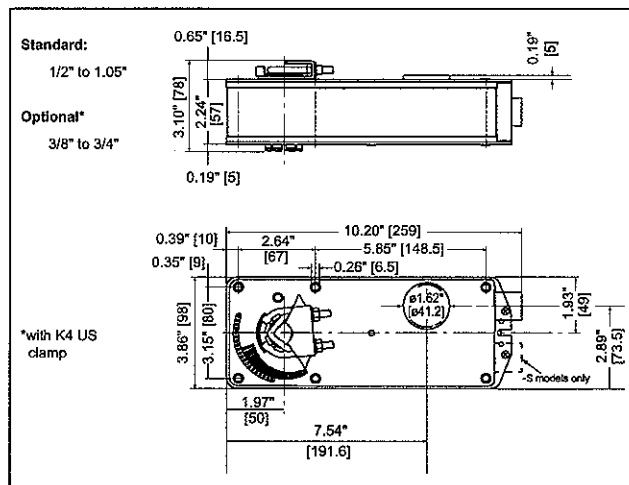
When actuators fail on existing dampers, the local authority having jurisdiction sets the code requirements for replacement actuators. The local inspector or fire marshal should be consulted. In some jurisdictions, a product meeting current codes may be required. The FSNF will meet or exceed requirements.

Caution must be used when replacing failed motors with new Belimo actuators. Many old motors did not have internal springs and depended on external springs on the side of the damper or wrapped around the damper shaft to close the damper.

In some cases, the damper must be replaced because the damper would have to undergo major modifications to replace an actuator.

In all cases, replacing the actuator voids the UL555 listing of the damper and actuator.

Dimensions [All numbers in brackets are in millimeters.]



Fire and smoke actuator, 70 in-lb, spring return, 350°F for half hour, 15 sec. cycle time

Accessories

AF series accessories may be employed:

- IND-AF2 Damper position indicator
- K4 US Universal clamp for 3/8" to 3/4" shafts
- K4-1 US Universal clamp for up to 1.05" dia. jackshafts
- K4-H Universal clamp for hexshafts 3/8" to 5/8"
- KH-AF Crankarm for up to 3/4" round shaft (Series 2)
- KH-AF-1 Crankarm for up to 1.05" jackshaft (Series 2)
- KH-AFV V-bolt kit for KH-AF and KH-AF-1
- Tool-06 8mm and 10 mm wrench
- ZDB-AF2 Angle of rotation limiter
- ZG-100 Universal mounting bracket
- ZG-101 Universal mounting bracket
- ZG-102 Multiple actuator mounting bracket
- ZG-103 Universal mounting bracket
- ZG-104 Universal mounting bracket
- ZG-106 Mounting bracket for Honeywell® Mod IV replacement or new crankarm type installations
- ZG-107 Mounting bracket for Honeywell® Mod III or Johnson® Series 100 replacement or new crankarm type installations
- ZG-108 Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crankarm type installations
- ZG-AF Crankarm adaptor kit for AF/NF
- ZG-AF108 Crankarm adaptor kit for AF/NF
- ZS-100 Weather shield (metal)

- ZS-150 Weather shield (polycarbonate)
- ZS-300 NEMA 4X housing
- 22965-00001 12mm form fit square shaft adaptor

For an overview of how to apply the accessories, see Belimo Mechanical Accessories and refer to the Belimo Mounting Methods Guide.

Note: When using FSNF (-S) US actuators, only use accessories listed on this page.

FSNF Typical specification

All smoke and combination fire and smoke dampers shall be provided with Belimo FSNF US actuators. No substitutions allowed.

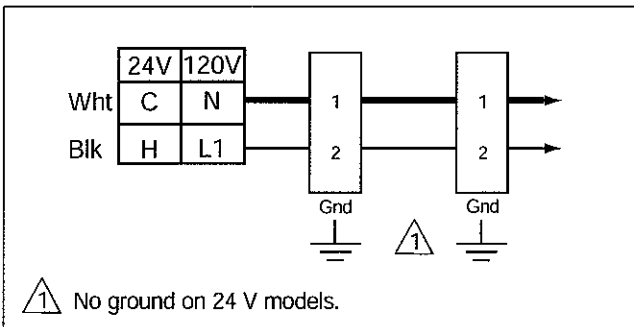
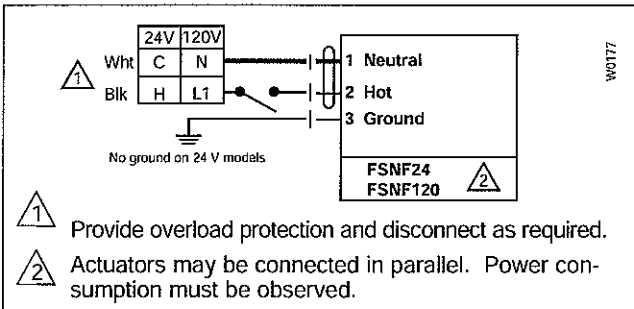
Damper and actuator shall have UL555S Listing for 350°F (250°F) and shall drive open in 15 seconds and spring closed in 15 seconds at elevated temperature.

Where auxiliary switches are required for signaling, starting fans, or position indication, -S model actuators, damper blade, or proximity switches shall be provided.

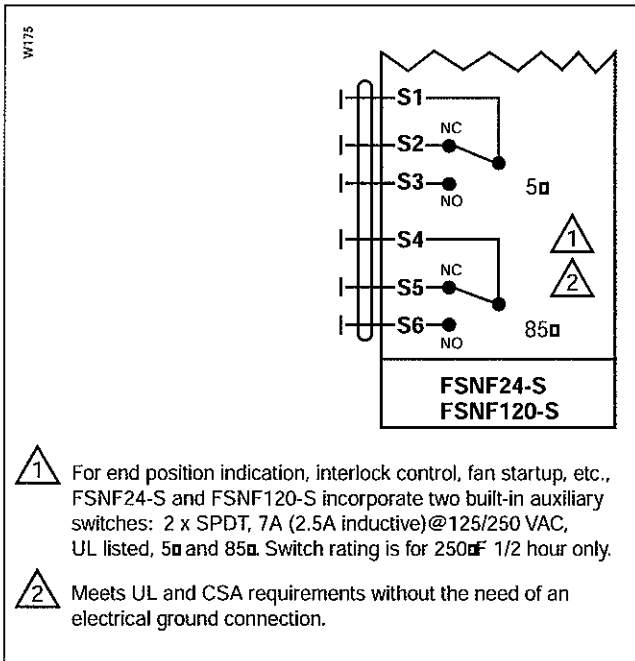
INDICATION SWITCH



Wiring



Parallel actuator wiring

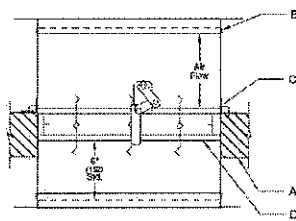


Auxiliary switch wiring for FSNF24-S, FSNF120-S

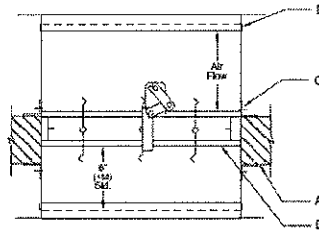
POTTORFF®

1½ hour — combination fire smoke dampers
horizontal installation instructions

The following installation details apply to models **CFS-171, CFS-172, FSD-141, FSD-142, FSD-143, FSD-151, FSD-152, FSD-171 and FSD-172**



