THIS FORM MUST BE PRINTED TO A STATIC PDF FOR DISTRIBUTION

Yellow highlighted text will not appear in the printed document.

SUBMITTAL REVIEW

CLIENT NAME: Vails Gate Fire Department

PROJECT TITLE: Vails Gate FD - New Firehouse

SUBMITTAL No.: 233700-1 **H2M PROJECT No.:** VGFD2001

SUBMITTAL NAME: Air Inlets & Outlets PD

SUBMITTAL REVIEW

REVIEW IS FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS.
NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS
OF DIMENSIONS OR DETAILS

- [x] NO EXCEPTIONS TAKEN
- [ ] SUBMIT SPECIFIED ITEM
- [ ] MAKE CORRECTIONS NOTED (RESUBMISSION NOT REQUIRED)
- [ ] NO ACTION TAKEN (REVIEW IS THE RESPONSIBILITY OF ANOTHER PARTY)
- [ ] REVISE & RESUBMIT
- [ ] NO ACTION TAKEN (THIS SUBMITTAL IS NOT REQUIRED BY THE CONTRACT)
- [ ] REJECTED - SEE REMARKS
- [ ] RECEIVED FOR RECORD

Corrections or comments made on the shop drawings during this review do not relieve contractor from compliance with requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating their work with that of all other trades; and performing the work in a safe and satisfactory manner.

H2M architects + engineers

Date: 05/10/2023 By: MJV

Rev.: 2020-05-20

Comments:

Contractor to confirm quantities.

CONTRACTOR'S COMPANY NAME
ADDRESS

SUBMISSION TRANSMITTAL FORM
CLIENT NAME: Vails Gate Fire District
PROJECT TITLE: VGFD2001-New Firehouse

H2M PROJECT NO.: VGFD2001

Product, Item, or System Submitted:	Air Inlets & Outlets Product Data		
Submission Date:	5/9/2023	Submission Log No.:	233700-1
Specification Section:	233700	Paragraph Reference:	1.04/A-C
Contract Drawing Reference(s):			
Manufacturer's Name:			
Manufacturer's Mailing Address:			
Manufacturer's Contact Information:	*Name*	( ) *Tel. no.*	*Email*
Supplier's Name:	Joseph Lombardo Plumbing & Heating		
Supplier's Mailing Address:			
Supplier's Contact Information:	*Name*	( ) *Tel. no.*	*Email*
This item is a substitution for the specified item:		☑ No	☐ Yes
KEY CONSTRUCTION SERVICES, LLC **Project No: VGFD2001** Reviewed for General Acceptance Only. This review does not relieve the Subcontractors or Suppliers of responsibility for making the work conform to the requirements of the contract. The Subcontractor and Suppliers are responsible for all dimensions, correct fabrication and accurate fit with the work of other trades. **SUBJECT TO ARCHITECT AND OR ENGINEER APPROVAL** **Signed** *Joseph Manfredi*(PM) **Date: 5/9/2023** Contractor's Approval Stamp with Signature & Date		Contractor's Brief Comments or Remarks (attach separate letter as needed): By making this submission, we represent that we have determined and verified all field measurements and dimensions, field construction criteria, site and building constraints in terms of limitations in moving the item into the enclosed space, materials, catalog and model numbers and similar data and that we have checked and coordinated this submission with other work at or adjacent to the installed location in accordance with the requirements contained in the Contract Documents.	

END OF SECTION 013300

Joe Lombardo

Plumbing & Heating of Rockland, Inc.

LETTER OF TRANSMITTAL

321 Spook Rock Road
Suffern, NY 10901
Ph. 845-357-6537 Fx 845-357-8529
E: info@josephlombardo.com
Website: www.josephlombardo.com

Rockland Cty. Plumbing #1000 *Rockland Cty. Cooling # 1468*
Westchester Cty. Plumbing #460 *New Jersey State Plumbing #12702*

DATE:	JOB NO.
5-8-23	
ATTENTION: Joe Manfredi	
RE: Vails Gate Firehouse	

TO: Key Construction
4246 Albany Post Rd. Suite 1
Hyde Park, NY 12538

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

EMAIL	DATE	NO.	DESCRIPTION
1	5-8-23	233700	AIR INLETS AND OUTLETS AND FIR DAMPERS

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ No Exceptions Taken ☐ Resubmit _____ copies for review
☐ For your use ☐ Make Corrections Noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Rejected ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 20___ ☐ PRINTS RETURNED AFTER LOAN TO US

COPY TO: Joe Manfredi

SIGNED: Ronald J. Lombardo

RKB
SHEET METAL INC.
Commercial And Industrial Ductwork
15 ANACONDA DRIVE LAKE KATRINE, NY 12449
PHONE (845) 382-2010 FAX (845) 382-2019

SUBMITTAL COVER SHEET

SUBMITTAL FOR APPROVAL

SUMBITTAL DATE: 5/4/2023
SUBMITTED BY: MF
SUBMITTAL NO.: 3

PROJECT: VAILS GATE FD
NEW WINDSOR, NY

JOB No: 22-018

ARCHITECT: H2M ENGINEERS

ENGINEER:

CONTRACTOR: Joe Lombardo Plumbing & Heating of Rockland, Inc.

SPECIFICATION:

PRODUCT: FD & FSD

MANUFACTURER: Greenheck

VENDOR: Buckley Associates, Inc.

SUBMITTAL

Job Name: **VAILS GATE FIREHOUSE & Storage**

Engineer: H2M Engineers
Contractor: RKB Sheet Metal
Elevation: (ft) 292
Date: 4/07/2023
Submitted By: Mark Schroeder

BUCKLEY ASSOCIATES INC
120 RAILROAD AVE
ALBANY, NY 12205
US
Phone: (518)438-7423
Fax: (518)438-5527
Email Address: mschroeder@buckleyonline.com

FD-150 FD-150: 1 1/2 hour static rated fire damper

APPLICATION & DESIGN

Model FD-150 is approved for use in walls, floors and partitions with fire resistance ratings less than 3 hours. UL 555 classifies static rated fire dampers for use in HVAC that automatically shut down in the event of a fire.

DAMPER RATINGS

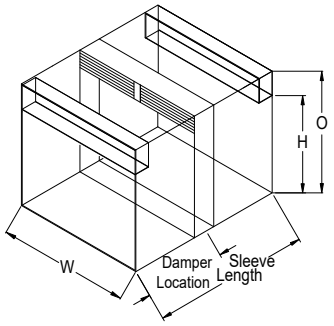
Fire Rating: 1½ hours

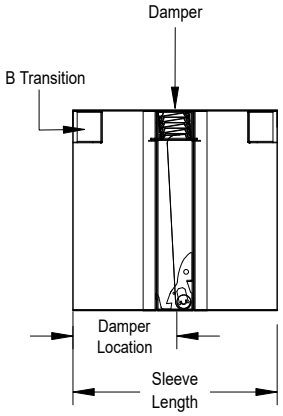
PRODUCT DETAILS

Frame:	Galvanized Steel
Frame Depth:	3.688
Blade:	Galvanized Steel
Closure Device:	Fusible Link
Closure Temp:	165 F
Sizing:	Nominal

OPTIONS & ACCESSORIES

Transition:	B
Transition Location:	Both Sides
Retaining Angle Type:	2-Side Loose
Retaining Angle Size:	Minimum UL
Union Label:	No Preference





• This drawing shows a general damper configuration and is not intended to depict the exact configuration of all dampers in this submittal.
• Damper is furnished approximately 0.250 in. undersize. (Add sleeve thickness for overall sleeved damper dimension)
• Installation instructions available at www.greenheck.com.

CODES APPROVED

This model meets the requirements for fire dampers established by:
• UL Classfied (U.S. and Canada) Standard UL 555 (Listing #R13317)
• National Fire Protection Association NFPA Standard 80,90A & 101
• IBC: International Building Codes
• California State Fire Marshal: CSFM listing # 3225-981:102

SUMMARY

ID #	TAG	QTY	Width	Height	CONFIGURATION			
9-1		1	18.000 in.	6.000 in.	Sections Wide: 1	Sections High: 1	"O" Dim: 8.000 in.	Sleeve Length: 12.000 in.
					Sleeve Thickness: 20 ga	Damper Location: 6.000 in.	Mounting: Vertical	

FD-150 FD-150: 1 1/2 hour static rated fire damper

APPLICATION & DESIGN

Model FD-150 is approved for use in walls, floors and partitions with fire resistance ratings less than 3 hours. UL 555 classifies static rated fire dampers for use in HVAC that automatically shut down in the event of a fire.

DAMPER RATINGS

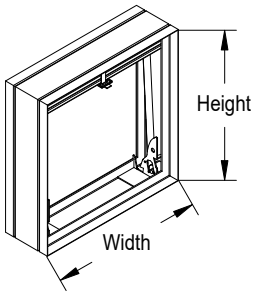
Fire Rating: 1½ hours

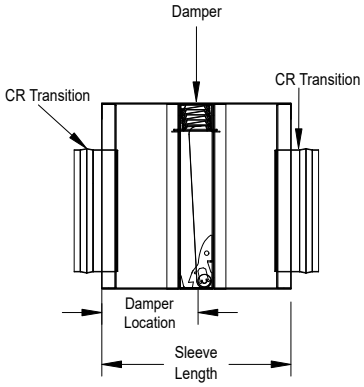
PRODUCT DETAILS

Frame:	Galvanized Steel
Frame Depth:	3.688
Blade:	Galvanized Steel
Closure Device:	Fusible Link
Closure Temp:	165 F
Sizing:	Nominal

OPTIONS & ACCESSORIES

Transition:	CR
Transition Location:	Both Sides
Retaining Angle Type:	2-Side Loose
Retaining Angle Size:	Minimum UL
Union Label:	No Preference





Damper Width = Diameter + 2 in.
or 5 in. minimum
Damper Height = "O" Dimension

• This drawing shows a general damper configuration and is not intended to depict the exact configuration of all dampers in this submittal.
• Damper is furnished approximately 0.250 in. undersize.
(Add sleeve thickness for overall sleeved damper dimension)
• Installation instructions available at www.greenheck.com.

CODES APPROVED

This model meets the requirements for fire dampers established by:
• UL Classfied (U.S. and Canada)
Standard UL 555 (Listing #R13317)
• National Fire Protection Association
NFPA Standard 80,90A & 101
• IBC: International Building Codes
• California State Fire Marshal: CSFM listing # 3225-981:102

SUMMARY

ID #	TAG	QTY	Diameter	CONFIGURATION			
10-1		4	4.000 in.	Sections Wide: 1	Sections High: 1	"O" Dim: 7.000 in.	Sleeve Length: 12.000 in.
				Sleeve Thickness: 20 ga	Damper Location: 6.000 in.	Mounting: Vertical	

FSD-212 Combination Fire Smoke Damper

APPLICATION & DESIGN

Model FSD-212 is a combination fire smoke damper with 3V style blades. This model is designed for operation and dynamic closure in emergency fire smoke situations. It is rated for airflow and leakage in either direction. The FSD-212 may be installed horizontally or vertically (with blades running horizontally).

DAMPER RATINGS

UL 555 Fire Resistance Rating

Fire Rating:	1 1/2 hours
Dynamic Closure Rating:	Actual ratings are size dependent
Velocity:	Up to 2,000 ft/min
Pressure:	6 in. wg

UL 555S Leakage Rating

Leakage Class:	II
Operational Rating:	Actual ratings are size dependent
Velocity:	Up to 2,000 ft/min
Pressure:	Up to 6 in. wg
Temperature:	Up to 350 F depending on actuator

PRODUCT DETAILS

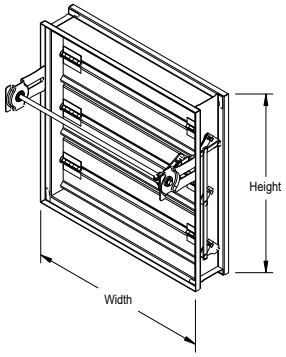
Frame Type:	Channel
Frame Thickness:	16 ga
Closure Device:	RRL / OCI
Closure Temperature:	165 F
Blade Action:	Parallel
Blade Seal:	Silicone
Axle/Linkage Material:	Steel
Axle Bearings:	316 SS
Sizing:	Nominal

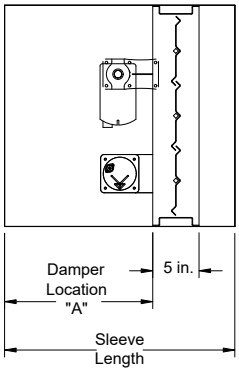
ACTUATOR INFORMATION

Actuator Type:	24 VAC
Operating Mode:	Two Position
Actuator Operation:	Spring Return
Fail Position:	Closed
Time Cycle:	Standard
Operating Temperature:	350 F
Velocity:	2,000 ft/min
Pressure:	4 in. wg
Auxiliary Switches:	Yes
NEMA Enclosure:	1

OPTIONS & ACCESSORIES

Retaining Angle Type:	2-Side Loose
Retaining Angle Size:	Minimum UL
Union Label:	No Preference





• 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.

