

CUT SHEET

Job Name: **Cambria Hotel**

Elevation: (ft) 108

Date: 6/08/2022

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FSD-331 Combination Fire Smoke Damper

APPLICATION & DESIGN

Model FSD-331 is a high performance combination fire smoke damper with Class I leakage. High strength airfoil blades ensure the lowest resistance to airflow in HVAC systems with velocities to 4,000 ft/min and pressures to 8 in. wg. Model FSD-331 may be installed horizontally or vertically (with blades running horizontally) and is rated for airflow and leakage in either direction.

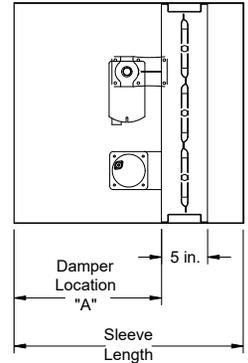
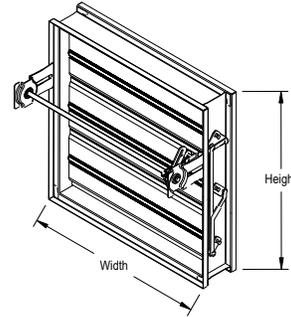
DAMPER RATINGS

UL 555 Fire Resistance Rating

Fire Rating: 3 hours
Dynamic Closure Rating: Actual ratings are size dependent
Velocity: Up to 4,000 ft/min
Pressure: 8 in. wg

UL 555S Leakage Rating

Leakage Class: I
Operational Rating: Actual ratings are size dependent
Velocity: Up to 4,000 ft/min
Pressure: 8 in. wg
Temperature: Up to 350 F depending on actuator



PRODUCT DETAILS

Frame Type: Channel
Frame Thickness: 16 ga
Closure Device: RRL
Closure Temperature: 165 F
Blade Action: Opposed
Blade Seal: Silicone
Axle/Linkage Material: Plated Steel
Axle Bearings: 316 SS
Performance Method: Volume
Sizing: Nominal

- This drawing shows a general damper configuration and is not intended to depict the exact configuration of all dampers in this submittal.
- Width and height furnished approximately 0.250 in. undersize.
- Add sleeve thickness for overall sleeved damper dimension.
- If the actuator is contained, then it does not extend more than 1.500 in. above or below the damper sleeve.
- Dampers with more than one section wide will be furnished with a single OCI device per row when the blade indicator option is selected.
- Installation instructions available at www.greenheck.com.

ACTUATOR INFORMATION

Actuator Type: 120 VAC
Actuator Mounting: External
Actuator Location: Right Side
Operating Mode: Two Position
Actuator Operation: Spring Return
Fail Position: Closed
Time Cycle: Standard
Operating Temperature: 250 F
Velocity: 2,000 ft/min
Pressure: 4 in. wg
NEMA Enclosure: 1

CODES APPROVED

Model FSD-331 meets the requirements for fire dampers, smoke dampers and combination fire smoke dampers established by:
 National Fire Protection Association:
 NFPA Standards 80, 90A, 92, 101, 105
 IBC (International Building Codes)
 CSFM (California State Fire Marshal)
 Fire Damper Listing (3225-0981:103)
 Leakage (Smoke) Damper Listing (3230-0981:104)
 Underwriters Laboratories:
 UL Classified to U.S. and Canadian safety standards
 Standard 555 & 555S (Listing # R13317)



OPTIONS & ACCESSORIES

Union Label: No Preference

SUMMARY

ID #	TAG	QTY	Width	Height	CONFIGURATION			
1-1	FSD-1	1	22.000 in.	16.000 in.	AMCA: AMCA 5.3	Perf. Volume: 2,000 CFM	Perf. Velocity: 818 ft/min	Perf. Pressure Drop: 0.016 in. wg
					Actuator Contained: Yes	Drive Arrangement: Drive- MLS-11-1FER-1	Actuator Mfr: Honeywell	Actuator Model: MS4104F1010
					Actuator Qty: 1	Act. Orientation: Parallel	Sleeve Length: 16.000 in.	Sleeve Thickness: 20 ga
					Damper Location: 7.188 in.	Mounting: Vertical	Component Location Code: N/A	

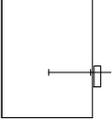
AMCA



Greenheck Fan Corporation certifies that the model 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 Programs. The AMCA Certified Ratings Seal applies to air performance ratings only.