**Horizontal Mount
(Single Side Mounting Angle)**



**Horizontal Mount
(2-sided Mounting Angles)**



• Illustration depicts damper installed from the top down with the actuator above the floor line. Damper may also be installed from the bottom up with the actuator below the floor line. Illustrations show triple-V bladed (140/170 type), steel airfoil blade (150 type) similar.



- A. Concrete or masonry fire partition shown. The opening shall be a minimum of ¼" (6) with a maximum of ¾" (19) larger than the overall damper and sleeve assembly size. When openings are larger than ¾" (19), but less than or equal to 6" (152) the mounting angles must be a minimum of 16 gauge (1.5) and must be wide enough to overlap the opening by a minimum of 1" (25). The damper must be installed with leading edge of closed blade within the partition.
- B. For rigid type duct connections, the sleeve shall be a minimum of 16 gauge (1.5) for dampers up to 36" wide by 24" high (914 x 610) and a minimum of 14 gauge (1.9) for larger units. When lighter gauge sleeves are used, one or more of commonly used breakaway style connections are required. Refer to Sleeve Termination Supplemental Installation Instructions for further details. In no case will the sleeve gauge be less than the duct gauge to which it is connected. The damper sleeve shall not extend more than 16" (406) beyond the rated partition on the actuator side. The opposite side extension shall be a maximum of 6" (152) unless an access door is installed in the sleeve which then permits the extension to be a maximum of 16" (406).
- C. Mounting angles shall be a minimum 1-½" x 1-½" x 16 gauge (38 x 38 x 1.5). Mounting angles are only required on the top side of the opening and must be attached to the sleeve at 6" (152) o.c. maximum, to the partition at 24" (610) o.c. maximum. There must be a minimum of two fasteners per side to both the sleeve and partition on all four sides. Alternately, mounting angles may be installed on both sides of the partition and must be attached only to the sleeve at 12" (305) o.c. maximum, with a minimum of two connections per side on all four sides. Attachment to the sleeve shall be with a minimum of #10 (M5) screws or bolts, ⅜" (4.8) diameter steel rivets, Quick-Lock joints, or welds. Attachment to the partition shall be with a minimum of #10 (M5) steel fasteners: anchors, bolts, or self-tapping masonry screws. A minimum ¾" x 20 gauge (19x1) flange termination may be used in lieu of mounting angles. Ensure that the attachment device does not interfere with the operation of the damper and the free movement of the damper blades.

Note: If optional sealing between the mounting angle (or flange) leg and the surface of the partition, or floor and/or between the mounting angle leg and the surface of the damper sleeve is required, any of the following sealants may be used: Dow-Corning 700 or 732 or GE RTV 108 or SCS 1201 RTV. These sealants must be applied such that they do not intrude into the annular space between the outside surface of the damper sleeve and the opening of the partition, or floor into which the damper/sleeve is installed. The annular space between damper sleeve and opening must not be filled with firestop materials such as fill, void, or cavity materials.

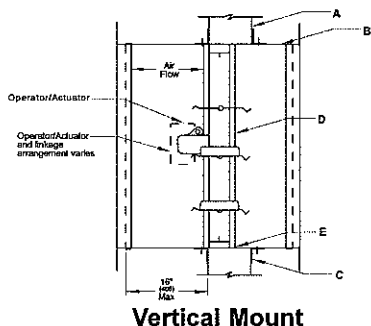
- D. When joining multiple sections or fastening the damper to the sleeve, the damper shall be fastened with minimum ⅜" (4.8) diameter steel rivets, Quick-Lock Joints, welds or #10 (M5) bolts or sheet metal screws at 8" (203) o.c. maximum. There must be a minimum of two connections per side, top and bottom. For FSD-151 and 152 installations more than one damper high and three dampers wide, a minimum 14 gauge x 5" (1.9 x 127) supplemental steel mullion is required. The mullion should be the same length as the opening/duct height and must be installed between the damper frames running parallel to the opening/duct height, at the center of the assembly. Support mullions should be attached to the damper frames using the same fasteners indicated previously in this section.
- E. A continuous bead of Dow-Corning 700 or 732, or GE RTV 108 or SCS 1201 RTV silicone rubber sealant shall be applied between the damper and the sleeve and between sections of a multiple damper assembly. Sealant is only required on one side of the damper.
- F. Fire/Leakage rated dampers and qualified operators are tested together by Underwriters Laboratories and are factory installed to qualify for standard damper/operator warranties. Damper operator/actuator must be tested prior to system start-up to ensure proper operation. Before applying power to the operator/actuator, the power must be verified.

DUCT SIZES	GALVANIZED STEEL				STAINLESS STEEL
	FSD-141, 142, 143	FSD-151, 152	FSD-171, 172	CFS-171, 172	FSD-141, 142, 143
Maximum Single Section	36" x 48" (914 x 1219)	32" x 48" (813 x 1219)	24" x 24" (610 x 610)	12" x 12" (305 x 305)	36" x 48" (914 x 1219)
Maximum Multiple Section	108" x 48"* (2743 x 1219)	144" x 96"* (3658 x 2438)	N/A	N/A	72" x 48" or 36" x 96"* (1829 x 1219 or 914 x 2438)

Information is subject to change without notice or obligation.

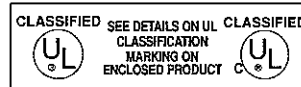
NOTE: Dimensions in parentheses () are millimeters.

The following installation details apply to models **FSD-141, FSD-142, FSD-143, FSD-151, FSD-152, FSD-171** and **FSD-172**



All dimensions shown in () are in millimeters. Illustration depicts damper installed vertical right side up. Damper may also be installed upside down.