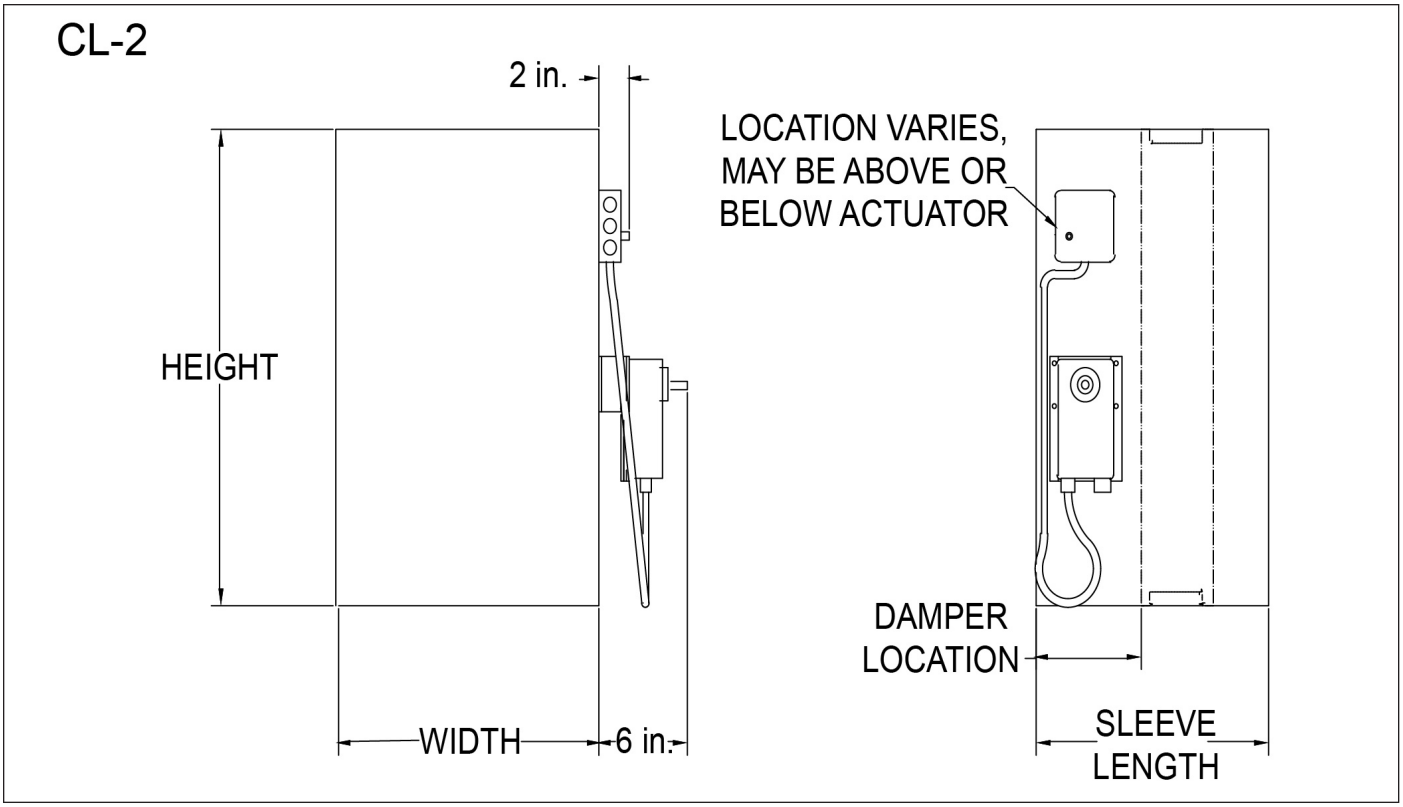
CODES APPROVED

Model FSD-212 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)

SUMMARY

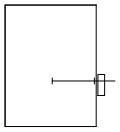
ID #	TAG	QTY	Width	Height	CONFIGURATION			
11-1		1	10.000 in.	6.000 in.	Compact Configuration: No	Actuator Contained: No	Actuator Mounting: External	Actuator Location: Right Side
					Drive Arrangement: Drive-MLS-11-1FER-1	Actuator Mfr: Belimo	Actuator Model: FSLF24-S	Actuator Qty: 1
					Act. Orientation: Perp Down	Sleeve Length: 21.000 in.	Sleeve Thickness: 20 ga	Damper Location: 12.000 in.
					Mounting: Vertical	Component Location Code: CL-2		

COMPONENT LOCATIONS



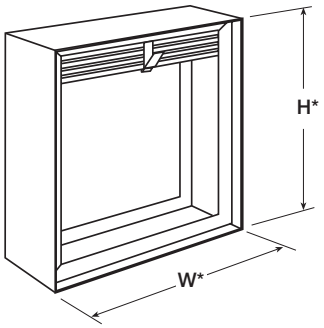
Damper Drive Arrangements Job Summary -Start-

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

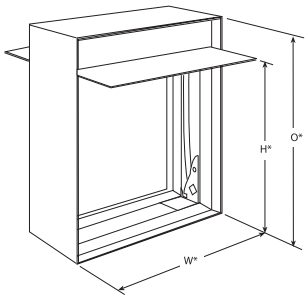


Damper Drive Arrangements Job Summary -End-

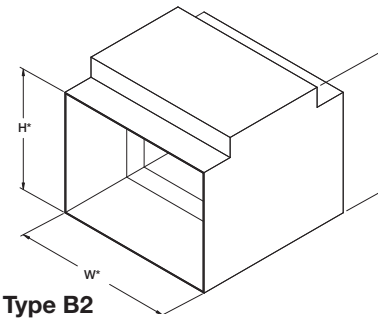
Transitions for Curtain Fire Dampers



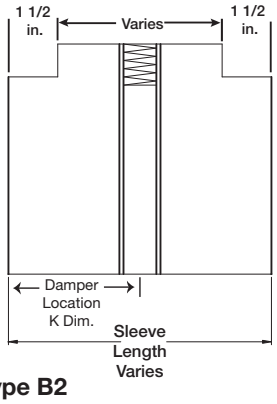
Type A



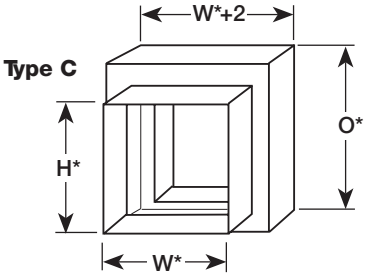
Type B

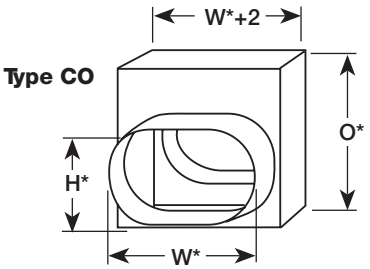


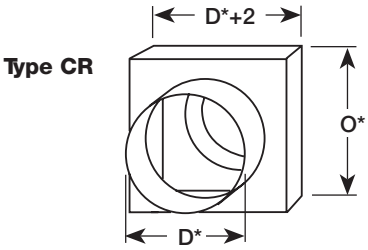
Type B2

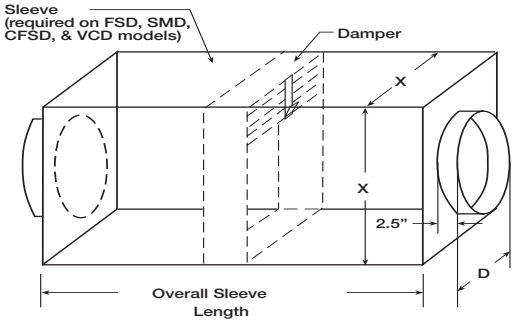


Type B2









Type R

POC Retaining Angle

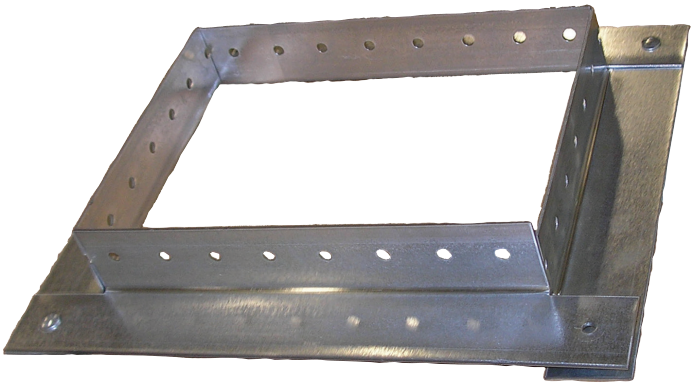
Application

Greenheck's one piece retaining angle, the POC (literally named for being a "Piece of Cake") makes damper installation a breeze. The POC angle is designed by fastening four pieces together to form one piece. When installed the angles simply wraps around the sleeve of the damper and is fastened in place.

Retaining angles for 1½ hour rated fire and combination fire smoke dampers witha width ad height 48 in. (1219mm) or less must be a minimum of 20 ga. (1mm) steel. Retaining angles for all 3 hour rated dampers and all dampers with a width or height greater than 48 in. (1219mm) must be a minimum of 16 ga. (1.5mm).

If the damper width plus damper height is less than or equal to 44 inches (1117mm), then the POC angles ship in one piece. If damper width plus damper height is greater than 44 in. (1117mm), the POC angle ships in two pieces.

The POC retaining angles meets the requirements of UL 555 and UL 555S.



Retaining angle as shipped from the factory.

The four sides are connected together by rivets in three corners allowing for easy installation.

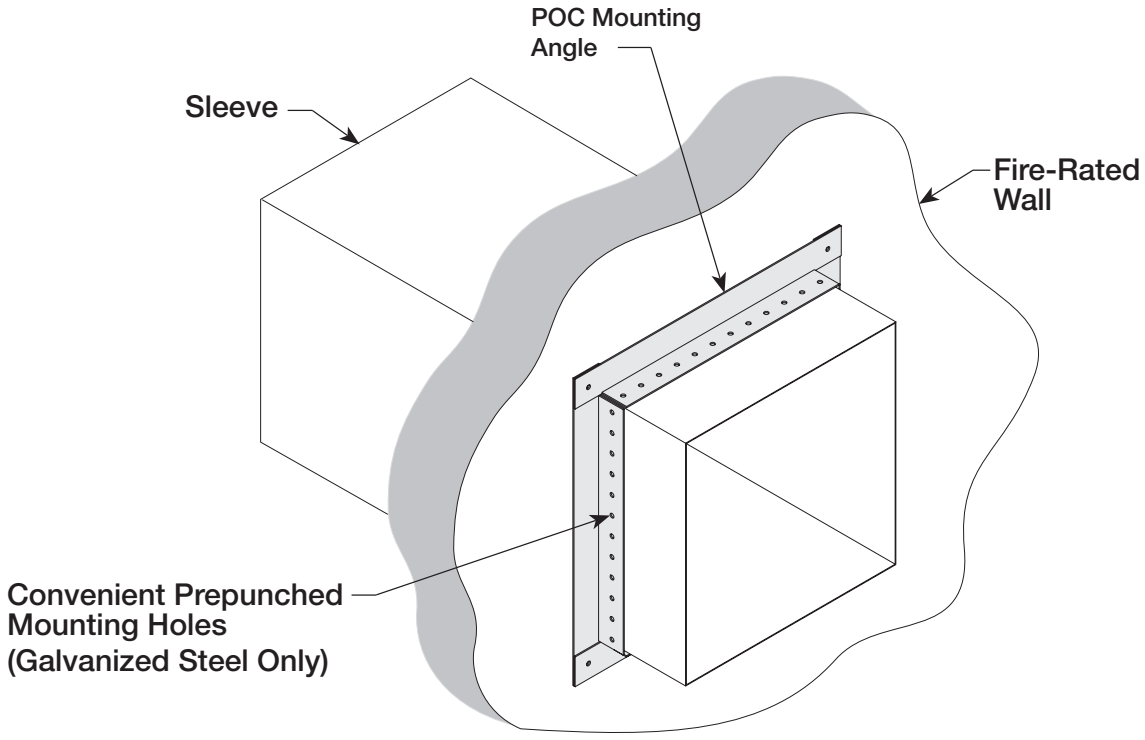
Construction

Material

20 ga. (1mm) or 16 ga. (1.5mm) galvanized steel

Sizes

1½ in. x 1¼ in. (38mm x 32mm) or 2½ x 1½ in. (64mm x 38mm) for sizes greater than 48 inches (1219mm)



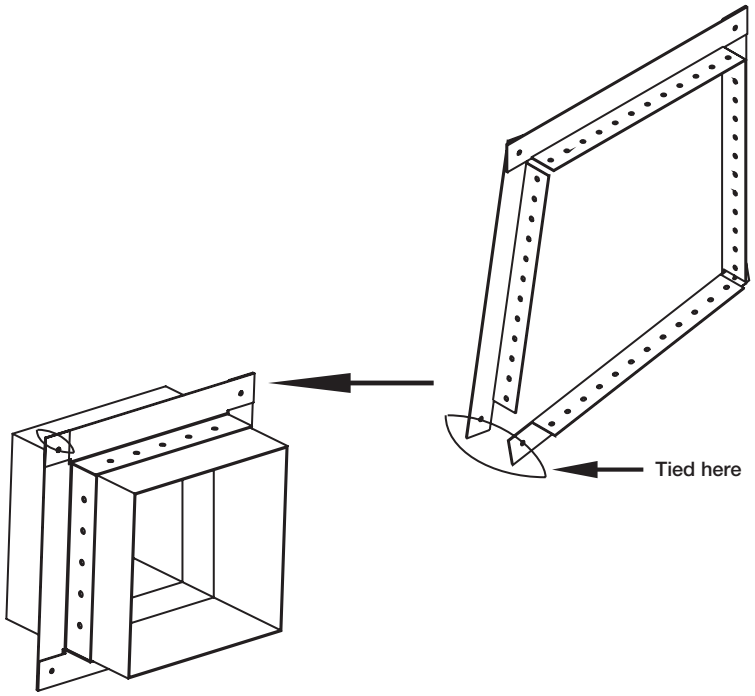
Retaining angle as mounted in the field.

The POC angle wraps around the sleeve. The factory provides prepunched mounting holes to further simplfy installation.

SS retaining angles are provided without prepunched mounting holes.

Available Retaining Angle Options:

- **Loose** - Angle(s) ships unattached to the damper. (DFD series , FD Series, FSD series, VCD series)
- **Wrapped** - Angle is wrapped around the damper sleeve and tied together. (DFD series , FD Series, FSD series)



GREENHECK
P.O. Box 410 • Schofield, WI 54476-0410 • 715.359.6171 • greenheck.com

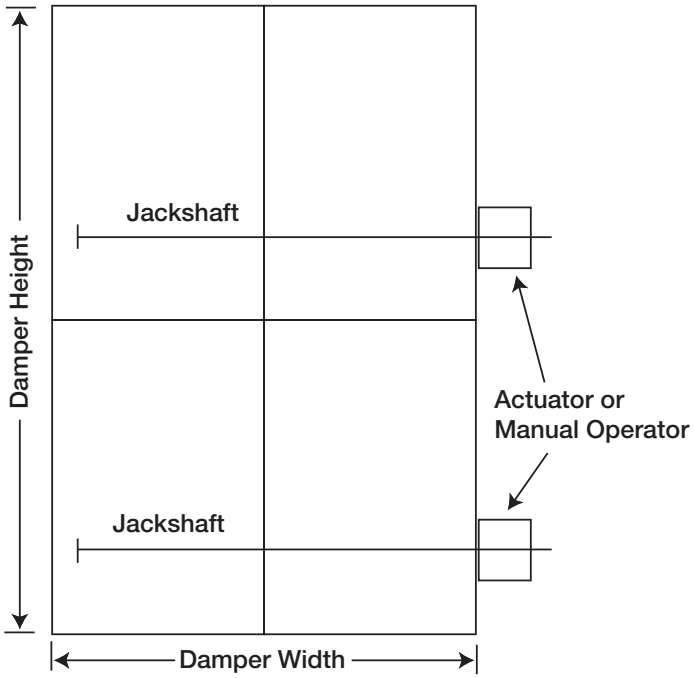
Drive Arrangement Definition

Actuator driven dampers are supplied with a drive arrangement code that helps describe the configuration of the damper. The following breaks down what each number and letter represents.

22-2FER-2

1 2 3 4 5 6 7

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



Each damper is supplied with a Drive Arrangement Prefix to help describe its construction. See the following examples:

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

RRL/OCI

Resettable Link Option with Blade Indicator for Combination Fire Smoke Dampers

Application

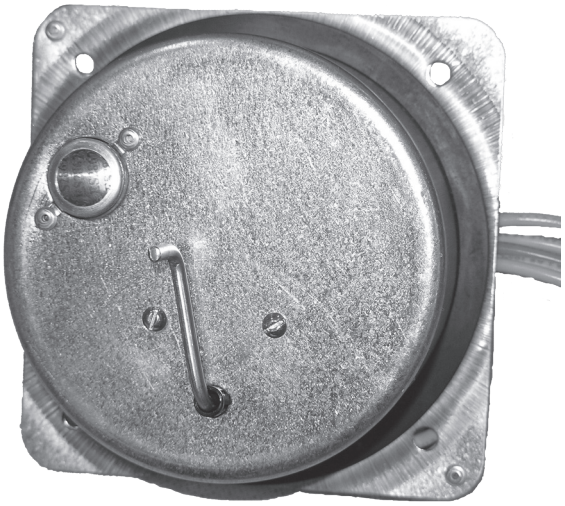
The RRL/OCI is a closure and position indication device for combination fire smoke dampers. It combines the functionality of a resettable, reusable link (RRL) with an open or close blade indicator (OCI).

