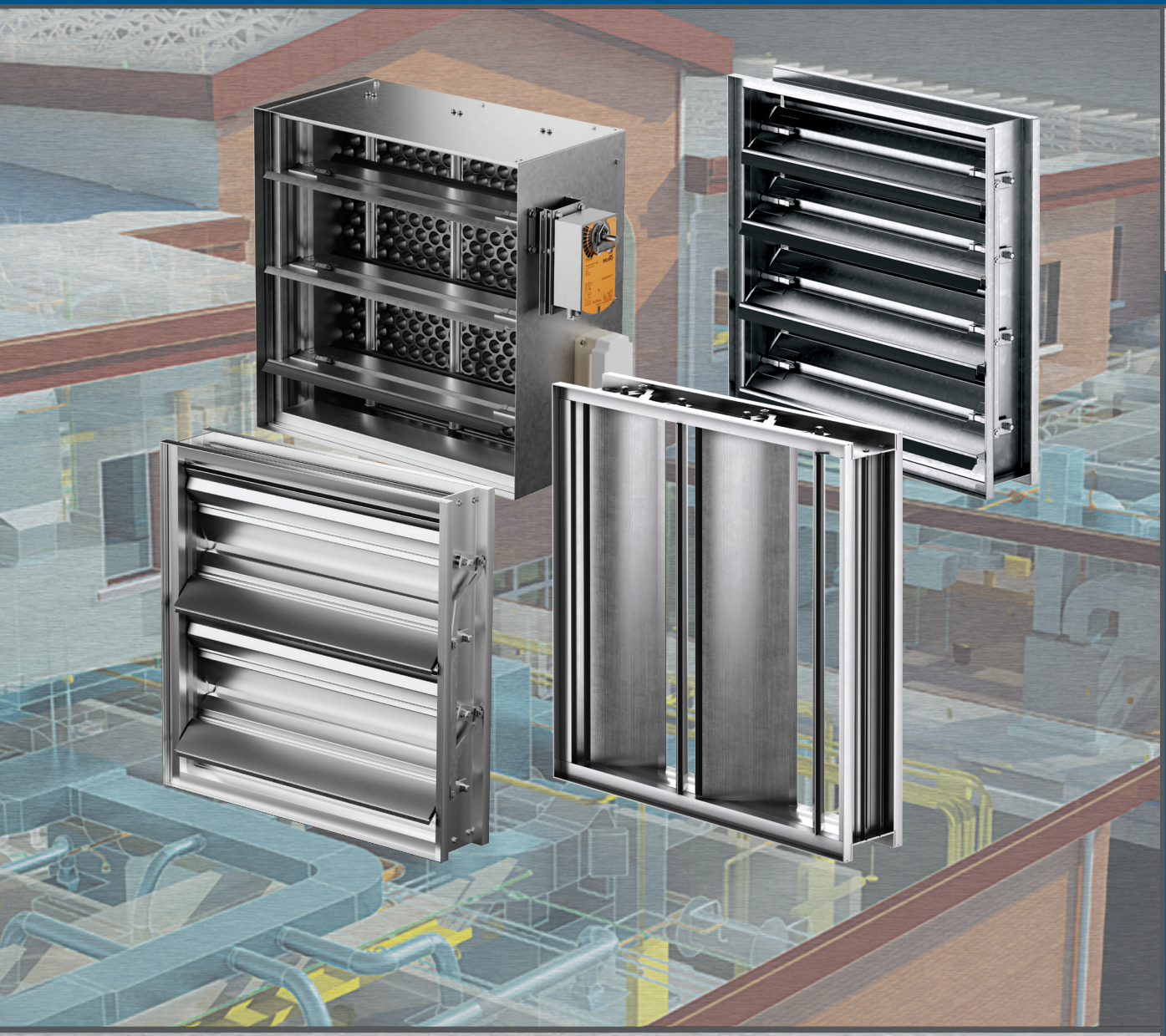
Control Damper Selection Guide for Air Handlers



GREENHECK
Building Value in Air.

BUILDING VALUE IN AIR.