Illustrations show triple-V bladed (140/170 type), steel airfoil blade (150 type) similar.



Vertical Mount

- A. Concrete or masonry fire partition shown. See Wood Stud and/or Steel Stud Framing for Fire Dampers in Drywall and/or Cavity Shaftwall Partitions Supplemental Installation Instructions for further vertical mount installation details. The opening shall be a minimum of ¼" (6) with a maximum of ¾" (19) larger than the overall damper and sleeve assembly size. When openings are larger than ¾" (19), but less than 6" (152) the mounting angles must be a minimum of 16 gauge (1.5) and must be tall enough to overlap the opening by a minimum of 1" (25). Damper must be installed with leading edge of closed blade within the partition.
 - B. For rigid type duct connections, the sleeve shall be a minimum of 16 gauge (1.5) for dampers up to 36" wide by 24" high (914 x 610) and 14 gauge (1.9) for larger units. When lighter gauge sleeves are used, one or more of commonly used breakaway style connections are required. Refer to Sleeve Termination Supplemental Installation Instructions for further details. In no case will the sleeve gauge be less than the duct gauge to which it is connected. Damper sleeve shall not extend more than 16" (406) beyond the rated partition on the actuator side. The opposite side extension shall be a maximum of 6" (152) unless an access door is installed in the sleeve which then permits the extension to be a maximum of 16" (406).
 - C. Mounting angles shall be a minimum of ¾" x 1-½" tall x 20 gauge (19 x 38 x 1.0). For opening sizes ≤80" wide (2032), 96" tall (2438) and not exceeding 26.67 square feet (2.48 square meters) mounting angles are required on only one side of the partition and must be attached to the sleeve and the partition. For larger openings (or optional on smaller openings) 1-½" x 1-½" x 16 gauge (38 x 38 x 1.5) mounting angles are required on both sides of the partition and must be attached to the sleeve only. Attachment to the sleeve shall be with a minimum of #10 (M5) screws or bolts, ⅜" (4.8) diameter steel rivets, Quick-Lock joints, or welds at 12" (305) o.c. maximum. Attachment to the partition/opening shall be with minimum #10 (M5) fasteners with a minimum length as follows: For metal studs and the angles under the drywall, the fasteners must be a minimum of ½" (12.7) long. For metal studs and the angles over the drywall the fastener must be a minimum of ½" (12.7) longer than the thickness of the drywall, i.e. if the partition has one layer of ⅝" (15.9) drywall on the attachment side, the screws must be ½" + ⅝" = 1 1/8" (12.7 + 15.9 = 28.6) long. For wood stud openings, the minimum length is 1-½" (38) longer than the thickness of the drywall on the attachment side. For concrete or masonry openings, the anchors must be a minimum of #10 (M5) fasteners: screws, bolts or self-tapping masonry screws. Fasteners in the partition should be spaced at 12" (305) o.c. maximum. There must be a minimum of two connections per side on all four sides. A minimum of ¾" x 20 gauge (19 x 1) flange termination may be used in lieu of mounting angles. Refer to Sleeve Termination Supplemental Installation Instructions and Framing for Fire Dampers for further details. Ensure that the attachment device does not interfere with the operation of the damper and the free movement of the damper blades.
- Note:** If optional sealing between the mounting angle (or flange) leg and the surface of the partition, wall, or floor and/or between the mounting angle leg and the surface of the damper sleeve is required, any of the following sealants may be used: Dow-Corning 700 or 732 or GE RTV 108 or SCS 1201 RTV. These sealants must be applied such that they do not intrude into the annular space between the outside surface of the damper sleeve and the opening of the partition, wall or floor into which the damper/sleeve is installed. The annular space between damper sleeve and wall opening must not be filled with firestop materials such as fill, void, or cavity materials
- D. When joining multiple sections or fastening the damper to the sleeve, the damper shall be fastened with ⅜" (4.8) diameter steel rivets, Quick-Lock Joints, welds or #10 (M5) bolts or sheet metal screws at 8" (203) o.c. maximum. There must be a minimum of two connections per side, top and bottom. For vertical installations >108" wide x 96" high (2743 x 2438), a minimum 14 gauge x 5" wide (1.9 x 127) supplemental steel mullion is required. The mullion must be the same length as the opening/duct height. The mullion must be installed between the damper frames running parallel to the opening/duct height located at the center of the assembly. Supplemental support mullions should be attached to the damper frames using any of the same fasteners indicated previously in this section.
 - E. A continuous bead of Dow-Corning 700 or 732, or GE RTV 108 or SCS 1201 RTV silicone rubber sealant shall be applied between the damper and the sleeve and between sections of a multiple damper assembly. Sealant is only required on one side of the damper.
 - F. Fire/Leakage rated dampers and qualified operators are tested together by Underwriters Laboratories and are factory installed to qualify for standard damper/operator warranties. Damper operator/actuator must be tested prior to system start-up to ensure proper operation. Before applying power to the operator/actuator, the power must be verified.

DUCT SIZES	GALVANIZED STEEL			STAINLESS
	FSD-141, 142, 143	FSD-151, 152	FSD-171, 172	FSD-141, 142, 143
Maximum Single Section	36" x 48" (914 x 1219)	32" x 48" (813 x 1219)	24" x 24" (610 x 610)	36" x 48" (914 x 1219)
Maximum Multiple Section	144" x 96" (3658 x 2438)	144" x 96" (3658 x 2438)	N/A	72" x 48" or 36" x 96" (1829 x 1219 or 914 x 2438)

The above information for dampers installed in a vertical fire separation pertains to those where the damper blades are horizontal. However, as an exception, if the dampers are Model FSD-141 and are 6" (152) wide by 6" (152) high, they may be installed with the blades in a vertical orientation. All other installation details are as outlined above except that the mounting angle on the top of the damper sleeve needs only to be a minimum of ¼" (19) tall.

Information is subject to change without notice or obligation.

NOTE: Dimensions in parentheses () are millimeters.