The RRL device includes an electric sensor (thermostat) with a fixed temperature the specified temperature is reached, the sensor interrupts power to the actuator which causes the internal spring return mechanism to close the damper. The RRL can be reset after the temperature has cooled down below the sensor set point. The following temperature setting options are available for the RRL: 165°F (74°C), 212°F (100°C), 250°F (121°C) or 350°F (177°C).

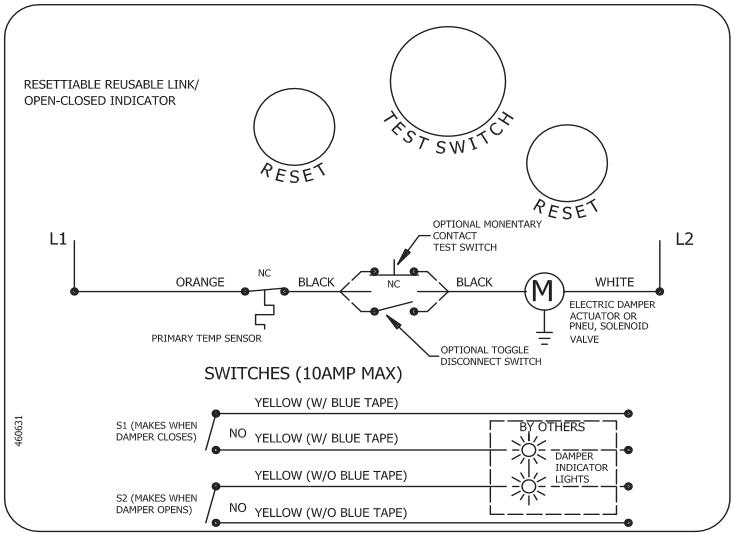
Note that available temperature setting options are dependent on damper ratings. Before resetting any sensor, a careful inspection of the damper and sensor should be made as exposure to actual fire conditions may render these devices unusable.

The OCI assembly contains two single pole, single throw switches that are used to indicate damper blade position. One switch provides a positive signal when the damper blades are in the open position, while the other switch provides a positive signal when the damper is closed. These switches can be used in conjunction with remote indicator lights or a building automation system (furnished by others) to monitor damper blade position from a remote location. The OCI is commonly used in active smoke control applications to positively indicate the status of all smoke and combination fire smoke dampers in a building. The single pole, single throw switch assembly may also be used to provide a start/stop control circuit for remote fan installations.

Note that in order to meet UL requirements, factory installation of the damper actuator and factory wiring of the electric sensor is required.



Temperature	Assembly Number	Field Kit Number
165°F (74°C)	820733	852291
212°F (100°C)	821277	-
250°F (121°C)	824673	-
350°F (177°C)	824674	852468



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RRL/OCI Option, R7, April 2022

FSLF24-S-FC US

On/Off, Spring Return, 350°F for a Half Hour, 15 Seconds Cycle Time

5 YEAR WARRANTY

LISTED 94 D5 TEMP. IND. & REG. EQUIP. c UL us

Fire & Smoke damper actuator

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.

IMPORTANT 24VDC NOTE: The FSLF24 & -S models will not operate below 24VDC. A filtered and regulated power supply must be used.

Operation

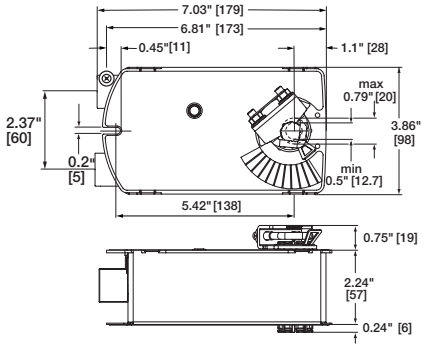
Mounting of the actuator to the damper axle shaft or jackshaft is via a cold-weld clamp. Teeth in the clamp and V-bolt dig into the metal of both solid and hollow shafts maintaining a perfect connection. The specially designed clamp will not crush hollow shafts. The bottom end of the actuator is held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

Technical Data	
Power Supply	24 VAC, ±10%, 50/60 Hz, 24 VDC, -0% / +50%
Power consumption in operation	15 VA
Power consumption in rest position	2.5 W, 3.5 VA, End stop 25 VA, 1 A slow blow fuse *
Transformer sizing	24 VA (class 2 power source)
Shaft Diameter	3/8" to 1/2" round, centers on 1/2"
Electrical Connection	3 ft [1 m], 18 GA, 2 color coded leads
Overload Protection	electronic throughout 0° to 95° rotation
Electrical Protection	actuators are double insulated
Angle of rotation	95°
Torque motor	30 in-lb [3.5 Nm] from 32...350°F [0...177°C]
direction of rotation motor	reversible with CW/CCW mounting
direction of rotation spring-return	reversible with CW/CCW mounting
Position indication	visual indicator, 0° to 95° (0° is full spring return position)
Running time motor	<15 sec at rated voltage and torque 32...122°F [0...50°C]
Running time emergency control position	<15 sec
Ambient humidity	5 to 95% RH non-condensing
Ambient temperature	32...122°F [0...50°C]
Non-operating temperature	-40...176°F [-40...80°C]
Degree of Protection	IP30, NEMA 1
Housing material	zinc coated steel
Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, Listed to UL 2043 - suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC. NYC Department of Buildings MEA 197-07-M California State Fire Marshal Listing 3210-1593:102
Noise Level (Fail-Safe)	45 dB (A) motor, 62 dB (A) spring, inaudible holding
Maintenance	maintenance free
Quality Standard	ISO 9001
Weight	4.2 lb [1.9 kg]
Auxiliary switch	2 x SPST, 3A resistive (0.5A inductive) @ 250 VAC, one set at 10°, one set at 85°

† UL File XAPX.E108966

Dimensions (Inches[mm])



Safety Notes

* Neither UL nor Belimo require individual fusing of FSLF actuators. The FSLF draws higher peak current when driving against its end stop or any other type of stop. Given the technology of fuses & breakers, this requires the value of fuse or breaker to be increased to avoid nuisance opening or tripping. A 1 amp slow blow should be used for 24VAC. A 0.25 amp slow blow should be used for 120VAC. A .125 amp slow blow should be used for 230V.

SAFETY NOTES

Wiring and installation must comply with all local electrical and mechanical codes.

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

Cables are not plenum rated and require flex conduit.

1/2" Threaded Connector: Screw a conduit fitting into the actuator's metal bushing. Jacket the actuator's input wiring with suitable fl exible conduit. Properly terminate the conduit in a suitable junction box.

3/8" Flex Connector (-FC models): Mount the flexible conduit into the actuator's metal bushing by means of the provided screw with a torque of 1.2 Nm. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

FSLF24-S-FC US

On/Off, Spring Return, 350°F for a Half Hour, 15 Seconds Cycle Time

Accessories

---BAE165 US	165° F electric thermal sensor, SPST, normally closed.
---S2A-F US	Auxiliary switch, 2x SPDT, 3A (0.5A inductive) @250 VAC max.

Typical Specification

All smoke and combination fire and smoke dampers shall be provided with Belimo FSTF, FSLF, FSNF, or FSAF actuators. All substitutions must be approved before submission of bid. Damper and actuator shall have UL 555S Listing for 250°F (350°F). Actuator shall have been tested to UL 2043 per requirements of IMC 602.2 and NEC 300.22 (c). Where position indication is required -S models with auxiliary switches or damper blade switches will be provided per code requirements.

Wiring Diagrams

APPLICATION NOTES

1 Provide overload protection and disconnect as required.

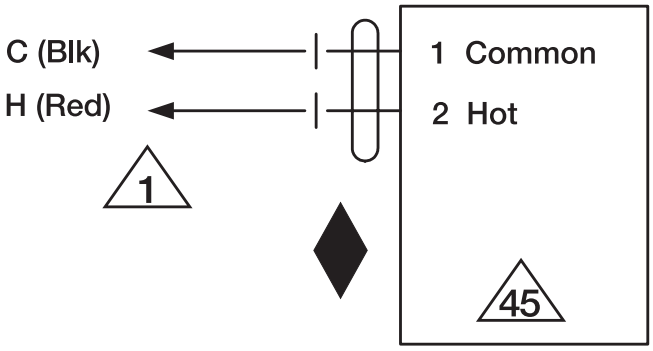
45 Actuators may be powered in parallel. Power consumption must be observed.

72 S4 makes to S6 when actuator is powered open.

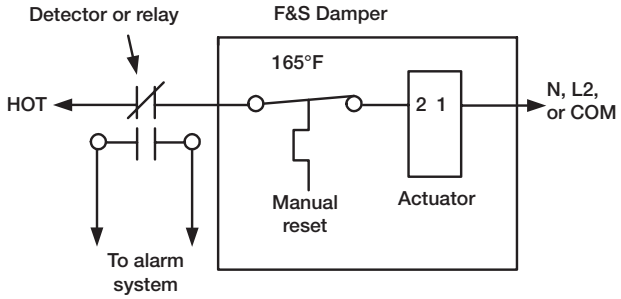
73 Auxiliary switches are for end position indication or interlock control.

74 Double insulated.

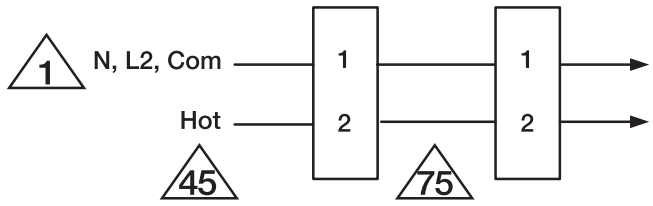
75 Ground present on some models.



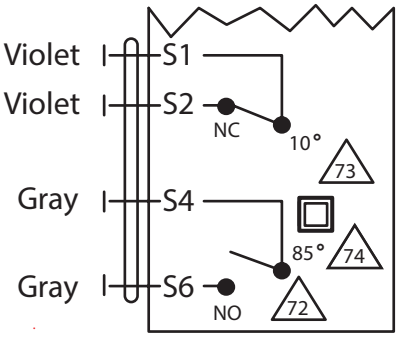
24 VAC



Typical containment damper control wiring



Parallel Actuator Wiring



Auxiliary Switch Wiring

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/ft^3(1.201 kg/m^3).

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.

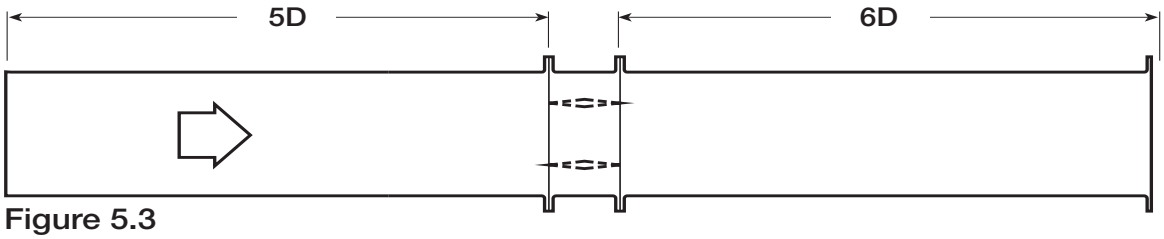


Figure 5.3

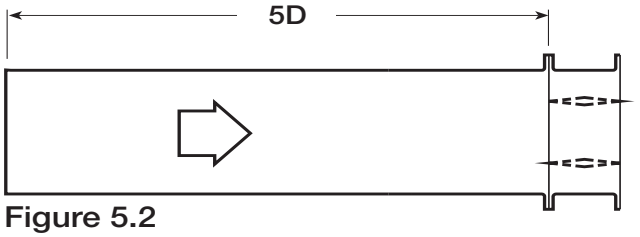


Figure 5.2

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

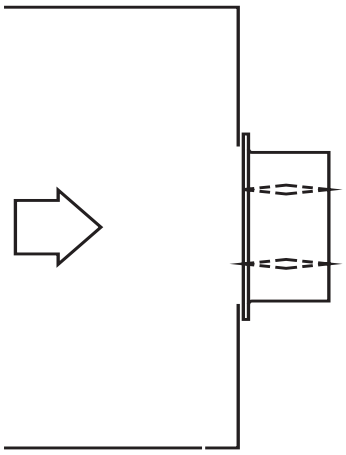


Figure 5.5

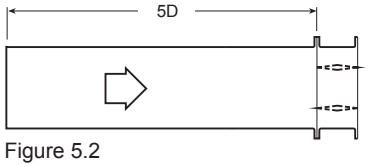


Figure 5.2

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.04
1000	0.14
1500	0.31
2000	0.55
2500	0.86
3000	1.24
3500	1.69
4000	2.20

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.02
1000	0.07
1500	0.16
2000	0.29
2500	0.45
3000	0.65
3500	0.89
4000	1.16

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.04
1500	0.09
2000	0.16
2500	0.25
3000	0.36
3500	0.49
4000	0.64

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.06
1500	0.13
2000	0.23
2500	0.36
3000	0.52
3500	0.70
4000	0.92

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.10
1500	0.23
2000	0.41
2500	0.63
3000	0.91
3500	1.24
4000	1.62

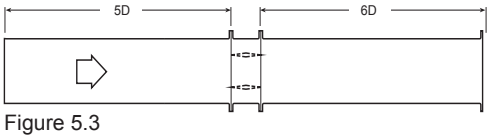


Figure 5.3

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.02
1000	0.09
1500	0.20
2000	0.36
2500	0.56
3000	0.81
3500	1.10
4000	1.44

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.04
1500	0.09
2000	0.16
2500	0.25
3000	0.35
3500	0.48
4000	0.63

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.03
1500	0.06
2000	0.11
2500	0.17
3000	0.24
3500	0.33
4000	0.42

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.04
1500	0.10
2000	0.17
2500	0.27
3000	0.39
3500	0.53
4000	0.70

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.02
1000	0.07
1500	0.16
2000	0.29
2500	0.45
3000	0.64
3500	0.88
4000	1.14

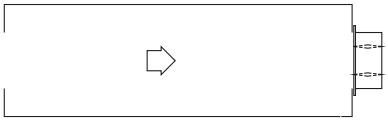


Figure 5.5

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.06
1000	0.22
1500	0.50
2000	0.89
2500	1.39
3000	2.00
3500	2.72
4000	3.55

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.14
1500	0.31
2000	0.54
2500	0.85
3000	1.22
3500	1.66
4000	2.17

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.12
1500	0.26
2000	0.46
2500	0.73
3000	1.05
3500	1.42
4000	1.86

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.13
1500	0.30
2000	0.53
2500	0.83
3000	1.19
3500	1.62
4000	2.11

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.04
1000	0.17
1500	0.38
2000	0.67
2500	1.04
3000	1.50
3500	2.05
4000	2.67

Greenheck Fan Corporation certifies that the model CFSD-211, CFSD-212; DFD-210, 230; DFDTF-210; SEDFD-210; FSD-211, 211M, 212, 213, 231, 311, 311M, 312, 312M, 331; SSFSD-211, SEFSD-211, OFSD-211, 212, 311, 312; SMD-201, 201M, 202, 203, 301, 302, 301M, 302M, SESMD-201 and SSSMD-201shown 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.