July
2024

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Damper Models	VCD-20	VCD-23	VCD-23V	FBV-23	SEVCD-23	VCD-33	VCD-33V	SEVCD-33	VCD-34	VCD-34V
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Airfoil Blade	-					Figure 13				
Insulated Airfoil	-								Not Shown	-
Aluminum Airfoil	-									
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Thrust Washers	-	-	Figure 24	-			Figure 24	-	-	Figure 24
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Jackshaft										
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Insert Mount	Figure 48									
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Flange Insert Mount	Figures 43 & 45			-			Figures 43 & 45			
Double Flange Mount	Figure 47			-			Figure 47			

Damper Models	VCD-40	VCD-42	VCD-43	VCD-43V	ICD-44	ICD-45
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3V Blade	-					
Airfoil Blade	-					
Airfoil-Insulated	-					
Aluminum Airfoil	Figure 15				-	
Insulated & Thermally Broken	-				Figure 16	
Vertical Blade						
Thrust Washers	-			Figure 24	-	
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Accessories						
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Mounting Options						
Insert Mount	Figure 48					
Flange Mount	Figures 44 & 46					
Flange Insert Mount	Figures 43 & 45					
Double Flange Mount	-	Figure 47			-	

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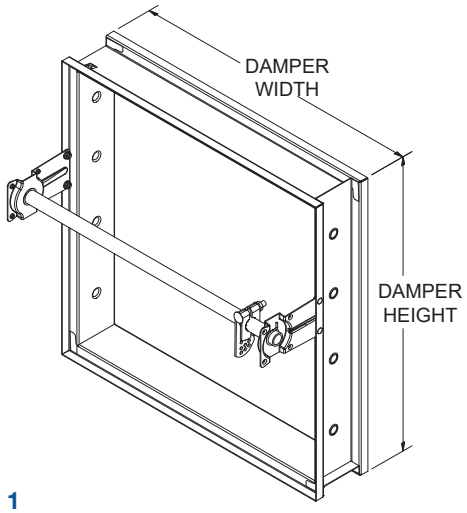


Figure 1

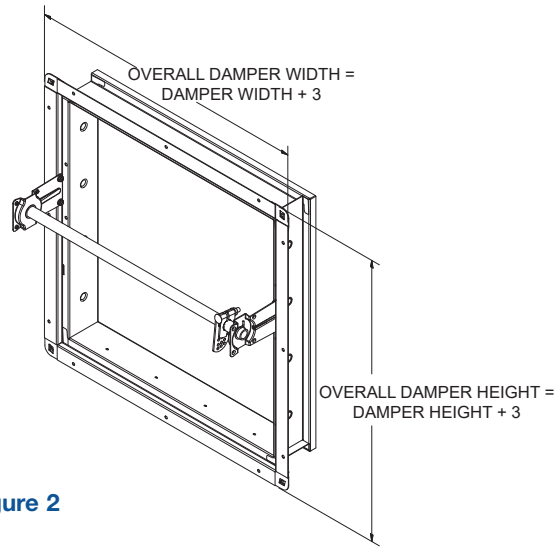
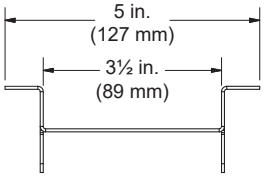
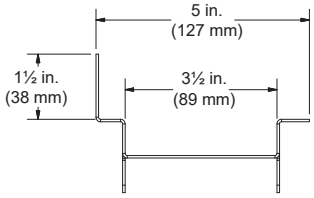