Damper Drive Arrangements Job Summary -Start-

Drive Arrangement: Drive-MLS-11-1FER-1



Damper Drive Arrangements Job Summary -End-

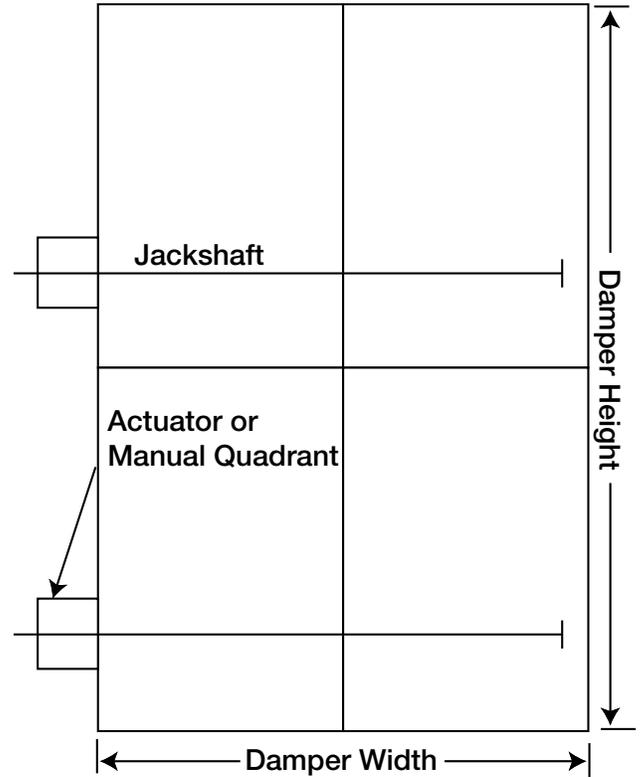
Drive Arrangement Definition

On multi-blade dampers (except vertical blade and Face & Bypass), they are given a drive arrangement code that helps describe the construction of the damper. The following breaks down what each number and letter represents.

22-2FEL-2

① ② ③ ④ ⑤ ⑥ ⑦

- ① Number of sections wide
- ② Number of sections high
- ③ Number of actuators or manual quadrants
- ④ Who supplies the actuators or manual quadrants
F - Factory
C - Customer Supplied (field mounted)
- ⑤ Actuator or manual quadrant mounting
E - External
I - Internal
B - Both internal and external
- ⑥ Actuator or manual quadrant location
L - Left hand drive
R - Right hand drive
B - Both right and left
- ⑦ Number of jackshafts

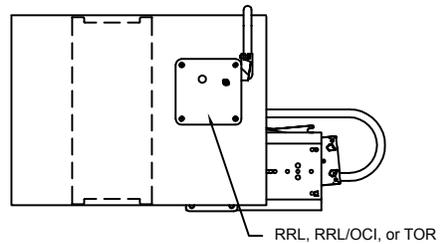
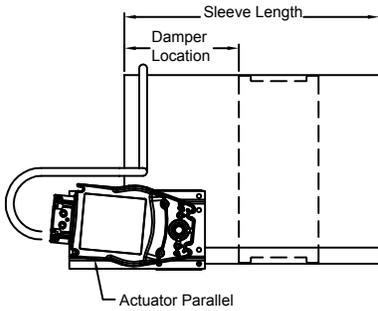
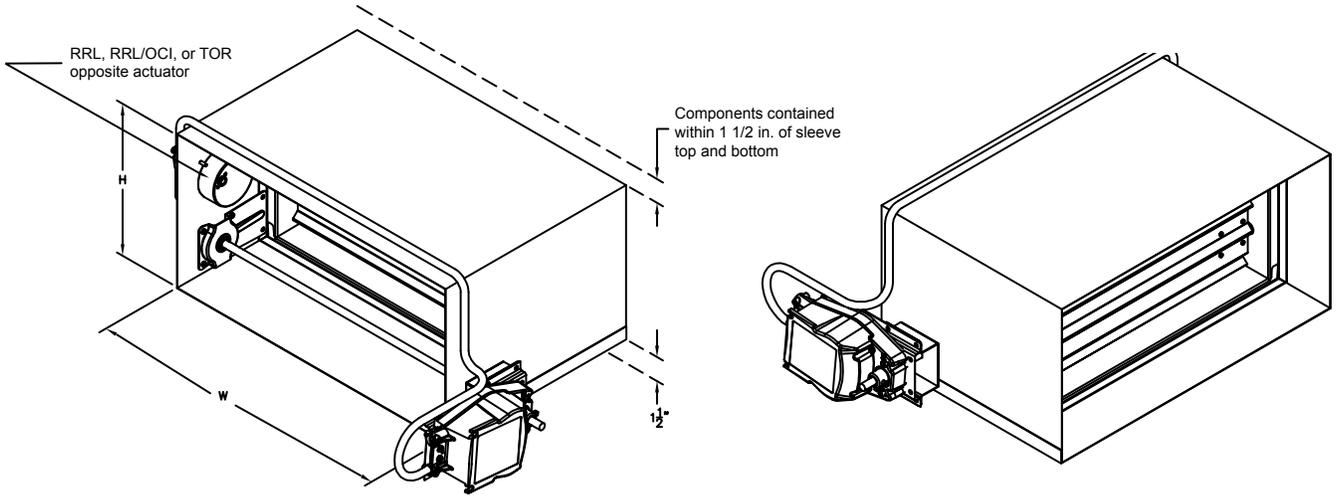