RKB
SHEET METAL INC.
Commercial And Industrial Ductwork
15 ANACONDA DRIVE LAKE KATRINE, NY 12449
PHONE (845) 382-2010 FAX (845) 382-2019

SUBMITTAL COVER SHEET

SUBMITTAL FOR APPROVAL

SUMBITTAL DATE: 5/4/2023
SUBMITTED BY: MF
SUBMITTAL NO.: 2

PROJECT: VAILS GATE FD
NEW WINDSOR, NY

JOB No: 22-018

ARCHITECT: H2M ENGINEERS

ENGINEER:

CONTRACTOR: Joe Lombardo Plumbing & Heating of Rockland, Inc.

SPECIFICATION: 15936H

PRODUCT: LOUVERS & DAMPERS

MANUFACTURER: Greenheck

VENDOR: Buckley Associates, Inc.

SUBMITTAL

Job Name: **VAILS GATE FIREHOUSE & Storage**

Engineer: H2M Engineers
Contractor: RKB Sheet Metal
Elevation: (ft) 292
Date: 4/07/2023
Submitted By: Mark Schroeder

BUCKLEY ASSOCIATES INC
120 RAILROAD AVE
ALBANY, NY 12205
US
Phone: (518)438-7423
Fax: (518)438-5527
Email Address: mschroeder@buckleyonline.com

ESD-635 6 in. Frame, 35 deg Blade

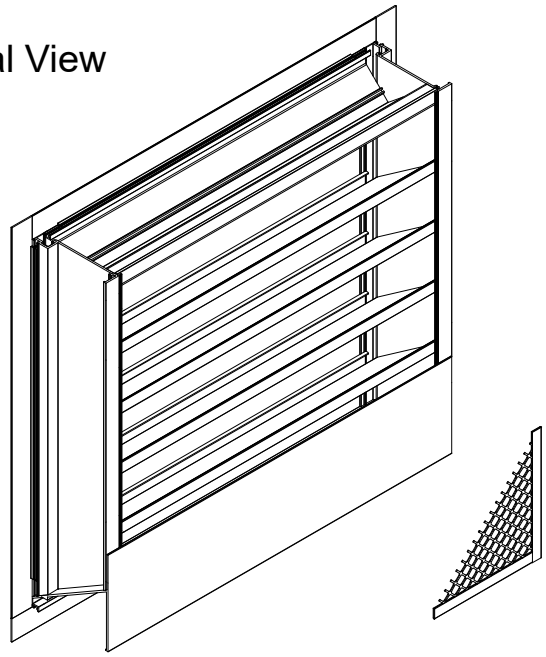
APPLICATION & DESIGN

ESD-635 is a weather louver designed to protect air intake and exhaust openings in building exterior walls. Design incorporates drain gutters in the head member and horizontal blades to channel water to the jambs where water is further channeled through vertical downspouts and out at the sloped sill. The ESD-635 is an extremely efficient louver with AMCA LICENSED PERFORMANCE DATA enabling designers to select and apply with confidence.

PRODUCT DETAILS

Frame: 6 in. x 0.081 in. Frame Thickness
Frame Type: Flanged, 1.5 in., Exterior
Blades: 0.081 in. Fixed Blade Thickness
Material: Aluminum
Sizing: 1/4 Inch Under
Shape: Rectangular
Construction: Mechanically Fastened

Internal View



OPTIONS & ACCESSORIES

Finish: Painted
Finish Performance: AAMA 2605
Coating Type: 2Ct 70%Kynar/100%Fluoropolymer
Color: Standard TBS
Bird Screen: 0.75 in. x 0.05 in., Flat Expanded Aluminum, Internal, Mill Finish
Union Label: No Preference
Warranty: 1 year Standard Product Warranty
10 year Standard Finish Warranty

SUMMARY

ID #	TAG	QTY.	W (in.)	H (in.)	FREE AREA (ft2)	FREE AREA (%)	SECT. WIDE	SECT. HIGH	SHIP SECT.
1-1	LV-1	1	72	24	5.80	49	1	1	1
1-2	LV-2	1	72	24	5.80	49	1	1	1
1-3	LV-3	1	72	24	5.80	49	1	1	1
1-4	LV-5	1	30	36	4.08	55.2	1	1	1

Total Louver Qty: 4 **Total Weight (lb):** 169 **Louver Area (ft2):** 44

Total Ship Sect.: 4

**Weight shown is an estimate only based on the default base product configuration without options or accessories.

Larger openings may require field assembly of multiple louver panels to make up the overall opening size. Individual louver panels are designed to withstand windloads up to a maximum of 25 PSF (size and configuration dependent). Design, materials and installation of structural reinforcement required to adequately support large sections or multiple section assemblies within a large opening are not provided by Greenheck. Options and accessories including, but not limited to, screens, filter racks, louver doors, and blankoff panels are not subject to structural analysis unless indicated otherwise by Greenheck. Unless specifically indicated, the following are NOT included in the quote provided: structural steel, installation hardware (anchors, angle clips, continuous angles, shims, fasteners, inserts, backer rod and sealant), field measuring and/or installation, miscellaneous flashing, trim or enclosures, blank off panels, mullion covers or mullion hardware, hinged frames or removable subframes, custom bird/insect screen, 3-coat, metallic and/or exotic paint finishes, bituminous paints for unlike metals, any applicable taxes, stamped and sealed structural calculations seismic calculations or job specific engineered submittal drawings.

Louvers Product Limited Warranty

Thank you for purchasing Greenheck louvers. Greenheck warrants this equipment to be free from defect in material and workmanship for a period of **1 year** from the date of product shipment. Any units or parts, which prove defective during the warranty period, will be repaired, or replaced at our option when returned to our factory, transportation prepaid. Unless agreed upon otherwise Greenheck will not be held responsible for costs associated with removal or installation of product(s).

The legal remedies described in this Limited Warranty are the sole exclusive remedy of Customer. This limited warranty will be void if payment from Customer is not received within a commercially reasonable time frame. GREENHECK MAKES NO OTHER WARRANTY, EITHER EXPRESS OR IMPLIED, REGARDING ITS PRODUCTS, OR ITS SELECTION AND APPLICATION, INCLUDING, BUT NOT LIMITED TO, COMPLIANCE WITH BUILDING CODES, SAFETY CODES, LAWS, MERCHANTABILITY OR FITNESS OR A PARTICULAR PURPOSE. This limited warranty is extended solely to the Customer. It is nontransferable and non-assignable, and the Customer shall not permit or authorize its employees, agents, representatives, or customers to claim, represent or imply that this limited warranty extends or is available to anyone other than the Customer.

In the event of material breach by the Customer of any of the conditions of this warranty, Greenheck shall have no liability for and product failure claims.

Failure to pay Greenheck in full for original services will automatically make this warranty null and void.

Greenheck will not be held liable for incidental or consequential damages of any kind. The limited warranty of product(s) replaced or repaired under this limited warranty shall be limited to the remainder of the original warranty period. Greenheck reserves the right to reasonable field access to diagnose and repair any product alleged to be defective. This limited warranty may not be modified by anyone and may not be changed by such things as purchase order forms or acceptance forms, unless otherwise agreed upon by Greenheck.

This limited warranty is provided in lieu of any other warranty requirements or obligations, including, but not limited to, those within project specifications.

All notices and claims given under or pursuant to this agreement shall be in writing and sent by certified or registered mail, postage prepaid, return receipt requested to: Greenheck, Attn: Louver Sales, 525 Western Road, Schofield, WI 54476.

By proceeding to use our products and services on your project, you accept the terms of these limited warranties.

Louvers Architectural Finish Limited Warranty

70% Kynar / 100% Fluoropolymer Paint
Greenheck warrants the finish of 70% Kynar / 100% Fluoropolymer paint for a period of **10 years** from the date of product shipment when applied to aluminum louvers or aluminum architectural products. Greenheck warrants that for **10 years** after the date of product shipment the applied finish:

A) Will not chip, crack, or peel (lose adhesion) but does not include minute fracturing, which may occur in proper fabrication of building parts.
B) Will not chalk in excess of ASTM D-4214-89 number 8 rating, determined by the procedure outlined in ASTM D-4214-89 specification test.
C) Will not change color more than five (5) Delta-E Hunter units (square root of the sum of Delta L, Delta A and Delta B) as determined by ASTM method D-2244. It is acknowledged that fading or color changes may not be uniform if the surfaces are not equally exposed to the sun and elements.

Metallic and Mica colors are exempt in the warranty from item C but will hold the L value within 5 Delta E or the L scale of the Hunter E unit system.

Exotic colors will receive a full 10 year warranty if they have the recommended clear coat applied. However, Exotic colors are excluded from the 20 year warranty.

Any units or parts, which prove defective during the warranty period, will be repaired or replaced at our option when returned to the factory, transportation prepaid. Unless agreed upon otherwise Greenheck will not be held responsible for costs associated with installation or removal of product(s).

Greenheck limited warranties are not applicable when failure is caused by events that cannot be controlled by Greenheck. These include, but are not limited to, Acts of God, fire or other casualty or physical damage; Government restrictions; Acts of aggression; Harmful fumes or foreign substances in the atmosphere; Improper storage or packaging of the parts prior to installation; Product failure due to improper usage and/or application; Failure to provide reasonable and routine maintenance and/or improper maintenance, including, but not limited to the use of chemical cleaning agents not in accordance with AAMA recommendations or failure to use a systematic maintenance cleaning program in areas of high salt concentration; Corrosive atmosphere found in the interior of buildings, which effect the interior surface of material; Standing or ponding water on the metal; Excessive building movements; Work performed or materials supplied by others; Improper treatment of finished material; Corrosion of the metal substrate; Incompatibility between materials, including, but not limited to, Galvanic corrosion due to contact with adjacent dissimilar metals such as stainless steel; Damage to the painted metal occasioned by moisture or other contamination detrimental to the finish because of improper storage of the finished metal prior to installation as outlined in AAMA Publication 10, “Care and handling of Architectural Aluminum From Shop to Site."

The legal remedies described in this Limited Warranty are the sole exclusive remedy of Customer. This limited warranty will be void if payment from Customer is not received within a commercially reasonable time frame. GREENHECK MAKES NO OTHER WARRANTY, EITHER EXPRESS OR IMPLIED, REGARDING ITS PRODUCTS, OR ITS SELECTION AND APPLICATION, INCLUDING, BUT NOT LIMITED TO, COMPLIANCE WITH BUILDING CODES, SAFETY CODES, LAWS, MERCHANTABILITY OR FITNESS OR A PARTICULAR PURPOSE. This limited warranty is extended solely to the Customer. It is nontransferable and non-assignable, and the Customer shall not permit or authorize its employees, agents, representatives or customers to claim, represent or imply that this limited warranty extends or is available to anyone other than the Customer.

In the event of material breach by the Customer of any of the conditions of this warranty, Greenheck shall have no liability for and product failure claims.

Failure to pay Greenheck in full for original services will automatically make this warranty null and void.

Greenheck will not be held liable for incidental or consequential damages of any kind. The limited warranty of product(s) replaced or repaired under this limited warranty shall be limited to the remainder of the original warranty period. Greenheck reserves the right to reasonable field access to diagnose and repair any product alleged to be defective. This limited warranty may not be modified by anyone and may not be changed by such things as purchase order forms or acceptance forms, unless otherwise agreed upon by Greenheck.

This limited warranty is provided in lieu of any other warranty requirements or obligations, including, but not limited to, those within project specifications.

All notices and claims given under or pursuant to this agreement shall be in writing and sent by certified or registered mail, postage prepaid, return receipt requested to: Greenheck, Attn: Louver Sales, 525 Western Road, Schofield, WI 54476.

By proceeding to use our products and services on your project, you accept the terms of these limited warranties.

ESD-635 6 in. Frame, 35 deg Blade

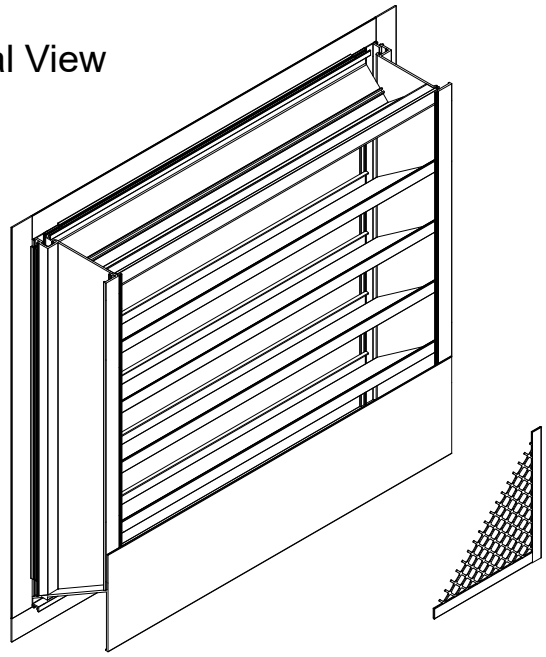
APPLICATION & DESIGN

ESD-635 is a weather louver designed to protect air intake and exhaust openings in building exterior walls. Design incorporates drain gutters in the head member and horizontal blades to channel water to the jambs where water is further channeled through vertical downspouts and out at the sloped sill. The ESD-635 is an extremely efficient louver with AMCA LICENSED PERFORMANCE DATA enabling designers to select and apply with confidence.

PRODUCT DETAILS

Frame: 6 in. x 0.081 in. Frame Thickness
Frame Type: Flanged, 1.5 in., Exterior
Blades: 0.081 in. Fixed Blade Thickness
Material: Aluminum
Sizing: 1/4 Inch Under
Shape: Rectangular
Construction: Mechanically Fastened

Internal View



OPTIONS & ACCESSORIES

Finish: Painted
Finish Performance: AAMA 2605
Coating Type: 2Ct 70%Kynar/100%Fluoropolymer
Color: Standard TBS
Bird Screen: 0.75 in. x 0.05 in., Flat Expanded Aluminum, Internal, Mill Finish
Union Label: No Preference
Warranty: 1 year Standard Product Warranty
10 year Standard Finish Warranty

SUMMARY

ID #	TAG	QTY.	W (in.)	H (in.)	FREE AREA (ft2)	FREE AREA (%)	SECT. WIDE	SECT. HIGH	SHIP SECT.
2-1	LV-4	1	12	12	0.20	21	1	1	1
2-2	LV-6	1	24	24	1.82	46.5	1	1	1

Total Louver Qty: 2 **Total Weight (lb):** 19 **Louver Area (ft2):** 5

Total Ship Sect.: 2

**Weight shown is an estimate only based on the default base product configuration without options or accessories.

Larger openings may require field assembly of multiple louver panels to make up the overall opening size. Individual louver panels are designed to withstand windloads up to a maximum of 25 PSF (size and configuration dependent). Design, materials and installation of structural reinforcement required to adequately support large sections or multiple section assemblies within a large opening are not provided by Greenheck. Options and accessories including, but not limited to, screens, filter racks, louver doors, and blankoff panels are not subject to structural analysis unless indicated otherwise by Greenheck. Unless specifically indicated, the following are NOT included in the quote provided: structural steel, installation hardware (anchors, angle clips, continuous angles, shims, fasteners, inserts, backer rod and sealant), field measuring and/or installation, miscellaneous flashing, trim or enclosures, blank off panels, mullion covers or mullion hardware, hinged frames or removable subframes, custom bird/insect screen, 3-coat, metallic and/or exotic paint finishes, bituminous paints for unlike metals, any applicable taxes, stamped and sealed structural calculations seismic calculations or job specific engineered submittal drawings.