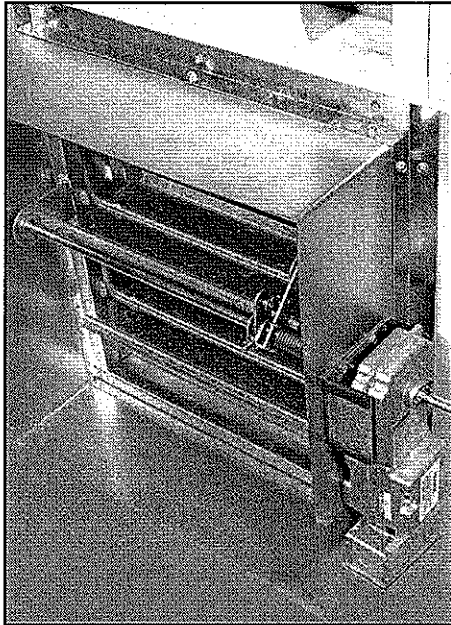


Figure 1: Single Mounting Angle Over Drywall with Wood Stud
(Cutaway shown for illustration purposes only)



Application

All Pottorff 1-½ hour fire and fire-smoke dampers may use single-side mounting angles in lieu of conventional 2-sided mounting angles. Single-side mounting angles may be field fabricated or factory-supplied and may be installed in metal stud, wood stud, concrete or masonry partitions.

Maximum Size

Vertical: 80" wide x 96" high (2032 x 2438), and not exceeding 26.67 square feet in area.

Horizontal: 144" wide x 96" high (3658 x 2438).

Note: Size shall not exceed damper model size limits.

General Notes

- Install dampers in accordance with the appropriate damper installation instructions sheet. Replace conventional 2-side mounting angles with single-sided mounting angles as appropriate.
- Vertical:** Single-side mounting angles shall be a minimum of ¾" x 1-½" tall x 20 gauge (19 x 38 x 1.0) steel. For metal stud partitions only, the single-side mounting angles may be attached to the metal stud prior to installation of the drywall. See Figure 3.
Horizontal: Single-side mounting angles shall be a minimum of 1-½" x 1-½" tall x 16 gauge (38 x 38 x 1.5) steel.
- Attach single-side mounting angles to the damper sleeve and the partition with a minimum of: No. 10 (M5) steel screws or bolts, ¾" (4.8) diameter steel rivets, Quick-lock joints or welds. For concrete or masonry partitions attach the angles with a minimum of No. 10 (M5) steel fasteners: anchors, bolts or self-tapping masonry screws. There must be a minimum of two connections per side, on all four sides. Ensure that the attachment device does not interfere with the operation of the damper and the free movement of the damper blades.

Vertical: Attach mounting angles to the sleeve and the partition at 12" (305) o.c. maximum.

Horizontal: Attach mounting angles to the sleeve at 6" (152) o.c. maximum, and to the partition at 24" (610) o.c. maximum.

Note: The annular space between damper sleeve and wall opening must not be filled with firestop materials such as fill, void, or cavity materials. However, if optional sealing between the mounting angle (or flange) leg and the surface of the partition, wall, or floor and/or between the mounting angle leg and the surface of the damper sleeve is required, any of the following sealants may be used: Dow-Corning 700 or 732 GE RTV 108 or SCS 1201 RTV. These sealants must be applied such that they do not intrude into the annular space between the outside surface of the damper sleeve and the opening of the partition, wall or floor into which the damper/sleeve is being installed.

Single Mounting Angle Over Drywall

Single Mounting Angle UNDER Drywall * Metal Stud Only

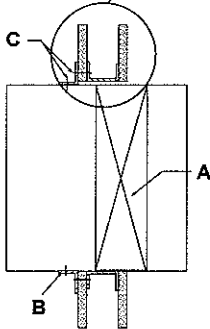
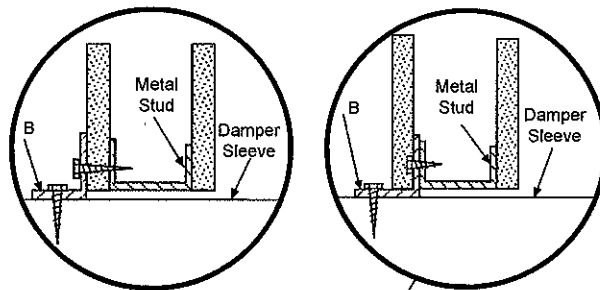


Figure 2: Metal Stud

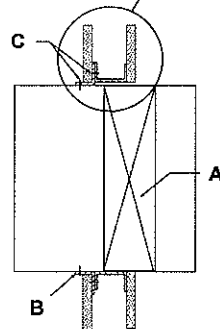


Figure 3: Under Drywall Installation (Metal Stud Only)

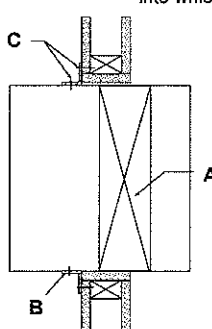


Figure 4: Wood Stud

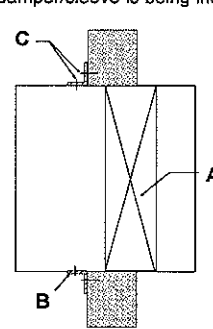


Figure 5: Concrete or Masonry

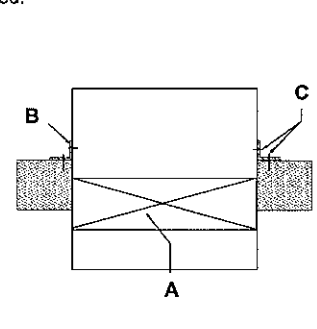
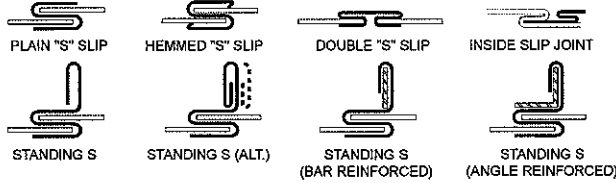


Figure 6: Horizontal Installation Concrete or Masonry only

Application - UL Approved Breakaway Connections

All of these connections may be used to terminate the damper sleeve in place of slip joints, for Pottorff multiple blade or single blade fire dampers, curtain type fire dampers, and combination fire-smoke dampers.

- 1) Duct-sleeve connections listed in UL 555, Fifth Edition, "Standard For Fire Dampers".



- 2) Additional duct-sleeve connections which were tested and witnessed by UL. The connections performed within the requirements of the UL test criteria.

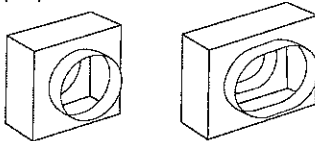
(a) Rectangular Duct - Breakaway Connections

Joints using connections shown in 1) above with a maximum of two No. 10 (M5) sheet metal screws on each side and on the bottom located in the center of the slip pocket and penetrating both sides of the slip pocket. Note: UL tested duct sealant may be used.