Vertical blade and face & bypass dampers are given a configuration ID number that helps describe the construction of the damper. See the following examples:

Model	Drive Arrangement Prefix
AMD-23, 33, 42	AMD
AMD-42V	VB
DFD-210, 230; DFDAF-310; DFDAF-330; SEDFD-210	MLS
FBH & FBV	FB
FSD, OFSD, CFSD, SMD, SEFSD, SSFSD, SESMD, SSSMD series (except vertical blade models)	MLS
FSD-311V, SMD-301V	VB
GFSD series	GFSD
ICD series	CC
IMO series	MLS
MBD-15 & VCD series (except vertical blade models)	CC
VCD-xxV (vertical blade models)	VB

Contained Actuator

Dampers less than 11 inches (279mm) that do not have compact configuration and that have contained actuator as required will have the RRL, RRL/OCI, or TOR mounted on the side opposite the actuator.





MS4104, MS4109, MS4604, MS4609, MS8104, MS8109 Fast-Acting, Two-Position Actuators

FOR FIRE/SMOKE CONTROL APPLICATIONS

PRODUCT DATA



FEATURES

- 30 lb-in. (3.4 N•m) or 80 lb-in. (9 N•m) minimum driving torque at 350°F (176°C).
- Reversible mounting facilitates use in either clockwise (cw) or counterclockwise (ccw) spring rotation.
- Integral spring return ensures level of return torque.
- Fifteen-second spring return timing.
- No special cycling required during long-term holding. (See Operation section.)
- No audible noise during holding.
- Patent pending design eliminates need for limit switches to reduce power consumption.
- Models available for 24, 120, and 230 Vac.
- Ninety-five degree angle of rotation.
- Actuator holds rated torque at reduced power level.
- Die-cast aluminum housing.
- Housing design allows flush mounting to damper.
- Designed to operate reliably in smoke control systems requiring Underwriter's Laboratories Inc. UL555S ratings up to 350°F.
- Non-UL marked models available.
- Models available with SPST position-indicating switches (7°, 85° stroke).

APPLICATION

The MS4104, MS4109, MS4604, MS4609, MS8104 and MS8109 Fast-Acting, Two-Position Actuators are spring return direct coupled actuators (DCA) for Fire and Smoke dampers (on/off control). The actuator accepts an on/off signal from a single-pole, single-throw (SPST) controller. Reversible mounting allows actuator to be used for either clockwise (cw) or counterclockwise (ccw) spring rotation.

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63-2740-11

SPECIFICATIONS

Models: See Table 1.

Table 1. Models.

Model ^a	Voltage (Vac)	Internal Auxiliary Switches
MS4104F1010	120	None
MS4104F1210	120	2 SPST ^b
MS4109F1010	120	None
MS4109F1210	120	2 SPST ^b
MS4604F1010	230	None
MS4604F1210	230	2 SPST ^b
MS4609F1010	230	None
MS4609F1210	230	2 SPST ^b
MS8104F1010	24	None
MS8104F1210	24	2 SPST ^b
MS8109F1010	24	None
MS8109F1210	24	2 SPST ^b

^a Product model numbers with 'NM' at the end do not contain an UL listing or marking. Check with local codes and authority having jurisdiction prior to commissioning this product type.

^b Internal switches are designed to pass UL555S requirements (at 350°F for 30 minutes) and are intended for use as position indication, if applicable.

Dimensions: See Fig. 1.

Minimum Damper Shaft Length: 2 in. (51 mm).

Device Weight: 5 lb (2.3 kg).