Louvers Product Limited Warranty

Thank you for purchasing Greenheck louvers. Greenheck warrants this equipment to be free from defect in material and workmanship for a period of **1 year** from the date of product shipment. Any units or parts, which prove defective during the warranty period, will be repaired, or replaced at our option when returned to our factory, transportation prepaid. Unless agreed upon otherwise Greenheck will not be held responsible for costs associated with removal or installation of product(s).

The legal remedies described in this Limited Warranty are the sole exclusive remedy of Customer. This limited warranty will be void if payment from Customer is not received within a commercially reasonable time frame. GREENHECK MAKES NO OTHER WARRANTY, EITHER EXPRESS OR IMPLIED, REGARDING ITS PRODUCTS, OR ITS SELECTION AND APPLICATION, INCLUDING, BUT NOT LIMITED TO, COMPLIANCE WITH BUILDING CODES, SAFETY CODES, LAWS, MERCHANTABILITY OR FITNESS OR A PARTICULAR PURPOSE. This limited warranty is extended solely to the Customer. It is nontransferable and non-assignable, and the Customer shall not permit or authorize its employees, agents, representatives, or customers to claim, represent or imply that this limited warranty extends or is available to anyone other than the Customer.

In the event of material breach by the Customer of any of the conditions of this warranty, Greenheck shall have no liability for and product failure claims.

Failure to pay Greenheck in full for original services will automatically make this warranty null and void.

Greenheck will not be held liable for incidental or consequential damages of any kind. The limited warranty of product(s) replaced or repaired under this limited warranty shall be limited to the remainder of the original warranty period. Greenheck reserves the right to reasonable field access to diagnose and repair any product alleged to be defective. This limited warranty may not be modified by anyone and may not be changed by such things as purchase order forms or acceptance forms, unless otherwise agreed upon by Greenheck.

This limited warranty is provided in lieu of any other warranty requirements or obligations, including, but not limited to, those within project specifications.

All notices and claims given under or pursuant to this agreement shall be in writing and sent by certified or registered mail, postage prepaid, return receipt requested to: Greenheck, Attn: Louver Sales, 525 Western Road, Schofield, WI 54476.

By proceeding to use our products and services on your project, you accept the terms of these limited warranties.

Louvers Architectural Finish Limited Warranty

70% Kynar / 100% Fluoropolymer Paint
Greenheck warrants the finish of 70% Kynar / 100% Fluoropolymer paint for a period of **10 years** from the date of product shipment when applied to aluminum louvers or aluminum architectural products. Greenheck warrants that for **10 years** after the date of product shipment the applied finish:

A) Will not chip, crack, or peel (lose adhesion) but does not include minute fracturing, which may occur in proper fabrication of building parts.
B) Will not chalk in excess of ASTM D-4214-89 number 8 rating, determined by the procedure outlined in ASTM D-4214-89 specification test.
C) Will not change color more than five (5) Delta-E Hunter units (square root of the sum of Delta L, Delta A and Delta B) as determined by ASTM method D-2244. It is acknowledged that fading or color changes may not be uniform if the surfaces are not equally exposed to the sun and elements.

Metallic and Mica colors are exempt in the warranty from item C but will hold the L value within 5 Delta E or the L scale of the Hunter E unit system.

Exotic colors will receive a full 10 year warranty if they have the recommended clear coat applied. However, Exotic colors are excluded from the 20 year warranty.

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Greenheck limited warranties are not applicable when failure is caused by events that cannot be controlled by Greenheck. These include, but are not limited to, Acts of God, fire or other casualty or physical damage; Government restrictions; Acts of aggression; Harmful fumes or foreign substances in the atmosphere; Improper storage or packaging of the parts prior to installation; Product failure due to improper usage and/or application; Failure to provide reasonable and routine maintenance and/or improper maintenance, including, but not limited to the use of chemical cleaning agents not in accordance with AAMA recommendations or failure to use a systematic maintenance cleaning program in areas of high salt concentration; Corrosive atmosphere found in the interior of buildings, which effect the interior surface of material; Standing or ponding water on the metal; Excessive building movements; Work performed or materials supplied by others; Improper treatment of finished material; Corrosion of the metal substrate; Incompatibility between materials, including, but not limited to, Galvanic corrosion due to contact with adjacent dissimilar metals such as stainless steel; Damage to the painted metal occasioned by moisture or other contamination detrimental to the finish because of improper storage of the finished metal prior to installation as outlined in AAMA Publication 10, “Care and handling of Architectural Aluminum From Shop to Site."

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VCD-23 Low Leakage 3V Blade Volume Control Damper

APPLICATION & DESIGN

The VCD-23 is a ruggedly built low leakage control damper intended for applications in low to medium pressure and velocity systems. A wide range of electric actuators are available.

DAMPER RATINGS

Pressure:	Up to 5 in. wg - pressure differential
Velocity:	Up to 3,000 ft/min
Leakage:	Class 1A @ 1 in. wg Class 1 @ up to 5 in. wg
Temperature:	Up to 250 F

PRODUCT DETAILS

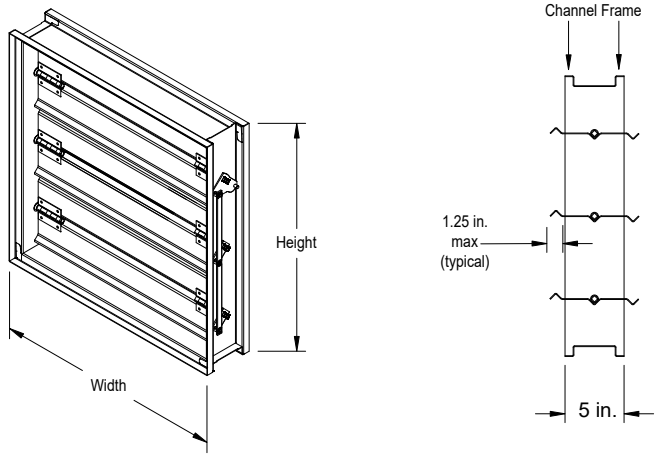
Frame Type:	Channel
Frame Thickness:	16 ga
Material:	Galvanized
Blade Type:	3V
Blade Action:	Opposed
Blade Seal Material:	TPE
Axle/Linkage Material:	Steel
Axle Bearings:	Synthetic
Jamb Seal Material:	Stainless Steel
Damper Temp. Rating:	180 F
Jackshafting:	No Preference
Actuator Sizing:	Default SqFt
Ext. Shaft Length:	Standard (6 in.)
Multi-Section Fastening:	Standard
Sizing:	Nominal

ACTUATOR INFORMATION

Actuator Type:	120 VAC
Actuator Mounting:	External
Actuator Location:	Left Side
Operating Mode:	TwoPosition
Actuator Operation:	Spring Return
Fail Position:	Closed
NEMA Enclosure:	Least Cost
Auxiliary Switches:	Yes
Spring Return Time:	Standard
Transformer:	Multi-Voltage 50VA

OPTIONS & ACCESSORIES

Union Label:	No Preference



• 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.
• Factory supplied actuators are sized for 1,500 fpm and a fully-closed differential pressure of 2 in. wc. Contact factory for actuator sizing on applications exceeding those levels.
• Installation instructions available at www.greenheck.com.

CODES APPROVED

IECC (International Energy Conservation Code) compliant
The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance ratings.

SUMMARY

ID #	TAG	QTY	Width	Height	CONFIGURATION			
3-1	LV-1	1	72.000 in.	24.000 in.	Drive Arrangement: Drive-CC-21-1FEL-0	Actuator Mfr: Belimo	Actuator Model: FSNF120-S	Actuator Qty: 1
					Act. Orientation: Perp Down	Standoff: 1.500 in.		
3-2	LV-2	1	72.000 in.	24.000 in.	Drive Arrangement: Drive-CC-21-1FEL-0	Actuator Mfr: Belimo	Actuator Model: FSNF120-S	Actuator Qty: 1
					Act. Orientation: Perp Down	Standoff: 1.500 in.		
3-3	LV-5	1	30.000 in.	36.000 in.	Drive Arrangement: Drive-CC-11-1FEL-0	Actuator Mfr: Belimo	Actuator Model: FSNF120-S	Actuator Qty: 1
					Act. Orientation: Perp Down	Standoff: 1.500 in.		

ID #	TAG	QTY	Width	Height	CONFIGURATION			
3-4	LV-6	1	24.000 in.	24.000 in.	Drive Arrangement: Drive-CC-11-1FEL-0	Actuator Mfr: Belimo	Actuator Model: FSLF120-S	Actuator Qty: 1
					Act. Orientation: Perp Down	Standoff: 1.500 in.		

VCD-23 Low Leakage 3V Blade Volume Control Damper

APPLICATION & DESIGN

The VCD-23 is a ruggedly built low leakage control damper intended for applications in low to medium pressure and velocity systems. A wide range of electric actuators are available.

DAMPER RATINGS

Pressure:	Up to 5 in. wg - pressure differential
Velocity:	Up to 3,000 ft/min
Leakage:	Class 1A @ 1 in. wg Class 1 @ up to 5 in. wg
Temperature:	Up to 250 F

PRODUCT DETAILS

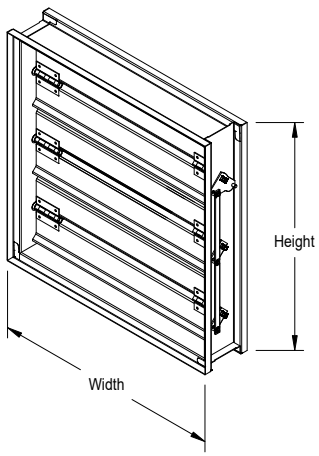
Frame Type:	Channel
Frame Thickness:	16 ga
Material:	Galvanized
Blade Type:	3V
Blade Action:	Opposed
Blade Seal Material:	TPE
Axle/Linkage Material:	Steel
Axle Bearings:	Synthetic
Jamb Seal Material:	Stainless Steel
Damper Temp. Rating:	180 F
Jackshafting:	No Preference
Actuator Sizing:	Default SqFt
Ext. Shaft Length:	Standard (6 in.)
Multi-Section Fastening:	Standard
Sizing:	Nominal

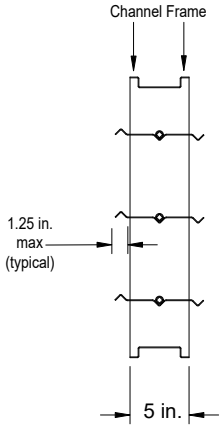
ACTUATOR INFORMATION

Actuator Type:	120 VAC
Actuator Mounting:	External
Actuator Location:	Left Side
Operating Mode:	TwoPosition
Actuator Operation:	Spring Return
Fail Position:	Closed
NEMA Enclosure:	Least Cost
Auxiliary Switches:	Yes
Spring Return Time:	Standard

OPTIONS & ACCESSORIES

Union Label:	No Preference





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• Installation instructions available at www.greenheck.com.

CODES APPROVED

IECC (International Energy Conservation Code) compliant
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SUMMARY

ID #	TAG	QTY	Width	Height	CONFIGURATION			
12-2	MD-2	1	10.000 in.	8.000 in.	Drive Arrangement: Drive-CC-11-1FEL-0	Actuator Mfr: Honeywell	Actuator Model: MS4104F1210	Actuator Qty: 1
					Act. Orientation: Parallel	Standoff: 1.500 in.		
12-3	MD-3	1	24.000 in.	12.000 in.	Drive Arrangement: Drive-CC-11-1FEL-0	Actuator Mfr: Honeywell	Actuator Model: MS4104F1210	Actuator Qty: 1
					Act. Orientation: Parallel	Standoff: 1.500 in.		
12-4	MD-4	1	24.000 in.	12.000 in.	Drive Arrangement: Drive-CC-11-1FEL-0	Actuator Mfr: Honeywell	Actuator Model: MS4104F1210	Actuator Qty: 1
					Act. Orientation: Parallel	Standoff: 1.500 in.		

ID #	TAG	QTY	Width	Height	CONFIGURATION			
12-5	MD-5	1	24.000 in.	12.000 in.	Drive Arrangement: Drive-CC-11-1FEL-0	Actuator Mfr: Honeywell	Actuator Model: MS4104F1210	Actuator Qty: 1
					Act. Orientation: Parallel	Standoff: 1.500 in.		

VCD-23 Low Leakage 3V Blade Volume Control Damper

APPLICATION & DESIGN

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DAMPER RATINGS

Pressure:	Up to 5 in. wg - pressure differential
Velocity:	Up to 3,000 ft/min
Leakage:	Class 1A @ 1 in. wg Class 1 @ up to 5 in. wg
Temperature:	Up to 250 F

PRODUCT DETAILS

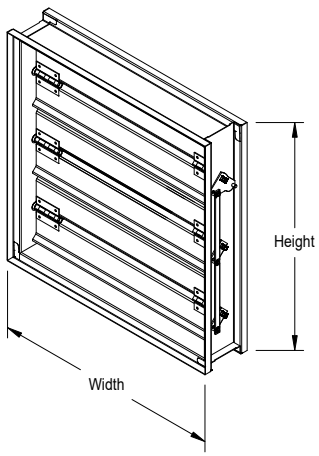
Frame Type:	Channel
Frame Thickness:	16 ga
Material:	Galvanized
Blade Type:	3V
Blade Action:	Opposed
Blade Seal Material:	TPE
Axle/Linkage Material:	Steel
Axle Bearings:	Synthetic
Jamb Seal Material:	Stainless Steel
Damper Temp. Rating:	180 F
Jackshafting:	No Preference
Actuator Sizing:	Default SqFt
Ext. Shaft Length:	Standard (6 in.)
Multi-Section Fastening:	Standard
Sizing:	Nominal

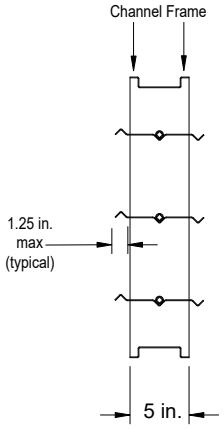
ACTUATOR INFORMATION

Actuator Type:	230 VAC
Actuator Mounting:	External
Actuator Location:	Left Side
Operating Mode:	TwoPosition
Actuator Operation:	Spring Return
Fail Position:	Closed
NEMA Enclosure:	Least Cost
Auxiliary Switches:	Yes
Spring Return Time:	Standard

OPTIONS & ACCESSORIES

Union Label:	No Preference





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• Installation instructions available at www.greenheck.com.

CODES APPROVED

IECC (International Energy Conservation Code) compliant
The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance ratings.

SUMMARY

ID #	TAG	QTY	Width	Height	CONFIGURATION			
13-1	MD-1	1	24.000 in.	16.000 in.	Drive Arrangement: Drive-CC-11-1FEL-0	Actuator Mfr: Honeywell	Actuator Model: MS4604F1210	Actuator Qty: 1
					Act. Orientation: Perp Up	Standoff: 1.500 in.		