(b) Round Duct - Breakaway Connections

Joints where round or oval spiral ducts attach to round or oval collars which are part of the damper sleeve as shown below. No. 10 (M5) sheet metal screws are spaced equally around the circumference of the duct per the following:

- Duct diameters 22" (560) and smaller—3 screws.
- Duct diameters over 22" (560) to and including 36" (920)—5 screws.



DAMPER/SLEEVE ASSEMBLIES WITH COLLARS FOR ROUND AND FLAT OVAL DUCTS

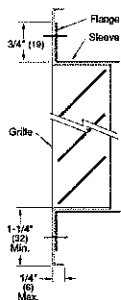
Notes:

- (1) For flat oval ducts, the diameter shall be considered the largest (major) dimension of the duct.
- (2) UL tested duct sealant may be used.

(c) Flat Drive Slips - Breakaway Connections



Joints using connectors of the types shown in 1) above on the top and the bottom and using flat drive slips not exceeding 20" (508) duct height on the sides (see sketch above). Note: If optional sealing of these joints is required, the following sealants may be applied in accordance with the instructions supplied by the manufacturer of the sealant: Design Polymerics - DP 1010 or Precision - PA2084T.



FLANGE TERMINATION AT A GRILLE

Grille (by others).

Grille is to be screwed to minimum 3/4" x 20 gauge (19 x 1) flange.

Grille flange must be minimum 1-1/2" (32) and overlap the opening a minimum of 1/2" (13).

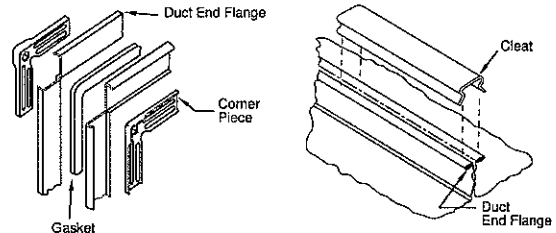
Select the damper with sleeve of sufficient length to permit attachment, with perimeter mouting angles, to duct work on one side of the wall, floor or ceiling opening. Detail shown is for vertical application.

General Installation for Flanged Duct Breakaway Connections

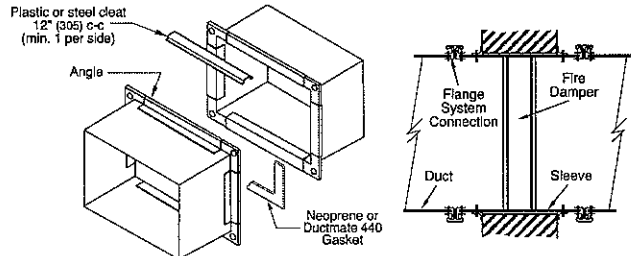
Flange corner pieces insert into the hollow web of the angles and slip over the duct and sleeve. Closed cell neoprene gasket or Ductmate 440 gasket tape is then applied to one face of the flange. To complete installation, butt the flange faces together, aligning edges, and install cleats over the flange. Cleats shall be 6" (153) long, **plastic or steel**. Install minimum one per side, spaced 12" (305) center to center.

- Note: Cleats may be replaced by #10 x 3/4" (19) Tek Screws.
• See Table below.

FLANGED DUCT CONNECTIONS



- (d) TDC and TDF roll-formed 4-bolt flanged connections assembled per the manufacturer's instructions using gaskets and metal or plastic cleats. Flanges may be joined with or without four 3/8" (10) steel bolts and nuts.



- (e) Ductmate, Ward and Nexus slip on 4-bolt flanged connections assembled per the manufacturer's instructions using gaskets and metal or plastic cleats as shown above. As an option, a 3/8" (9) bolt may be used in the corners to help with the alignment. [Min. 20 ga (1.0) thick sleeve].

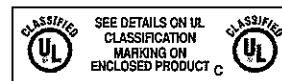
- Note: Cleats may be replaced by #10 x 3/4" (19) Tek Screws.
• See Table below.

Tek Screw Table

Sleeve Width (w) or Height (h)	No. of Tek Screws
w or h < 24"	1 per side
24" ≤ w or h < 36"	2 per side
36" ≤ w or h < 54"	3 per side
54" ≤ w or h < 72"	4 per side
w or h ≥ 72"	5 per side

Note:

It is not necessary to have the same connections on the damper sleeve and on the duct being connected/attached to the damper sleeve. The TDC, TDF, Ductmate, Ward and Nexus can be installed and mixed on the sleeve/duct. i.e. the damper sleeve can have a Ductmate connection and can be attached to duct with a TDC, TDF, etc. type connection, or vice versa. Any of the previously mentioned connections can be mixed/matched on the damper sleeve and duct.



Application

Pottorff fire and combination fire smoke dampers are approved for installation with manufactured flange systems by Ductmate, Ward, or Nexus and a TDC or TDF flange system. Connections may be between like systems or mixed. These flange systems permit installation with metal cleats, plastic cleats, or #10 screws; Butyl or Neoprene gasket, and bolted or non-bolted corners.

General Installation

1. Install the manufactured flange system onto the damper sleeve or duct per the manufacturer's instructions.
2. Neoprene or Butyl gasket may be applied to the mating surfaces to seal the two flange systems together.
3. Align the two flange systems together. A 3/8" (9) bolt may be used in the corners to help with alignment and attachment. These bolts do not have to be removed.
4. Install the plastic or metal cleat (Figure 1) or #10 tek screw (Figure 2), approximately equally spaced, per the following schedule.

Width (w) or Height (h)	Cleat or Screw Qty
w or h < 24" (610)	1 per side
24" (610) ≤ [w or h] < 36" (914)	2 per side
36" (914) ≤ [w or h] < 54" (1372)	3 per side
54" (1372) ≤ [w or h] < 72" (1829)	4 per side
w or h ≥ 72" (1829)	5 per side