Stroke: 95° ± 3°, mechanically limited.

Electrical Ratings: See Table 2.

Electrical Connections:

Power Lead Wires:

MS410xF and MS460xF: 32 inches (0.8m), 18 AWG

MS810xF: 39 inches (1m), 18 AWG

Switch Lead Wires: 18 inches, 18 AWG, 2 color coded leads

Mounting: Round 1/2 inch shaft adapter with 1/4 inch set screws.

Threads: 1/4-20 UNC-2A

Material: Alloy Steel hardened to HRC 45-53

Thread Lock: Nylon Patch

IMPORTANT

Honeywell does not recommend using linkages with these actuators because side-loading of the output hub reduces actuator life.

Temperature Ratings:

Ambient: 0°F to 130°F (-18°C to 55°C).

Shipping and Storage: -40°F to 140°F (-40°C to 60°C).

IMPORTANT

The actuator is designed to meet UL555S standards at 350°F (176°C) on applicable marked models. The actuator must be tested with the damper to achieve this rating.

Humidity Ratings: 5% to 95% RH noncondensing.

Noise Rating (Maximum):

Driving Open: 75 dBA at 1m.

Holding: 20 dBA at 1m (no audible noise).

Controller Type:

MS4104, MS4109: Line voltage (120 Vac), two-position, SPST (Series 40).

MS4604, MS4609: Line voltage (230 Vac), two-position, SPST (Series 40).

MS8104, MS8109: Low voltage (24 Vac), two-position, SPST (Series 80).

Table 2. MS4104, MS4109, MS4604, MS4609, MS8104 and MS8109 DCA Models.

Model	Power Consumption		Torque in lb-in. (N•m)	Voltage Input in Vac
	Running	Holding		
MS4104F	0.18A, 18W	0.11A, 9W	30 (3.4)	120 ±10%, 50/60 Hz
MS4109F	0.25A, 23W	0.13A, 7W	80 (9)	
MS4604F	0.13A, 18W	0.10A, 11W	30 (3.4)	230 ±10%, 50/60 Hz
MS4609F	0.13A, 23W	0.09A, 7W	80 (9)	
MS8104F	16 VA	8 VA	30 (3.4)	24Vac/dc
MS8109F	23 VA	7 VA	80 (9)	+20%, -10%, 50/60 Hz

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number. If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Environmental and Combustion Controls Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
1985 Douglas Drive North
Golden Valley, Minnesota 55422-4386
3. <http://customer.honeywell.com> or <http://customer.honeywell.ca>

International Sales and Service Offices in all principal cities of the world. Manufacturing in Belgium, Canada, China, Czech Republic, Germany, Hungary, Italy, Mexico, Netherlands, United Kingdom, and United States.

Torque Rating (at rated voltage):

Spring Return:

- MS4104F, MS4604F, MS8104F: 30 lb-in. (3.4 N•m).
- MS4109F, MS4609F, MS8109: 80 lb-in. (9 N•m).

Stall Maximum:

- MS4104F, MS4604F, MS8104F: 150 lb-in. (17 N•m).
- MS4109F, MS4609F, MS8109: 240 lb-in. (27 N•m).

350°F Driving:

- MS4104F, MS4604F, MS8104F: 30 lb-in. (3.4 N•m).
- MS4109F, MS4609F, MS8109: 80 lb-in. (9 N•m).

Timing (At Rated Torque and Voltage):

Drive Open: 15 seconds typical.

Spring Close: 15 seconds typical.

Auxiliary Switches:

Ratings (maximum load):

- MS4104F, MS4604F, MS4109F, MS4609F:
125 Vac/24Vdc, 3A resistive
- MS8104F, MS8109F:
24 Vac/24 Vdc, 3A resistive

Settings (fixed): 7° nominal stroke, 85° nominal stroke

Cycling Requirements:

The actuator and the internal spring are designed to require no special cycling during long-term holding. Honeywell recommends following all local, state and national codes for periodic testing of the entire smoke control system. Refer to National Fire Protection Association (NFPA) National Fire Codes®: NFPA90A, NFPA92A and NFPA92B for your application.

NFPA recommends periodic examination of each fire/smoke damper (semi-annually or annually) to ensure proper performance.

Design Life (at Rated Voltage): 30,000 full stroke cycles.

Approvals: See Table 3.

Environmental Protection Ratings: See Table 4.

Accessories:

- 205649 Mounting Bracket (supplied with actuator).
- 32003168-004 Shaft Adapter Extension.
- 50006427-001 Flexible Anti-Rotation Bracket.