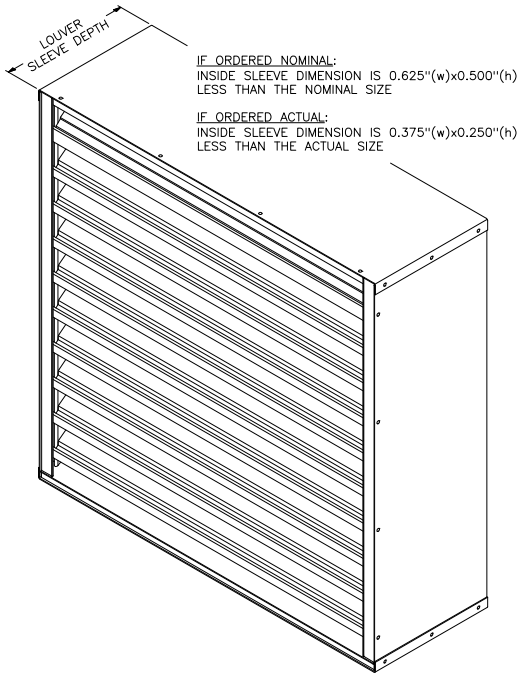
ESD-435 4 in. Frame, 35 deg Blade

APPLICATION & DESIGN

ESD-435 is a weather louver designed to protect air intake and exhaust openings in building exterior walls. Design incorporates drain gutters in the head member and horizontal blades to channel water to the jambs where water is further channeled through vertical downspouts and out at the sloped sill. The ESD-435 is an extremely efficient louver with AMCA LICENSED PERFORMANCE DATA enabling designers to select and apply with confidence.

PRODUCT DETAILS

Frame:	4 in. x 0.081 in. Frame Thickness
Frame Type:	Flanged, 1.5 in., Exterior
Blades:	0.081 in. Fixed Blade Thickness
Material:	Aluminum
Sizing:	1/4 Inch Under
Shape:	Rectangular
Construction:	Mechanically Fastened



OPTIONS & ACCESSORIES

Finish:	Painted
Finish Performance:	AAMA 2605
Coating Type:	2Ct 70%Kynar/100%Fluoropolymer
Color:	Standard TBS
Bird Screen:	0.75 in. x 0.05 in., Flat Expanded Aluminum, Internal, Match Louver Finish
Union Label:	No Preference
Sleeve:	Aluminum, 0.080 in., Mill
Warranty:	1 year Standard Product Warranty 10 year Standard Finish Warranty

SUMMARY

ID #	TAG	QTY.	W (in.)	H (in.)	SLEEVE LENGTH (in.)	FREE AREA (ft2)	FREE AREA (%)	SECT. WIDE	SECT. HIGH	SHIP SECT.
14-1		1	48	24	12	3.84	48.1	1	1	1
14-2		1	24	12	12	0.68	33.8	1	1	1
14-3		1	24	12	12	0.68	33.8	1	1	1
14-4		1	24	12	12	0.68	33.8	1	1	1
14-5		1	48	24	12	3.84	48.1	1	1	1

Total Louver Qty: 5 **Total Weight (lb):** 75 **Louver Area (ft2):** 22

Total Ship Sect.: 5

**Weight shown is an estimate only based on the default base product configuration without options or accessories.

Larger openings may require field assembly of multiple louver panels to make up the overall opening size. Individual louver panels are designed to withstand windloads up to a maximum of 25 PSF (size and configuration dependent). Design, materials and installation of structural reinforcement required to adequately support large sections or multiple section assemblies within a large opening are not provided by Greenheck. Options and accessories including, but not limited to, screens, filter racks, louver doors, and blankoff panels are not subject to structural analysis unless indicated otherwise by Greenheck. Unless specifically indicated, the following are NOT included in the quote provided: structural steel, installation hardware (anchors, angle clips, continuous angles, shims, fasteners, inserts, backer rod and sealant), field measuring and/or installation, miscellaneous flashing, trim or enclosures, blank off panels, mullion covers or mullion hardware, hinged frames or removable subframes, custom bird/insect screen, 3-coat, metallic and/or exotic paint finishes, bituminous paints for unlike metals, any applicable taxes, stamped and sealed structural calculations seismic calculations or job specific engineered submittal drawings.

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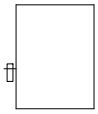
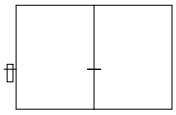
Damper Drive Arrangements Job Summary -Start-

Drive Arrangement: Drive-CC-11-1FEL-0



Drive Arrangement: Drive-CC-21-1FEL-0



Damper Drive Arrangements Job Summary -End-

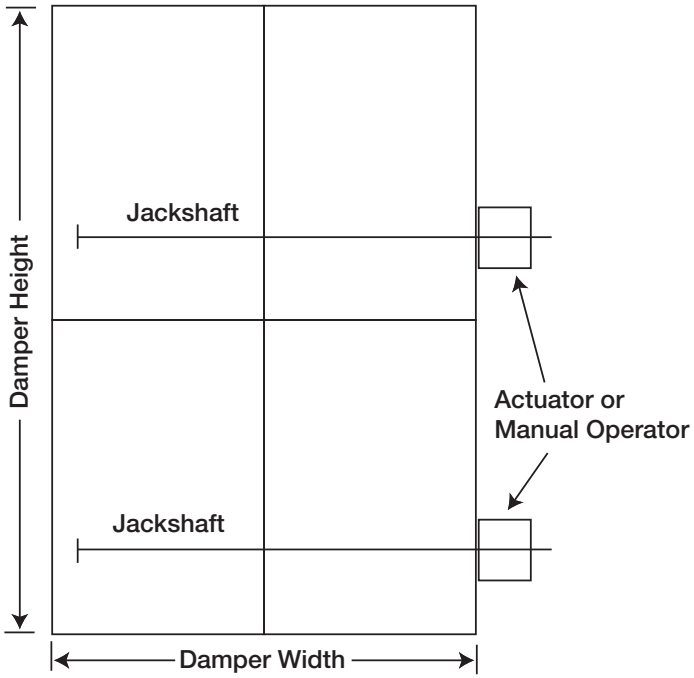
Drive Arrangement Definition

Actuator driven dampers are supplied with a drive arrangement code that helps describe the configuration of the damper. The following breaks down what each number and letter represents.

22-2FER-2

1 2 3 4 5 6 7

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



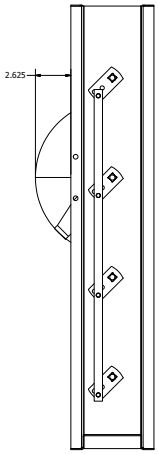
Each damper is supplied with a Drive Arrangement Prefix to help describe its construction. See the following examples:

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

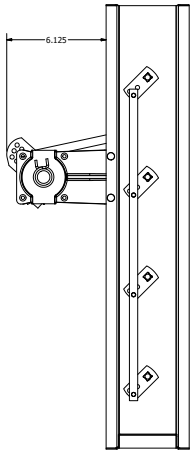
Jumpover Bracket

Application

The function of the jump-over bracket is to attach multiple damper sections together.

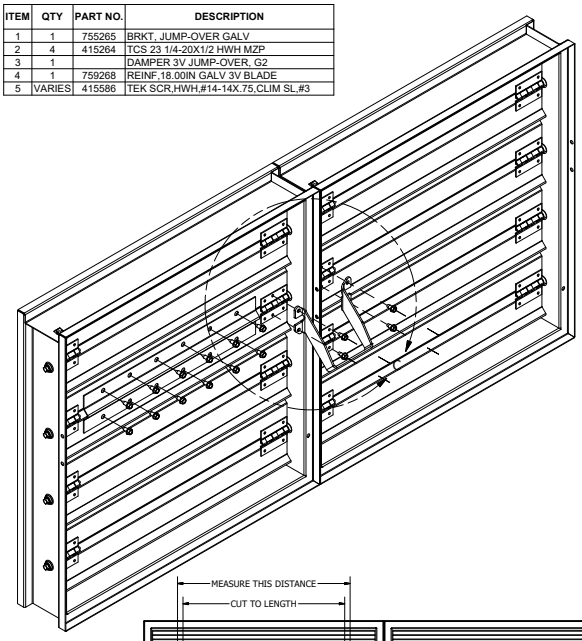


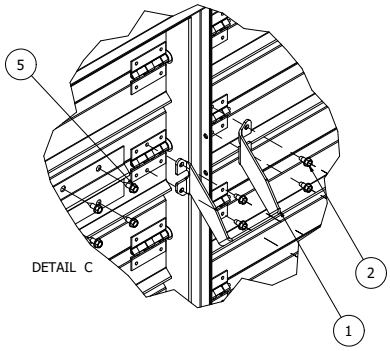
Jump-over

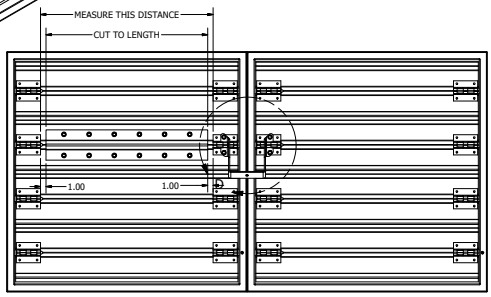


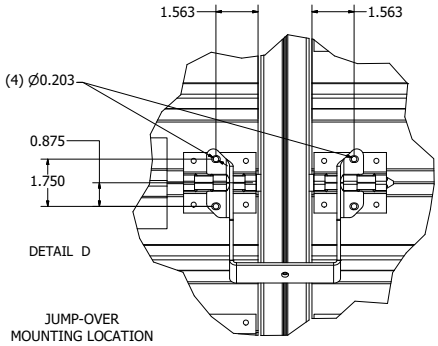
Jackshaft

ITEM	QTY	PART NO.	DESCRIPTION
1	1	755265	BRKT, JUMP-OVER GALV
2	4	415264	TCS 23 1/4-20X1/2 HWH MZP
3	1		DAMPER 3V JUMP-OVER, G2
4	1	759268	REINF,18.00IN GALV 3V BLADE
5	VARIES	415586	TEK SCR,HWH,#14-14X.75,CLIM SL,#3









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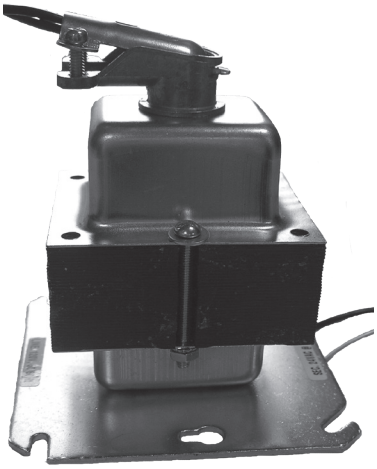
Jumpover Bracket, R3, November 2022

Multi-Voltage
Transformer

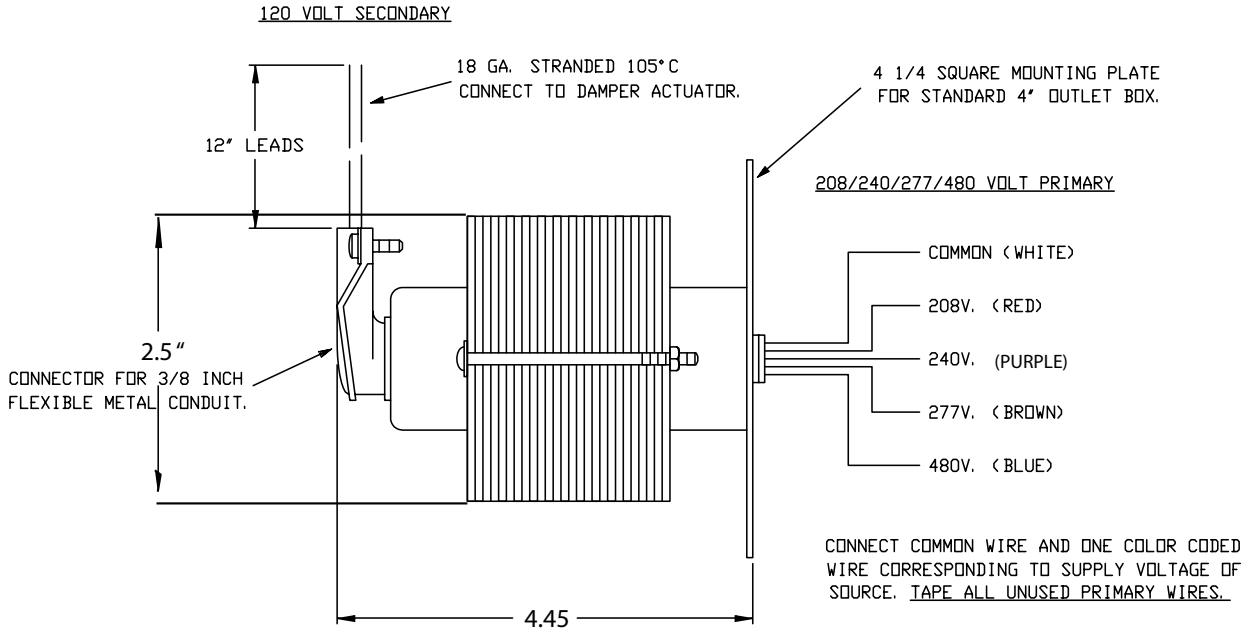
Application

The Multi-Voltage transformer converts primary voltage of 480V/277V and 240V/208V to secondary voltage of 120V. The transformer is shipped loose and is provided with a plate on the primary side for mounting on a standard 4 in. (102mm) outlet box.

For hookup to 3 phase primary source, connect common (white) and one other wire (same voltage as 3 phase source) to any 2 legs of the 3 phase source for 1 phase 120 volt secondary output. This transformer is NEMA 1, indoor use only.



Part Number	Capacity (VA)	Frequency (Hz)	Primary Voltage	Secondary Voltage
385709	50	50/60	480/277, 240/208	120V



SPECIAL NOTE

FOR HOOK UP TO 3 PHASE PRIMARY SOURCE-
CONNECT COMMON (WHITE) AND ONE OTHER
WIRE (SAME VOLTAGE AS 3 PHASE SOURCE)
TO ANY 2 LEGS OF THE 3 PHASE SOURCE
FOR 1 PHASE 120 VOLT SECONDARY OUTPUT.

APPROXIMATE WEIGHT = 3 3/4 lbs.