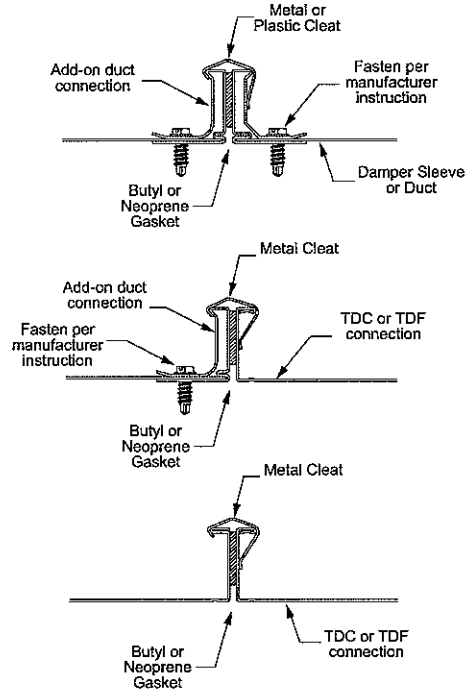


Figure 1 - Installation with Cleats

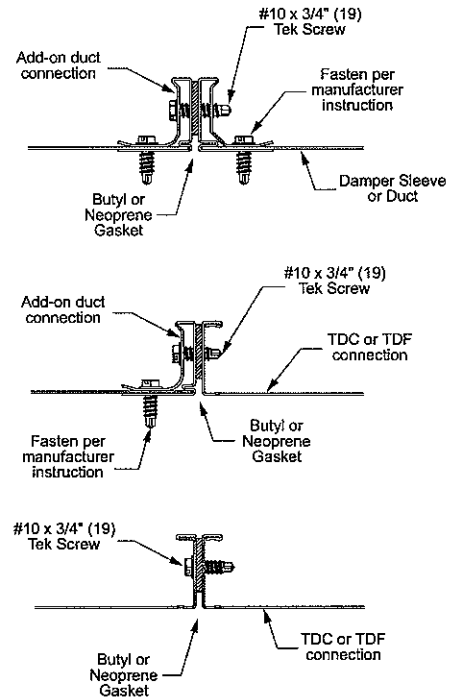
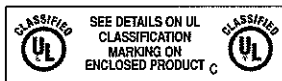


Figure 2 - Installation with #10 Tek Screws



Application

Pottorff dampers may be supplied with a factory hemmed 20 gauge (1) sleeve for use with standard drive slip and S-slip connections. Sleeves and duct may be field hemmed by folding back the vertical sides a maximum of 1/2" (13) to accommodate a 1" (25) wide drive slip (as shown in Figure 1). Standard drive slips are UL tested breakaway connections on dampers 20" (508) high and less.

General Installation

Join damper sleeve to duct at top and bottom sides using any plain S, hemmed S, double S, inside slip, standing S, or reinforced standing S slip. See Figure 2.

The drive slip connection is then used to join the vertical sides of the damper sleeve to the duct. Cut a length of drive slip connection a maximum of 4" (102) longer than the vertical duct dimension. Guide the drive slip connection onto the side members securing it over the hemmed edges until the connection extends beyond the top and bottom sides of the damper sleeve/duct. The extra length should be hammered flat overlapping all four corners.

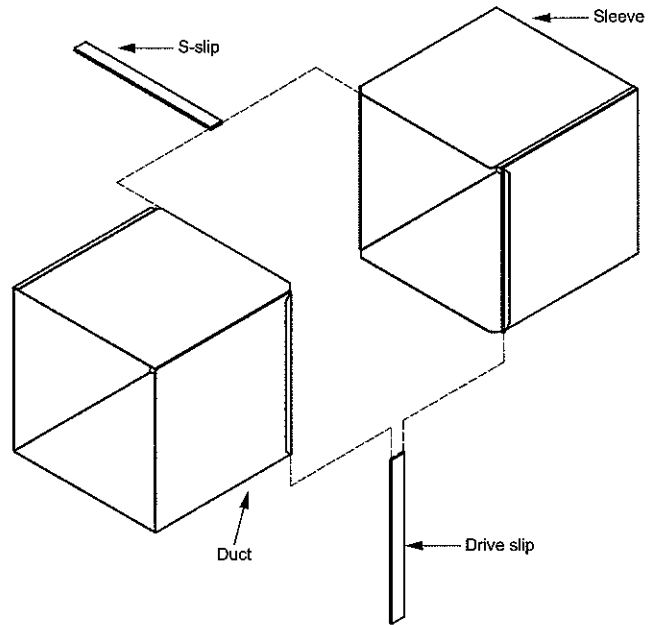


Figure 1

NOTES

1. Refer to appropriate damper installation sheet for installation information not covered on this sheet.
2. When optional duct sealing is required, the following sealants may be applied in accordance with the instructions supplied by the sealant manufacturer.

Design Polymeric - DP 1010

Precision - PA2084T

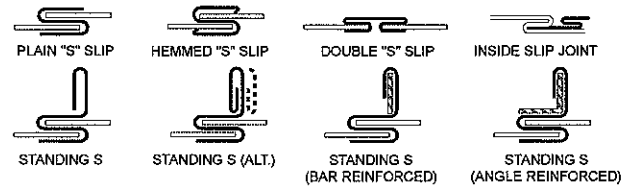


Figure 2 - S-slip Connections (side view)

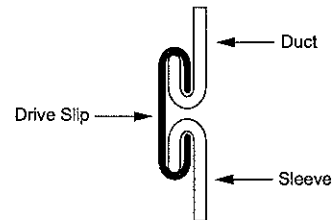
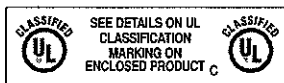
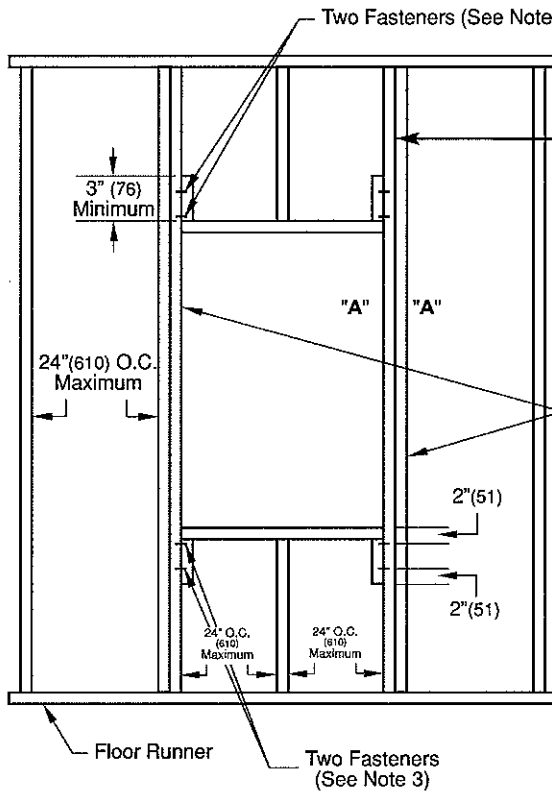
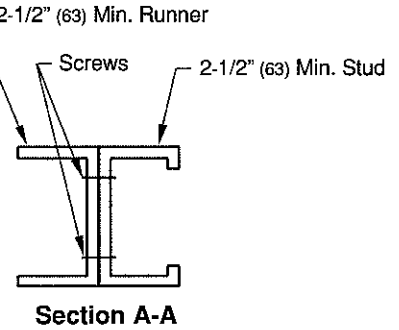


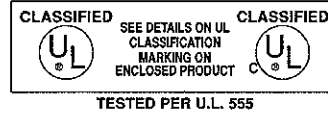
Figure 3 - Drive slip Connections (top view)



Note: Full length studs are not required next to the damper if the spacing from the damper to the full length stud does not exceed the maximum stud spacing. The opening may be framed with studs that are attached to full length studs.