Table 3. Approvals.

	MS4104F, MS4109F	MS4604F, MS4609F	MS8104F, MS8109F
UL/cUL (optional)	X	X	X
UL60730 (optional)	X	X	X
CE	X	X	X
C-Tick	X	X	X

Table 4. Environmental Ratings.

All Devices	MS4104, MS4109, MS4604, MS4609, MS8104 and MS8109
NEMA1	IP40

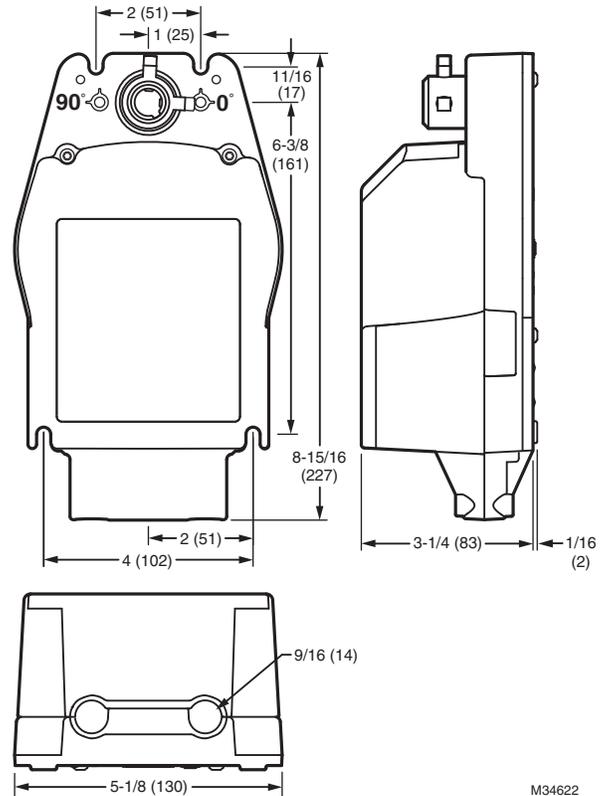


Fig. 1. MS4104, MS4109, MS4604, MS4609, MS8104 and MS8109 dimensional drawing in in. (mm).

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

IMPORTANT

All wiring must agree with applicable codes, ordinances and regulations.

WARNING

Electrical Power Hazard.
Line voltage can cause death or serious injury and short equipment circuitry.
Disconnect power supply before installation.

CAUTION

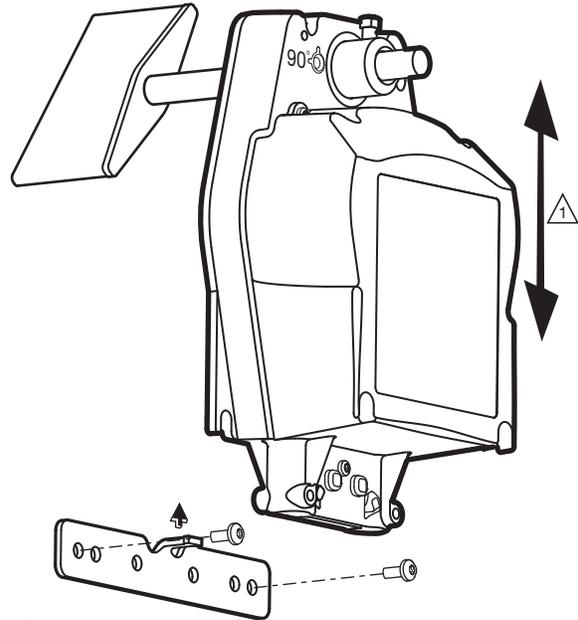
Electrical Shock or Equipment Damage Hazard.
Low voltage can shock individuals or short equipment circuitry.
Disconnect power supply before installation.

Location and Mounting

The actuators are designed to open a damper by driving the damper shaft in either clockwise  or counterclockwise  direction. The actuator housing has two slots on the bottom that, with a 205649 Mounting Bracket, secure it flush to a damper box (see Fig. 2). When mounted correctly, these slots allow the actuator to float without rotating relative to the damper shaft.

CAUTION

Equipment Damage Hazard.
Tightly securing actuator to damper housing can damage actuator.
Mount actuator to allow it to float along its vertical axis.



 ENSURE THAT MOUNTING ASSEMBLY PREVENTS ACTUATOR ROTATION AND ALLOWS ACTUATOR TO FLOAT ALONG INDICATED AXIS. WHEN TOO TIGHT, THE RESULTING BINDING CAN DAMAGE THE ACTUATOR OR REDUCE TORQUE OUTPUT.