Figure 2

Channel



Single Flange



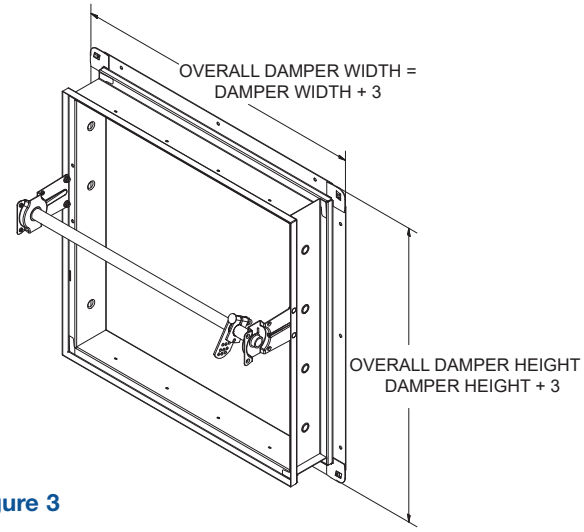


Figure 3

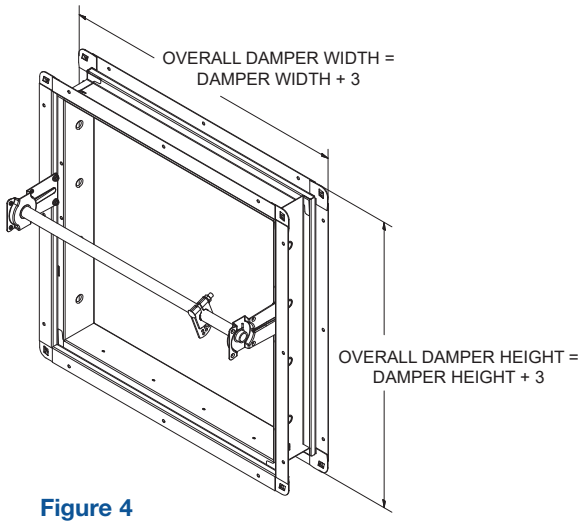
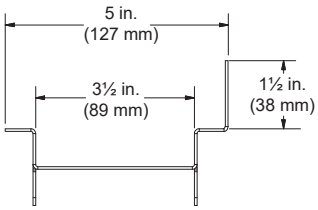
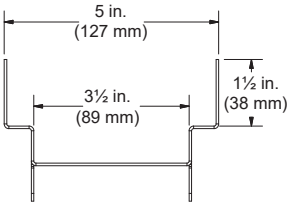


Figure 4

Reverse Flange



Double Flange



Note: Jackshaft shown for reference only.

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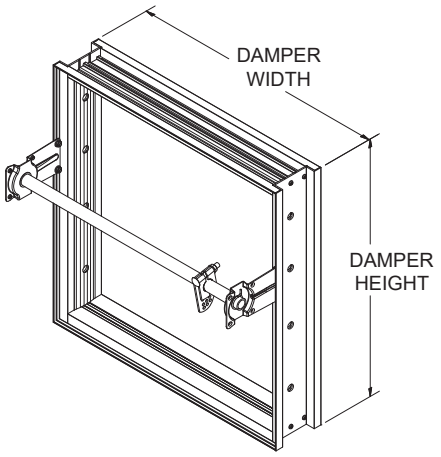


Figure 5

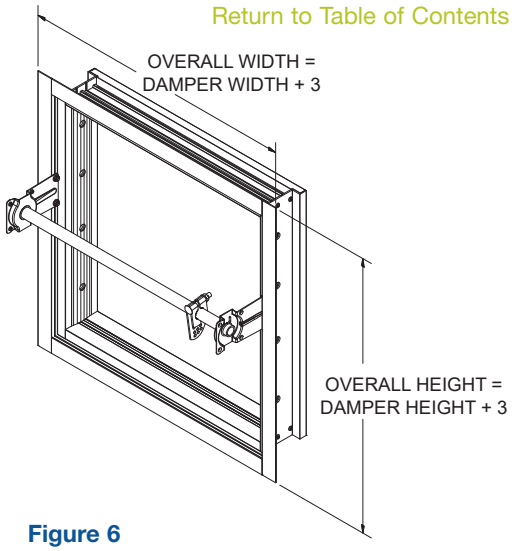
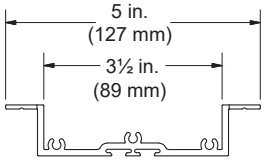
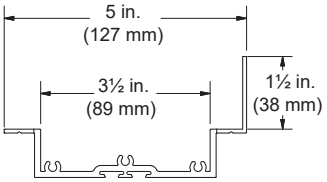