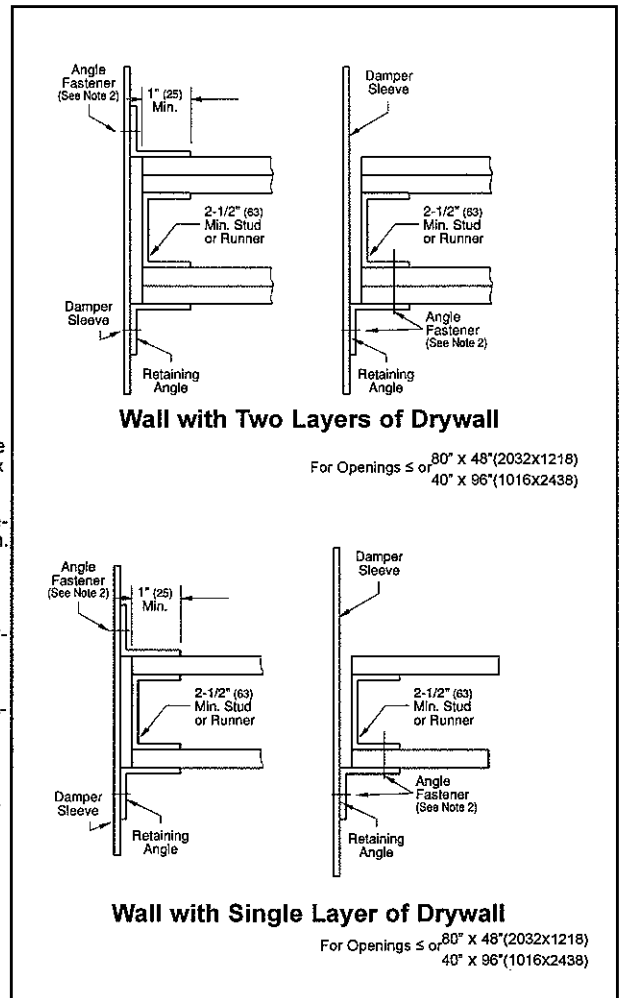
Double stud not required on Penetrations.
120" x 80" (3048 x 2032) or smaller



Opening Preparation Detail

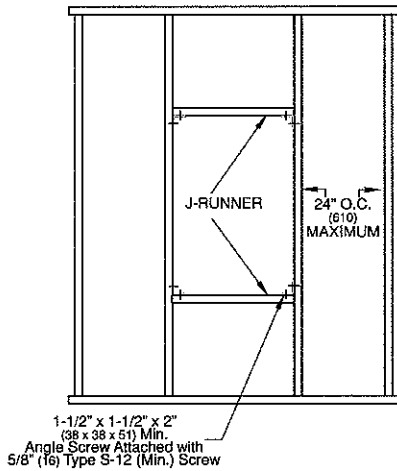
NOTES

- Gypsum panels must be screwed 12" (305) O.C. maximum to all stud and runner flanges surrounding opening.
- Mounting angles shall be a minimum of ¾" x 1-½" tall x 20 gauge (19 x 38 x 1.0). For opening sizes ≤ 80" wide (2032), 96" high (2438), and not exceeding 26.67 square feet in area retaining angles are only required on one side of the partition and must be attached to the sleeve and the partition. For larger openings (or optional on smaller openings), 1-½" x 1-½" x 16 gauge (38 x 38 x 1.5), retaining angles are required on both sides of the partition and must be attached to the sleeve. Attachment to the sleeve shall be with No. 10 (M5) screws or bolts, ⅜" (4.8) diameter steel rivets, Quick-Lock joints or welds, at 12" (305) o.c. maximum. Attachment to partition/opening shall be with min. #10 fasteners with a minimum length as follows: For metal stud and the angles under the drywall, the fasteners must be a min. ½" long. For metal stud and the angles over the drywall the fastener must be a min. ½" longer than the thickness of the drywall, i.e. if the partition has one layer of ½" drywall on the attachment side, the screws must be ½" + ½" = 1-½" long. The fasteners in the partition should be located such that they are ½" below the top of the 1-½" flange of the retaining angles. Fasteners in the partition should be spaced 12" o.c. max. A minimum of two connections per side, top and bottom. A minimum ¾" x 20 gauge (19 x 1) flange termination may be used in lieu of mounting angles. Refer to Sleeve Termination Supplemental Installation Instructions and Framing for Fire Dampers for further details. Ensure that attachment device does not interfere with the operation of the damper and the free movement of the damper blades.
- See standard damper installation instruction sheets for additional details.
- For dampers larger than 120" x 80" (3048 x 2032) double vertical studs are required.

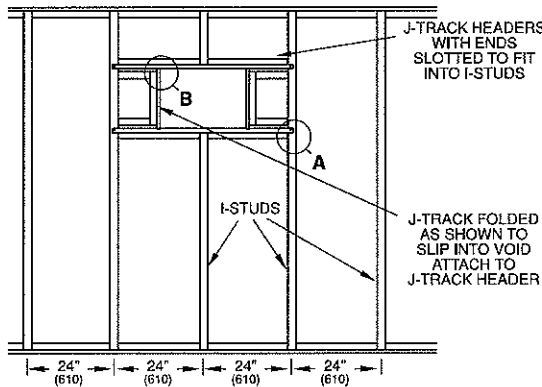


For Openings ≤ 80" x 48" (2032x1218)
40" x 96" (1016x2438)

For Openings ≤ 80" x 48" (2032x1218)
40" x 96" (1016x2438)