M34623A

Fig. 2. Mounting actuator to damper housing.

Preparation

Before mounting the actuator onto the damper shaft, determine the:

- Damper/valve opening direction for correct spring return rotation. The actuator can be mounted to provide clockwise or counterclockwise spring return.
- Damper shaft size (see Specifications section).

Installation



CAUTION

Device Malfunction Hazard.

Improper set screw tightening causes device malfunction.

Ensure damper blade is in the correct position and tighten set screws with proper torque to prevent damper shaft slippage.



CAUTION

Actuator Damage Hazard.

Using actuator as shaft bearing causes device damage.

Use actuator only to supply rotational torque. Avoid any side loads to actuator output coupling bearings.

To install actuator, proceed as follows:

1. Place actuator over damper shaft; and hold mounting bracket in place. See Fig. 2.
2. Mark screw holes on damper housing.
3. Remove actuator and mounting bracket.
4. Drill or center-punch holes for mounting screws (or use no.10 self-tapping sheet metal screws).
5. Turn damper blades to desired normal (closed) position.
6. Place actuator and mounting bracket back into position and secure bracket to damper box with sheet metal screws.
7. Tighten set screws securely into damper shaft using minimum 100 lb-in., maximum 130 lb-in. torque. Use 1/4 in. wrench (see Specifications for details) to tighten set screws.

Wiring

See Fig. 3 through 5 for typical wiring diagrams.



WARNING

Electrical Power Hazard.

Line voltage can cause death or serious injury and short equipment circuitry.

Disconnect power supply before installation.



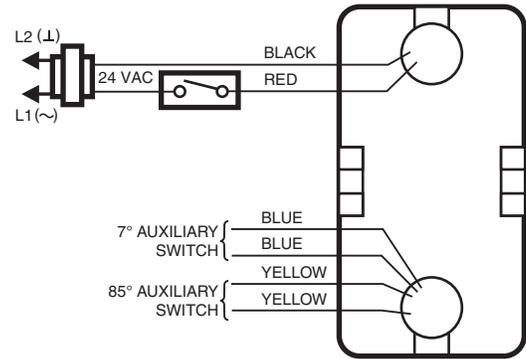
CAUTION

Electrical Shock or Equipment Damage Hazard. Low voltage can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

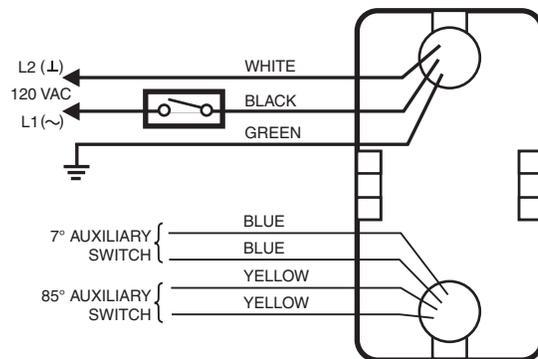
IMPORTANT

1. All wiring must comply with local electrical codes, ordinances and regulations.
2. Voltage and frequency of transformer must correspond with the characteristics of power supply and actuator.
3. Use wires rated for at least 75°C (167°F).
4. The conduit fittings are designed for use with 3/8 in. reduced-wall steel or aluminum flexible conduit.



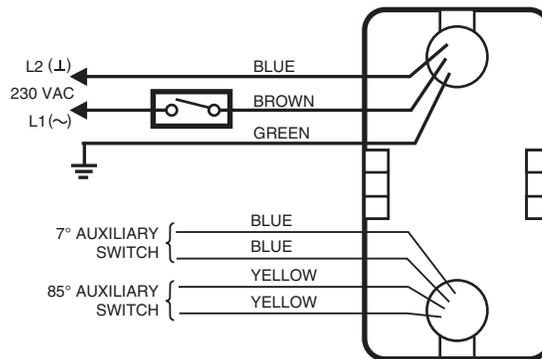
M34624

Fig. 3. Typical 24 Vac wiring.



M34625

Fig. 4. Typical 120 Vac wiring.



M34626

Fig. 5. Typical 230 Vac wiring.

OPERATION

The MS4104, MS4109, MS4604, MS4609, MS8104 and MS8109 DCA are designed for use in Smoke Control Systems. If power fails, the actuator spring returns to the 0° position. The actuator mounts flush with the damper box. The actuator drives from 0° to 95° and spring returns back to 0°.