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Multi-Voltage Transformer, R4, April 2022

FSNF120-S-FC US

On/Off, Spring Return, 350°F [177°C] for half hour, 120VAC, 15 Seconds Cycle Time

5 YEAR WARRANTY

LISTED 94 D5 TEMP. IND. & REG. EQUIP. c UL us

Technical Data	
Power Supply	120 VAC, ±10%, 50/60 Hz
Power consumption in operation	27 VA
Power consumption in rest position	6 W, 9 VA (50 Hz 15 VA), End stop 55 VA, 0.5 A slow blow fuse *
Shaft Diameter	1/2" to 1.05" round, centers on 1/2" and 3/4" with insert, 1.05" without insert
Electrical Connection	18 GA, 3 ft [1 m], 3 color coded wires
Overload Protection	electronic throughout 0° to 95° rotation
Electrical Protection	grounded enclosure, 120V
Angle of rotation	95°
Torque motor	70 in-lb [8 Nm] from 32...350°F [0...177°C]
direction of rotation motor	reversible with CW/CCW mounting
direction of rotation spring-return	reversible with cw/ccw mounting
Position indication	visual indicator, 0° to 95° (0° is full spring return position)
Running Time (Motor)	15 sec between 32...350°F [0...177°C], <15 sec at rated voltage & torque
Running Time (Fail-Safe)	15 sec
Ambient humidity	5...95% r.H. non-condensing
Ambient temperature	32...122°F [0...50°C]
Non-operating temperature	-40...176°F [-40...80°C]
Degree of Protection	IP40, NEMA 1
Housing material	zinc coated steel
Gears	steel, permanently lubricated
Agency Listing	cULus listed to UL873 and CAN/CSA C22.2 No.24, UL 2043 Listed for air plenum installation per NEC 300.22 and IMC Section 602 NYC Department of Buildings MEA 197-07-M.California State Fire Marshal Listing 3210-1593:101.
Noise level, motor	45 dB (A) motor, 62 dB (A) spring, inaudible holding
Maintenance	maintenance free
Quality Standard	ISO 9001
Weight	7.18 lb [3.3 kg]
Auxiliary switch	2 x SPDT, 7A resistive (2.5A inductive) @ 250 VAC, one set at 10°, one set at 85°

† UL File XAPX.E108966

Fire & Smoke damper actuator

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.

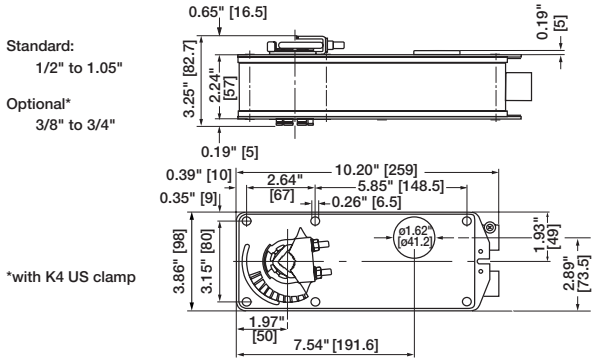
IMPORTANT 24VDC NOTE: The FSNF24 & -S models will not operate below 24VDC. A filtered and regulated power supply must be used.

Operation

Mounting of the actuator to the damper axle shaft or jackshaft (3/8" to 1.05") 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.

Dimensions (Inches[mm])



Safety Notes

* Neither UL nor Belimo require local over-current protection. The FSNF actuators draw higher peak current when driving against any type of stop. If used, this requires the value of a local fuse or breaker to be increased to avoid nuisance opening or tripping. A 2.5 amp slow blow should be used for 24VAC. A 0.5 amp slow blow should be used for 120 VAC. A 0.25 amp slow blow should be used for 230V and a 0.3 amp slow blow for 208 VAC. Transformers: Note that while a 24V 100VA transformer would handle 2 actuators, a 4 A breaker or plug fuse is insufficient. A 5 amp slow blow would be required.
Belimo Fire & Smoke actuators have passed the AMCA 520 and UL 555S Long Term Holding test. No special cycling is required during prolonged periods when actuator is driven open and held there. Periodic testing of dampers and actuators per local codes and NFPA 80 and NFPA 105 are required.
The actuator contains no components which the user can replace or repair.
A 1/2" threaded connector is standard. FSNFxx-FC models have a 3/8" Flex Connector. Other than the connector, these actuators are identical to the conduit connector version.
⚠ WARNING: For Belimo Products sold in California, these Products do or may contain chemicals which are known to the State of California to cause cancer and or birth defects or other reproductive harms. For more information see www.p65warnings.ca.gov.

FSNF120-S-FC US

On/Off, Spring Return, 350°F [177°C] for half hour, 120VAC, 15 Seconds Cycle Time

Accessories	
AF-P	Anti-rotation bracket AF/NF.
IND-AF2	End stop indicator
K4-1 US	Classic AF/NF jackshaft clamp (up to 1.05").
KH-AF-1 US	Classic AF/NF crankarm for Jackshaft to 1.05".
SH8	Push rod for KG6 & KG8 ball joints (36" L, 5/16" diameter).
ZDB-AF2 US	Angle of rotation limiter for Classic AF/NF.
ZG-100	Univ. right angle bracket 17"x11-1/8"x6" (HxWxbase).
ZG-101	Univ. right angle bracket 13x11x7-7/16" (HxWxbase).
ZG-AF US	Classic AF/NF crankarm adaptor kit.
ZG-AF108	Classic AF/NF crankarm adaptor kit with ZG-108.
ZG-DC1	Damper clip for damper blade, 3.5" width.
ZG-DC2	Damper clip for damper blade, 6" width.
ZS-100	Weather shield - galvaneal 13x8x6" (LxWxD).
ZS-150	Weather shield - PC w/ foam seal 16x8-3/8x4" (LxWxD).
ZS-260	Explosion proof housing.
ZS-300	NEMA 4X, 304 stainless steel enclosure.
BAE165 US	165° F electric thermal sensor, SPST, normally closed.
S2A-F US	Auxiliary switch, 2x SPDT, 3A (0.5A inductive) @250 VAC max.

Typical Specification

All smoke and combination fire and smoke dampers shall be provided with Belimo FSTF, FSLF, FSNF, or FSAF actuators. All substitutions must be approved before submission of bid. Damper and actuator shall have UL 555S Listing for 250°F (350°F). Actuator shall have been tested to UL 2043 per requirements of IMC 602.2 and NEC 300.22 (c). Where position indication is required -S models with auxiliary switches or damper blade switches will be provided per code requirements.

Wiring Diagrams

INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

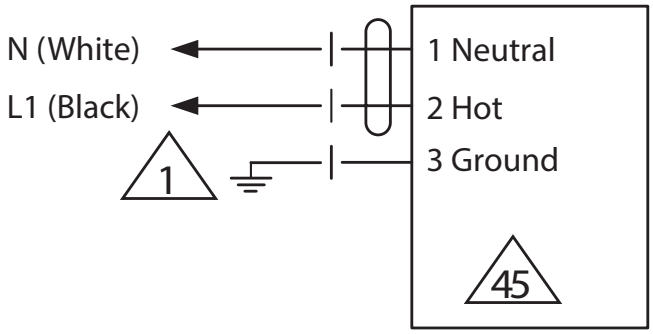
45 Actuators may be powered in parallel. Power consumption must be observed.

72 S4 makes to S6 when actuator is powered open.

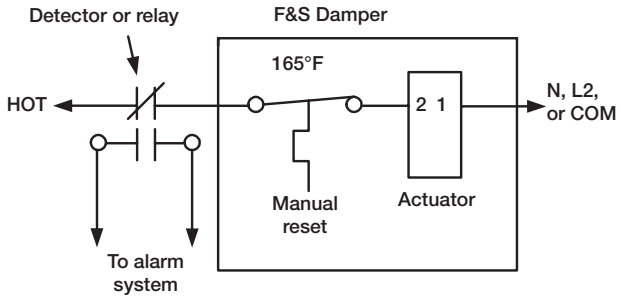
73 Auxiliary switches are for end position indication or interlock control.

74 Double insulated.

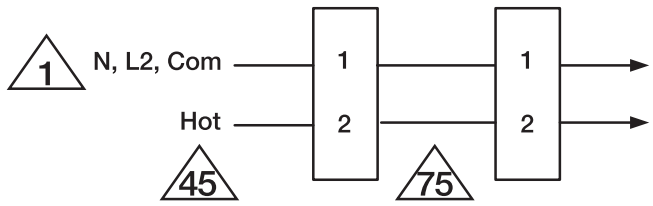
75 Ground present on some models.



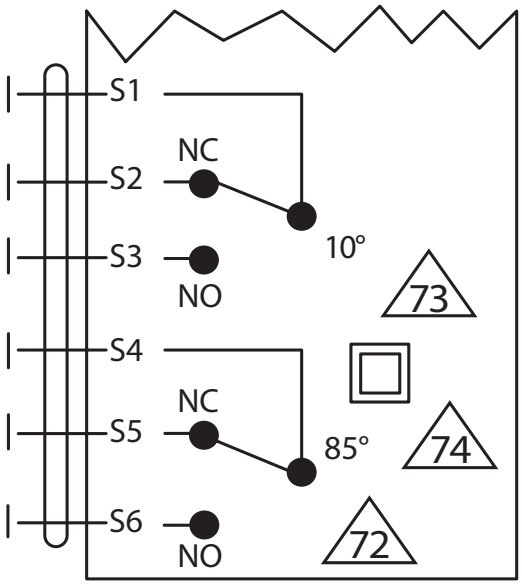
120 VAC



Typical containment damper control wiring



Parallel Actuator Wiring



Auxiliary Switch

FSLF120-S-FC US

On/Off, Spring Return, 350°F [177°C] for half hour, 120VAC, 15 Seconds Cycle Time

5 YEAR WARRANTY

LISTED 94 D5 TEMP. IND. & REG. EQUIP. c UL us

Technical Data	
Power Supply	120 VAC, ±10%, 50/60 Hz
Power consumption in operation	18 VA
Power consumption in rest position	4 W, 5.5 VA (50 Hz 8 VA), End stop 27 VA, 0.25 A slow blow fuse *
Shaft Diameter	3/8" to 1/2" round, centers on 1/2"
Electrical Connection	3 ft [1 m], 18 GA appliance cable with 1/2" conduit connector
Overload Protection	electronic throughout 0° to 95° rotation
Electrical Protection	grounded enclosure, 120V
Angle of rotation	95°
Torque motor	30 in-lb [3.5 Nm] from 32...350°F [0...177°C]
direction of rotation motor	reversible with CW/CCW mounting
direction of rotation spring-return	reversible with CW/CCW mounting
Position indication	visual indicator, 0° to 95° (0° is full spring return position)
Running time motor	<15 sec at rated voltage and torque 32...122°F [0...50°C]
Running time emergency control position	<15 sec
Ambient humidity	5 to 95% RH non-condensing
Ambient temperature	32...122°F [0...50°C]
Non-operating temperature	-40...176°F [-40...80°C]
Degree of Protection	IP30, NEMA 1
Housing material	zinc coated steel
Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, Listed to UL 2043 - suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC. NYC Department of Buildings MEA 197-07-M California State Fire Marshal Listing 3210-1593:102
Noise Level (Fail-Safe)	45 dB (A) motor, 62 dB (A) spring, inaudible holding
Maintenance	maintenance free
Quality Standard	ISO 9001
Weight	4.4 lb [2.0 kg]
Auxiliary switch	2 x SPST, 3A resistive (0.5A inductive) @ 250 VAC, one set at 10°, one set at 85°

† UL File XAPX.E108966

Fire & Smoke damper actuator

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.

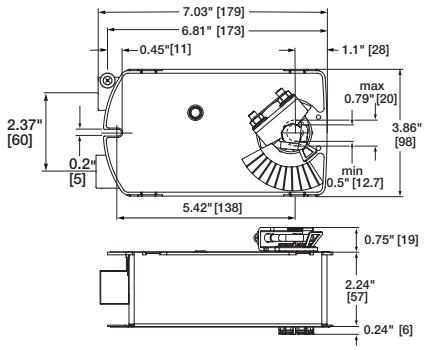
IMPORTANT 24VDC NOTE: The FSLF24 & -S models will not operate below 24VDC. A filtered and regulated power supply must be used.

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.

Dimensions (Inches[mm])



Safety Notes

* Neither UL nor Belimo require individual fusing of FSLF actuators. The FSLF draws higher peak current when driving against its end stop or any other type of stop. Given the technology of fuses & breakers, this requires the value of fuse or breaker to be increased to avoid nuisance opening or tripping. A 1 amp slow blow should be used for 24VAC. A 0.25 amp slow blow should be used for 120VAC. A .125 amp slow blow should be used for 230V.

SAFETY NOTES

Wiring and installation must comply with all local electrical and mechanical codes.

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

Cables are not plenum rated and require flex conduit.

1/2" Threaded Connector: Screw a conduit fitting into the actuator's metal bushing. Jacket the actuator's input wiring with suitable fl exible conduit. Properly terminate the conduit in a suitable junction box.

3/8" Flex Connector (-FC models): Mount the flexible conduit into the actuator's metal bushing by means of the provided screw with a torque of 1.2 Nm. Jacket the actuator's input wiring with suitable flexible conduit. Properly terminate the conduit in a suitable junction box.

FSLF120-S-FC US

On/Off, Spring Return, 350°F [177°C] for half hour, 120VAC, 15 Seconds Cycle Time

Accessories

---BAE165 US	165° F electric thermal sensor, SPST, normally closed.
---S2A-F US	Auxiliary switch, 2x SPDT, 3A (0.5A inductive) @250 VAC max.

Typical Specification

All smoke and combination fire and smoke dampers shall be provided with Belimo FSTF, FSLF, FSNF, or FSAF actuators. All substitutions must be approved before submission of bid. Damper and actuator shall have UL 555S Listing for 250°F (350°F). Actuator shall have been tested to UL 2043 per requirements of IMC 602.2 and NEC 300.22 (c). Where position indication is required -S models with auxiliary switches or damper blade switches will be provided per code requirements.

Wiring Diagrams

APPLICATION NOTES

1 Provide overload protection and disconnect as required.

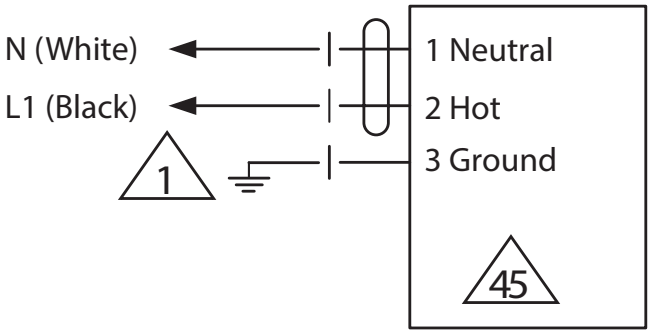
45 Actuators may be powered in parallel. Power consumption must be observed.

72 S4 makes to S6 when actuator is powered open.

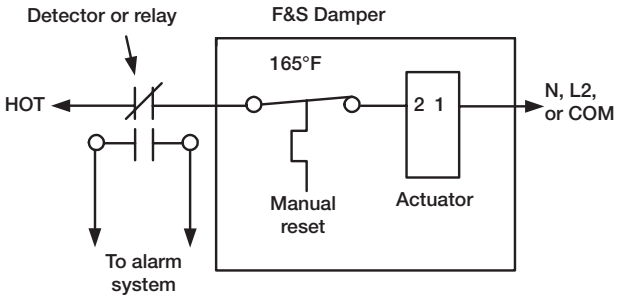
73 Auxiliary switches are for end position indication or interlock control.

74 Double insulated.

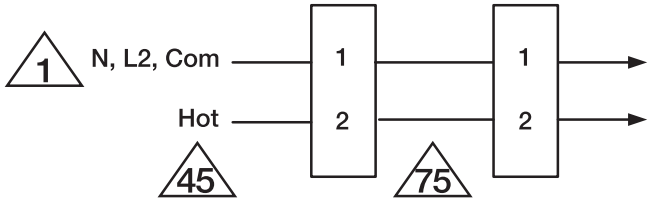
75 Ground present on some models.