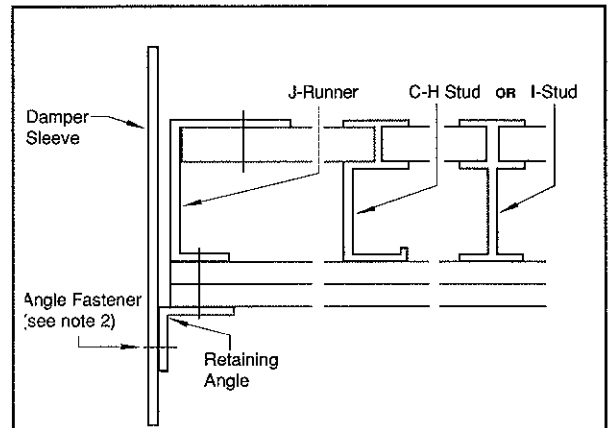
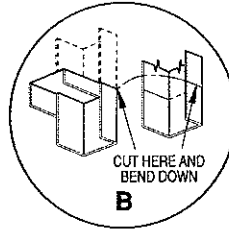
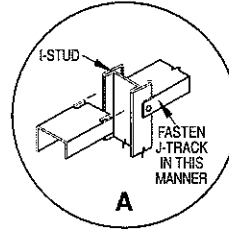
Opening Preparation Detail



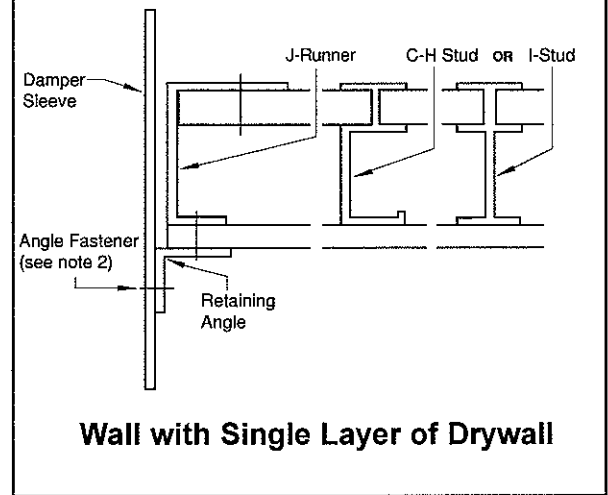
Optional Opening Preparation Detail for I-Stub Assembly

NOTES

- Gypsum panels must be screwed 12" (305) O.C. maximum to all stud and runner flanges surrounding opening.
- Mounting angles shall be a minimum of 3/4" x 1-1/2" tall x 20 gauge (19 x 38 x 1.0). For opening sizes ≤ 80" wide (2032), 96" high (2438), and not exceeding 26.67 square feet in area retaining angles are only required on one side of the partition and must be attached to the sleeve and the partition. For larger openings (or optional on smaller openings), 1-1/2" x 1-1/2" x 16 gauge (38 x 38 x 1.5) retaining angles are required on both sides of the partition and must be attached to the sleeve. Attachment to the sleeve shall be with No. 10 (M5) screws or bolts, 3/16" (4.8) diameter steel rivets, Quick-Lock joints or welds, at 12" (305) o.c. maximum. Attachment to partition/opening shall be with min. #10 fasteners with a minimum length as follows: For metal stud and the angles under the drywall, the fasteners must be a min. 1/2" long. For metal stud and the angles over the drywall the fastener must be a min. 1/2" longer than the thickness of the drywall, i.e. if the partition has one layer of 5/8" drywall on the attachment side, the screws must be 1/2" + 5/8" = 1-1/8" long. The fasteners in the partition should be located such that they are 1/2" below the top of the 1-1/2" flange of the retaining angles. Fasteners in the partition should be spaced 12" o.c. max. A minimum of two connections per side, top and bottom. A minimum 3/4" x 20 gauge (19 x 1) flange termination may be used in lieu of mounting angles. Refer to Sleeve Termination Supplemental Installation Instructions and Framing for Fire Dampers for further details. Ensure that attachment device does not interfere with the operation of the damper and the free movement of the damper blades.
- See standard damper installation instruction sheets for additional details.



Wall with Two Layers of Drywall



Wall with Single Layer of Drywall

Maintenance

Dampers do not typically require maintenance provided they are kept clean and dry. All moving parts are self-lubricating and additional lubrication is not required. If additional lubrication of axle bearings, jackshaft bearings or jamb seals is desired, use a silicone or dry graphic lubricant. **Do not use petroleum-based lubricants or other lubricants that attract contaminants and collect dust.**

Regular inspection and maintenance is essential to ensure that smoke-control systems will perform as intended during emergencies. Dampers shall be cycled and tested in accordance with NFPA 90 and 92A recommendations and local codes.

CAUTION - Power must be applied to the damper actuator to open the damper. **Do not manually position damper blades.** Disconnecting actuator linkage, loosening actuator set screws, disconnecting damper linkage or jack shafting may void the product warranty and invalidate UL ratings.

Operational Testing

Simulated Fire Closure

Depress the disc on DRS-30 or HS-10 (located inside the duct). This will disconnect power to the actuator and cause the damper to close. Push the reset button (located outside the duct) to reengage power and reopen the damper.

Position Indicator Switch Testing (if applicable)

- *Open Damper Indicator Switch* - Apply power to open damper and confirm damper-open indicator light is on.
- *Closed Damper Indicator Switch* - Disconnect power to close damper and confirm damper-closed indicator light is on.
- *Intermediate or 'Fault' Indication* (if applicable) - While damper is cycling (open-to-close or close-to-open) confirm that the 'fault' light is on when the damper is between open and closed (~25 to 70 degrees of stroke). **Do not insert objects between damper blades to restrict damper travel.** Objects may destroy blade edge seals, deform blades and/or damage linkage, which will void the product warranty and invalidate UL ratings.

Troubleshooting Guide

Problem	Possible Cause	Solution
Damper does not operate, or will not open and/or close fully	Installation screws interfering with damper blade or linkage travel	Inspect and remove interfering screws or debris
	Damper heat responsive device is tripped.	Push reset button (located outside the duct)
	Frame is 'racked' causing blades to bind	Adjust frame to be square and plumb
	Contaminants on damper	Clean with compressed air, mild detergent or mild non-petroleum based solvent
	Loose actuator set screws or linkage	Disconnect power to close damper, loosen actuator set screws, adjust linkage (if applicable), tighten actuator set screws, reapply power
	No power supplied to the actuator	Connect power
	Defective actuator	Disconnect power and loosen actuator set screws, cycle actuator. If good, reconnect. If bad, contact the factory
Corresponding control panel indicating light does not illuminate when damper is open and/or closed	System wiring/program is faulty	Verify wiring is correct. If it is, then disconnect system wires from damper indicator switch and test open/closed switch continuity directly. If good, reconnect system wires and correct system fault. If bad, contact the factory.
	Defective switch	Contact factory if above test shows no continuity with damper either full open or full closed