The actuators are operated by an spst two-position controller. When using an spst two-position controller, the actuator drives to the damper fully open position when controller contact makes and spring returns to the damper fully closed position when controller contact breaks. The actuator drops to holding power level on detection of stall, independent of hub position.

Cycling

The actuator and the internal spring are designed so that no special cycling during long-term holding is required. Honeywell recommends following all local, state, and national codes for periodic testing of the entire smoke control system. Refer to National Fire Protection Association (NFPA) National Fire Codes®: NFPA90A, NFPA92A, and NFPA92B for your application.

NOTE: The actuator is designed to operate for 30 minutes during a one-time excursion to 350°F (176°C).

CHECKOUT

MS4104F, MS4109F (120 Vac model)

1. Check damper position.
2. Connect 120 Vac to the black and white leadwires to drive the damper to the open position. The actuator should drive the damper.
3. If the actuator does not spring return, verify that the actuator is properly installed. See Installation section.
4. If the actuator is correctly installed but neither runs nor spring returns, replace the actuator.

MS4604F, MS4609F (230 Vac model)

1. Check damper position.
2. Connect 230 Vac to the blue and brown leadwires to drive the damper to the open position. The actuator should drive the damper.
3. If the actuator does not spring return, verify that the actuator is properly installed. See Installation section.
4. If the actuator is correctly installed but neither runs nor spring returns, replace the actuator.

MS8104F, MS8109F (24 Vac model)

1. Check damper position.
2. Connect 24 Vac to the red and black leadwires to drive the damper to the open position. The actuator should drive the damper.
3. If the actuator does not spring return, verify that the actuator is properly installed. See Installation section.
4. If the actuator is correctly installed but neither runs nor spring returns, replace the actuator.

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63-2740-11 M.S. Rev. 02-18
Printed in United States

Pressure Drop Data

FSD-3xx, SMD-3xx, DFDAF-3xx

This pressure drop testing was conducted in accordance with AMCA Standard 500-D using the three configurations shown. All data has been corrected to represent standard air at a density of .075 lb/ft³(1.201 kg/m³).

Actual pressure drop found in any HVAC system is a combination of many factors. This pressure drop information along with an analysis of other system influences should be used to estimate actual pressure losses for a damper installed in a given HVAC system.

AMCA Test Figures

Figure 5.3 Illustrates a fully ducted damper. This configuration has 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 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 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.

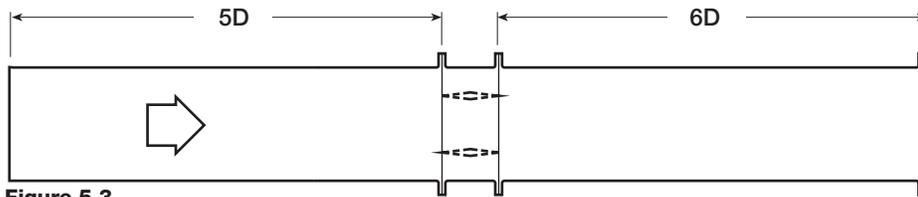


Figure 5.3

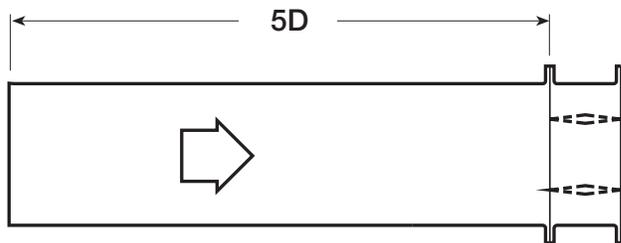


Figure 5.2

$$D = \sqrt{\frac{4(W)(H)}{3.14}}$$

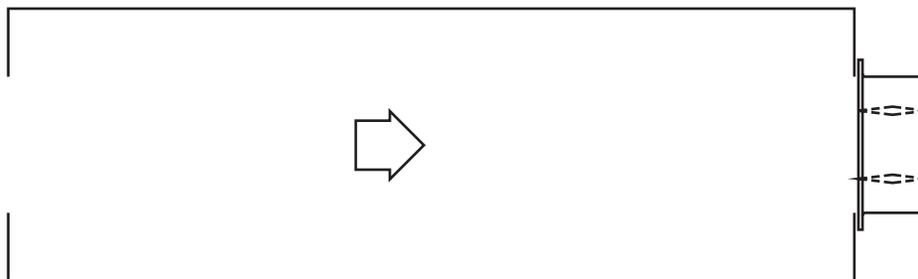
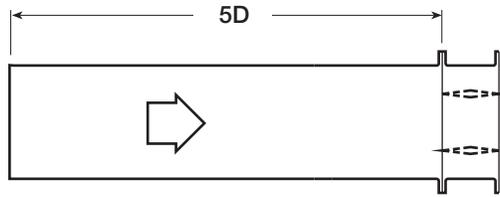