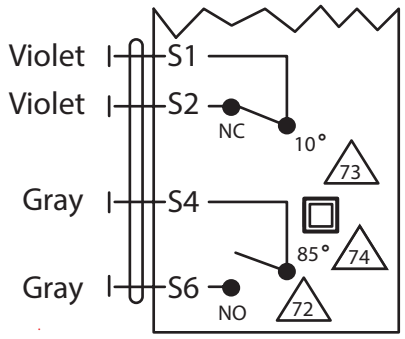
120 VAC



Typical containment damper control wiring



Parallel Actuator Wiring



Auxiliary Switch Wiring

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/ft^3 (1.2 kg/m^3).

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.

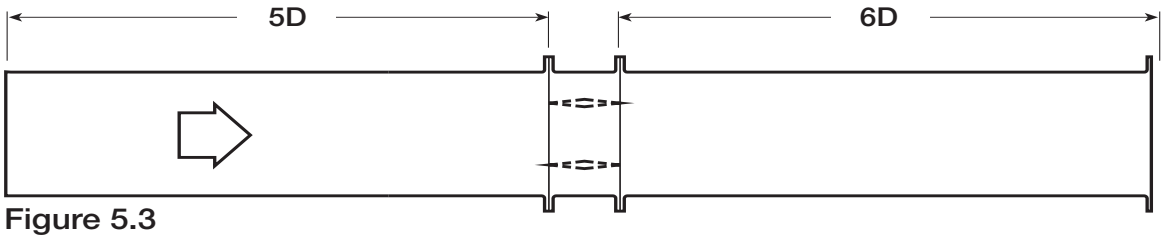


Figure 5.3

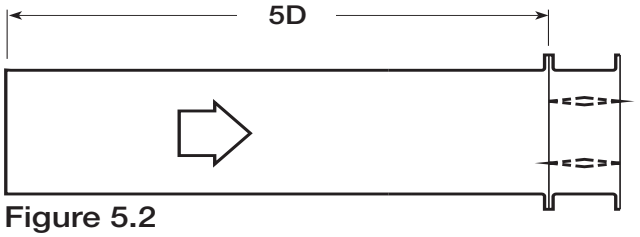


Figure 5.2

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

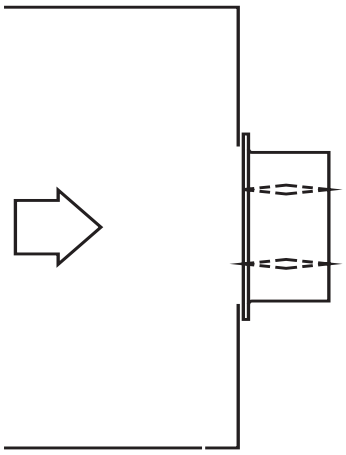
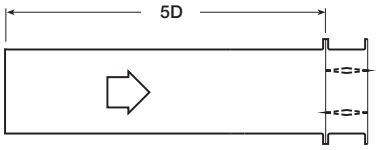


Figure 5.5

AMCA Certified Pressure Drop Data VCD-23 & SEVCD-23

Greenheck Fan Corporation certifies that the model VCD-23 and SEVCD-23 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 Leakage and Air Performance ratings.

AMCA 5.2



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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.05
1500	0.11
2000	0.19
2500	0.29
3000	0.41
3500	0.55
4000	0.72

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.03
1500	0.06
2000	0.10
2500	0.16
3000	0.23
3500	0.30
4000	0.40

36 in. 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	0.19
3500	0.27
4000	0.35

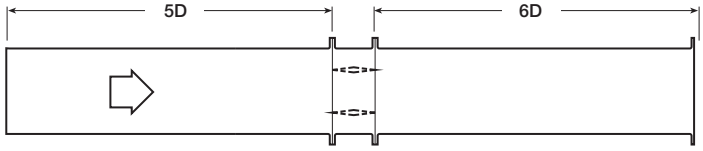
12 in. x 48 in. (305mm x 1219mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.04
1500	0.08
2000	0.15
2500	0.22
3000	0.32
3500	0.43
4000	0.56

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.03
1500	0.07
2000	0.12
2500	0.18
3000	0.26
3500	0.36
4000	0.47

AMCA 5.3



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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.03
1500	0.08
2000	0.13
2500	0.20
3000	0.29
3500	0.40
4000	0.51

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.02
1500	0.04
2000	0.07
2500	0.11
3000	0.16
3500	0.21
4000	0.28

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.02
1500	0.03
2000	0.06
2500	0.09
3000	0.13
3500	0.19
4000	0.25

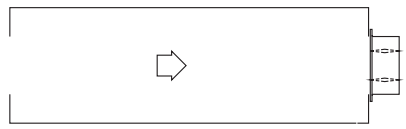
12 in. x 48 in. (305mm x 1219mm)

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.03
1500	0.07
2000	0.12
2500	0.18
3000	0.26
3500	0.36
4000	0.46

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.01
1000	0.03
1500	0.06
2000	0.10
2500	0.16
3000	0.22
3500	0.30
4000	0.39

AMCA 5.5



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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.13
1500	0.30
2000	0.53
2500	0.82
3000	1.19
3500	1.62
4000	2.10

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.12
1500	0.26
2000	0.47
2500	0.75
3000	1.04
3500	1.41
4000	1.90

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.13
1500	0.29
2000	0.52
2500	0.82
3000	1.19
3500	1.63
4000	2.13

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.12
1500	0.27
2000	0.47
2500	0.75
3000	1.07
3500	1.45
4000	1.91

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

Velocity (fpm)	Pressure Drop (in. wg)
500	0.03
1000	0.12
1500	0.28
2000	0.49
2500	0.77
3000	1.12
3500	1.53
4000	2.01

AMCA Certified Leakage Data VCD-23 & SEVCD-23

Air leakage is based on operation between 32°F (0°C) and 120°F (49°C).
Tested for leakage in accordance with ANSI/AMCA Standard 500-D, Figure 5.5.
Tested for air performance in accordance with ANSI/AMCA Standard 500-D, Figures 5.2, 5.3 and 5.5.

Torque
Data are based on a torque of 5.0 in.lb./ft² (0.56 N·m) applied to close and seat the damper during the test.

VCD-23 SEVCD-23	Leakage Class*	
Maximum Damper Width	1 in. wg (0.25 kPa)	4 in. wg (1 kPa)
48 in. (1219mm)	1A	1

Greenheck Fan Corporation certifies that the model VCD-23 and SEVCD-23 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 Leakage and Air Performance ratings.

***Leakage Class Definitions**

The *maximum* allowable leakage is defined by AMCA as the following:

- Leakage Class 1A - 3 cfm/ft^2 @ 1 in. wg (class 1A is only defined at 1 in. wg).
- Leakage Class 1
  - 4 cfm/ft^2 @ 1 in. wg
  - 8 cfm/ft^2 @ 4 in. wg
  - 11 cfm/ft^2 @ 8 in. wg
  - 12.6 cfm/ft^2 @ 10 in. wg

Honeywell

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

FOR FIRE/SMOKE CONTROL APPLICATIONS

PRODUCT DATA

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.

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).**

Contents

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: ¼-20 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 +20%, -10%, 50/60 Hz
MS8109F	23 VA	7 VA	80 (9)	

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

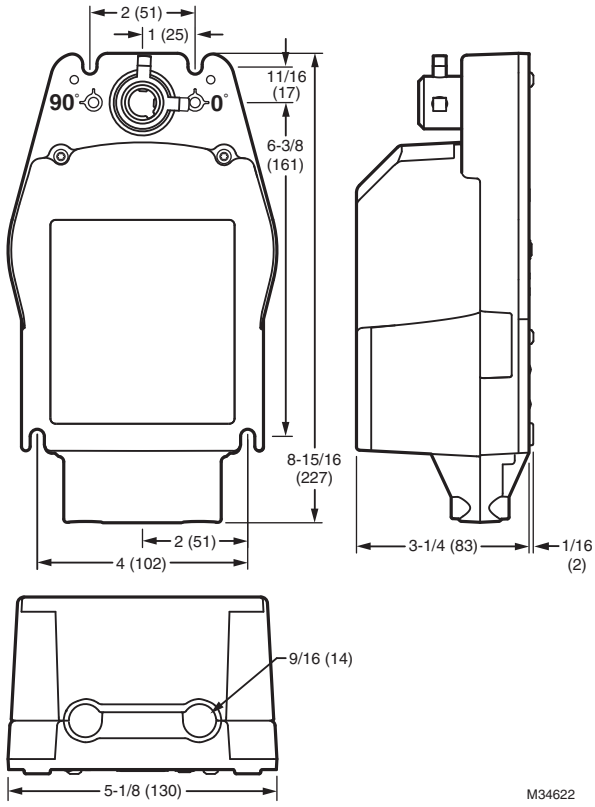


Fig. 1. MS4104, MS4109, MS4604, MS4609, MS8104 and MS8109 dimensional drawing in in. (mm).

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.

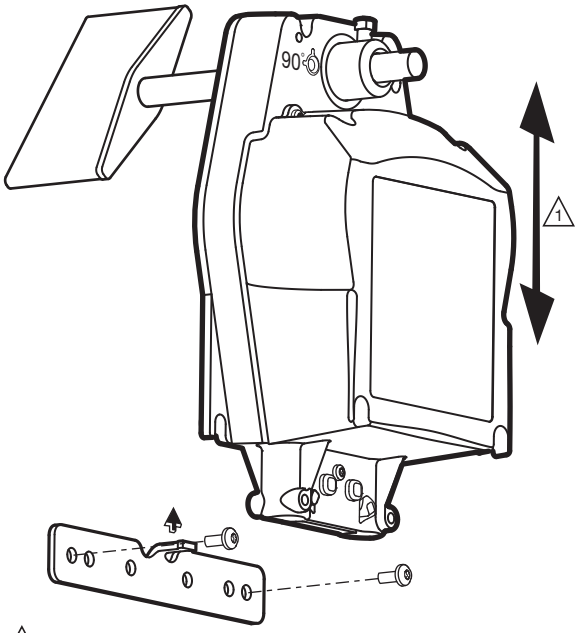


Fig. 2. Mounting actuator to damper housing.

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.*

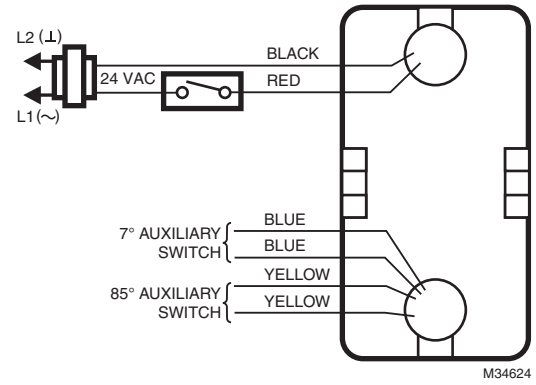


Fig. 3. Typical 24 Vac wiring.

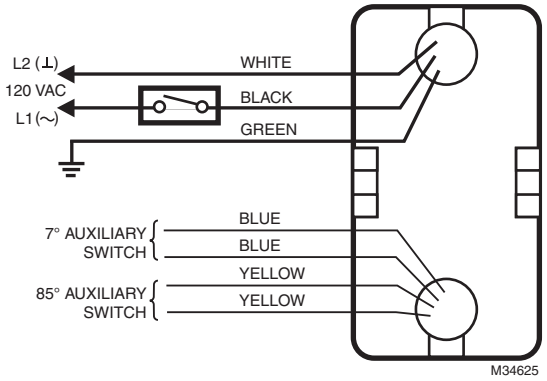


Fig. 4. Typical 120 Vac wiring.

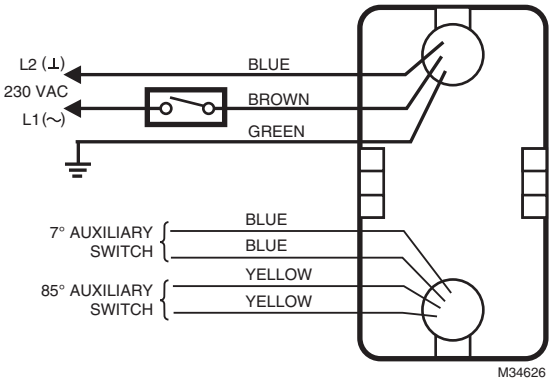


Fig. 5. Typical 230 Vac wiring.

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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LOUVER FINISHES & COLORS

Standard Colors

Greenheck offers 27 standard colors available in AAMA 2605 compliant coatings (70% Kynar PVDF/100% Fluoropolymer FEVE), AAMA 2604 compliant coatings (50% Kynar/Acroflur) or AAMA 2603 compliant coatings (Baked Enamel).

Bone White GF102	Ivory 031	Ascot White GF120
Dover White AL202	Cambridge White GF110	Herring Bone GF107
Sandstone GF112	Pueblo Tan GF116	Rawhide AL215
Smoke GF104	Sierra Tan GF118	Lindie Bronze AL218
Hampton Brown GF105	Spartan Bronze GF113	Classic Bronze GF108
Statuary Bronze AL221	Dove Gray AL213	Stone Gray GF103
Charcoal AL214	Flat Black 044	Gloss Black 045
Coronado Red GF121	Terra Cotta AL217	Hartford Green AL208
Capri Blue GF106	Aegean Blue AL204	Patina Green GF114

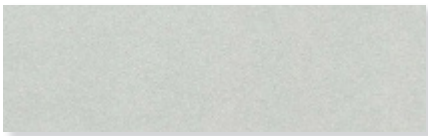
The samples incorporated in this presentation are as close to production materials as color reproduction technology allows. Color samples of metal coupons are available upon request. Custom color matching is available upon request. Consult your Greenheck representative for additional cost associated with custom colors.

GREENHECK
Building Value in Air.

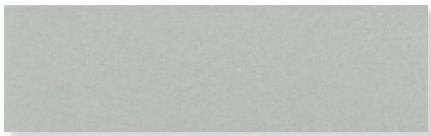
LOUVER FINISHES & COLORS

Mica Colors

Greenheck offers six standard Mica colors available in AAMA 2605 compliant coatings (70% Kynar PVDF/100% Fluoropolymer FEVE). Mica colors are formulated to reproduce the low-gloss metallic luster of anodized aluminum in a wider range of dynamic colors. These colors offer many performance advantages over conventional anodic finishes including longer warranty duration, superior resistance to salt spray, greater color uniformity and better chemical resistance. Additionally, Mica coatings are easier to repair and touch-up than conventional anodic finishes. Organic micas are comprised of natural minerals and crushed pearlescent that are highly resistant to harmful environmental effects.

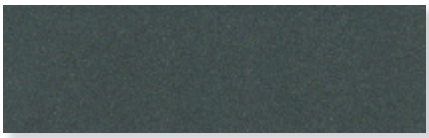


Clear Anodize Mica GF209

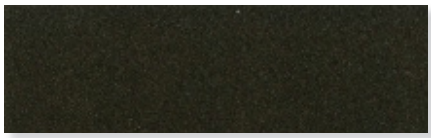


Bright Silver AL222

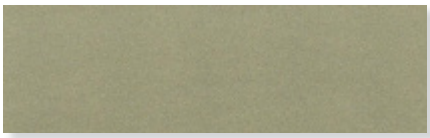
Sterling GF201



Gun Barrel AL239



Dark Bronze AL238



Asti AL236

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