Figure 5.5

Pressure Drop

FSD-3xx, SMD-3xx, DFDAF-3xx

AMCA Figure 5.2



12 in. x 12 in. (305mm x 305mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.12
1500	0.26
2000	0.46
2500	0.72
3000	1.04
3500	1.41
4000	1.84

24 in. x 24 in. (610mm x 610mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.06
1500	0.12
2000	0.22
2500	0.34
3000	0.49
3500	0.67
4000	0.87

36in. x 36 in. (914mm x 914mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.06
1500	0.12
2000	0.22
2500	0.34
3000	0.49
3500	0.67
4000	0.88

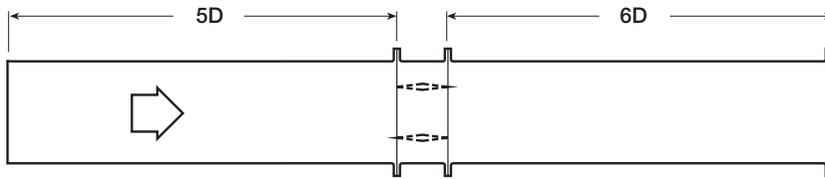
12in. X 48 in. (305mm x 1219mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.05
1500	0.12
2000	0.21
2500	0.33
3000	0.48
3500	0.65
4000	0.85

48 in. x 12 in. (1219mm x 305mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.02
1000	0.08
1500	0.18
2000	0.33
2500	0.51
3000	0.74
3500	1.00
4000	1.31

AMCA Figure 5.3



12 in. x 12 in. (305mm x 305mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.06
1500	0.13
2000	0.23
2500	0.37
3000	0.53
3500	0.73
4000	0.95

24 in. x 24 in. (610mm x 610mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.02
1500	0.06
2000	0.10
2500	0.16
3000	0.23
3500	0.32
4000	0.42

36in. x 36 in. (914mm x 914mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.02
1500	0.05
2000	0.09
2500	0.14
3000	0.21
3500	0.29
4000	0.38

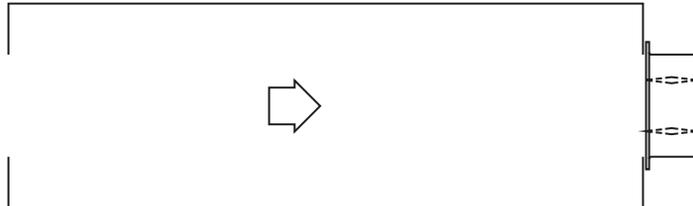
12in. X 48 in. (305mm x 1219mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.02
1500	0.06
2000	0.10
2500	0.16
3000	0.24
3500	0.33
4000	0.43

48 in. x 12 in. (1219mm x 305mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.04
1500	0.10
2000	0.18
2500	0.29
3000	0.42
3500	0.57
4000	0.74

AMCA Figure 5.5



12 in. x 12 in. (305mm x 305mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.04
1000	0.18
1500	0.42
2000	0.75
2500	1.17
3000	1.68
3500	2.29
4000	2.09

24 in. x 24 in. (610mm x 610mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.13
1500	0.29
2000	0.52
2500	0.81
3000	1.17
3500	1.60
4000	2.14

36in. x 36 in. (914mm x 914mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.12
1500	0.27
2000	0.48
2500	0.75
3000	1.08
3500	1.48
4000	1.93

12in. X 48 in. (305mm x 1219mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.12
1500	0.27
2000	0.49
2500	0.77
3000	1.11
3500	1.51
4000	1.97

48 in. x 12 in. (1219mm x 305mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.14
1500	0.32
2000	0.57
2500	0.89
3000	1.28
3500	1.75
4000	2.29



Greenheck Fan Corporation certifies that the model FSD-311, -311M, -312, -312M, -331, DFDAF-310, DFDAF-330, SMD-301, -302, -301M and SMD-302M 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 Programs. The AMCA Certified Ratings Seal applies to air performance ratings only.