Figure 6

Channel



Single Flange



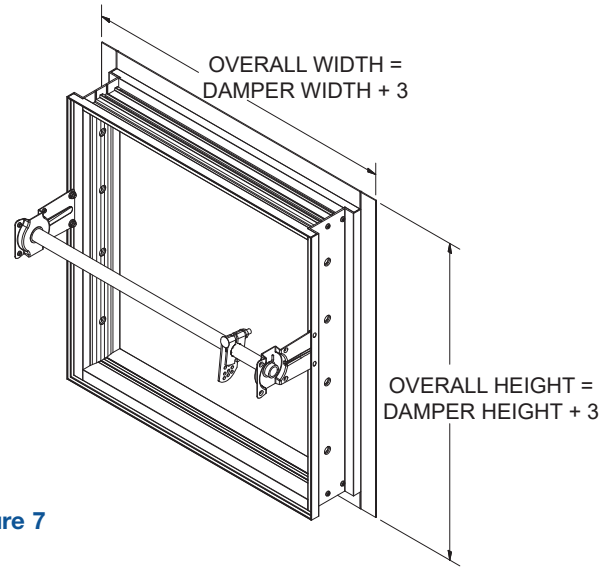


Figure 7

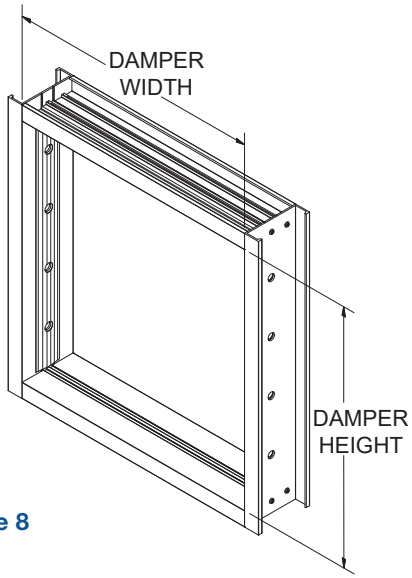
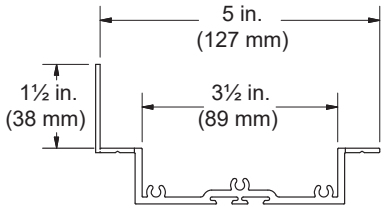
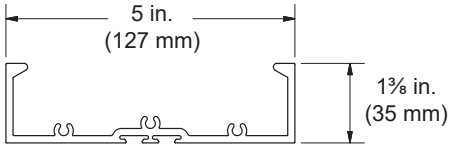


Figure 8

Reverse Flange



Quick Connect



Note: Jackshaft shown for reference only. Quick connect frame is actual inside dimensions.

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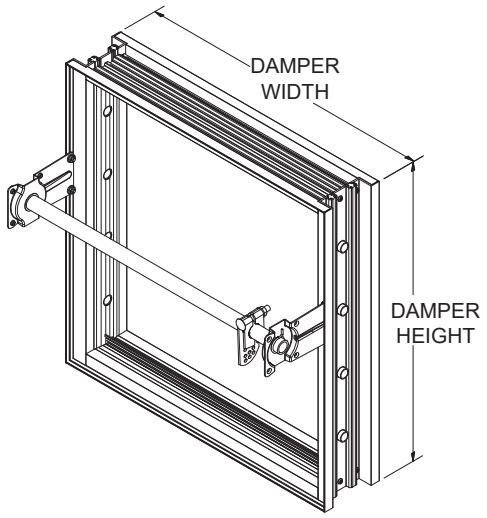


Figure 9

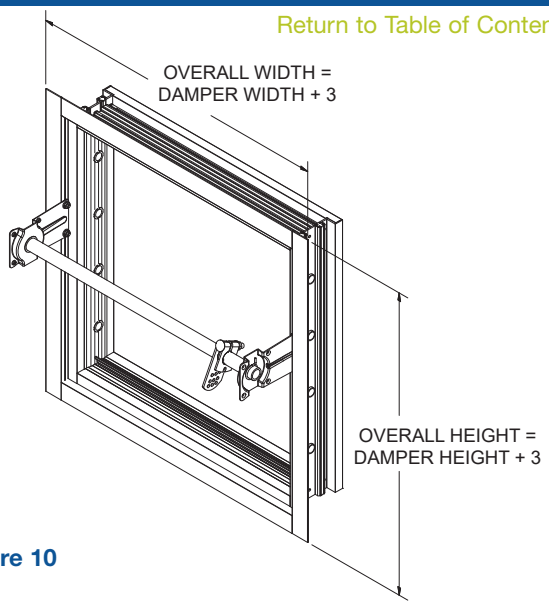
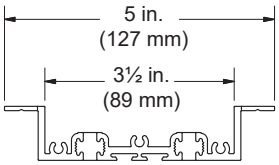
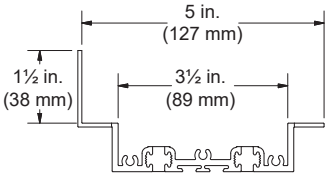


Figure 10

Channel



Single Flange



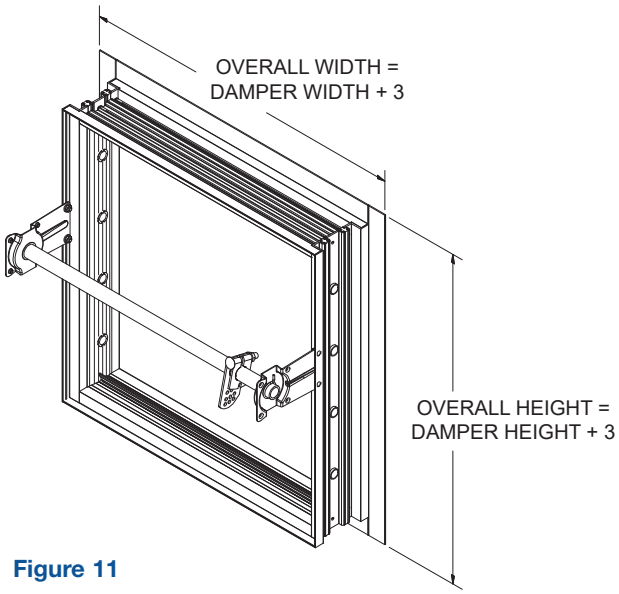


Figure 11

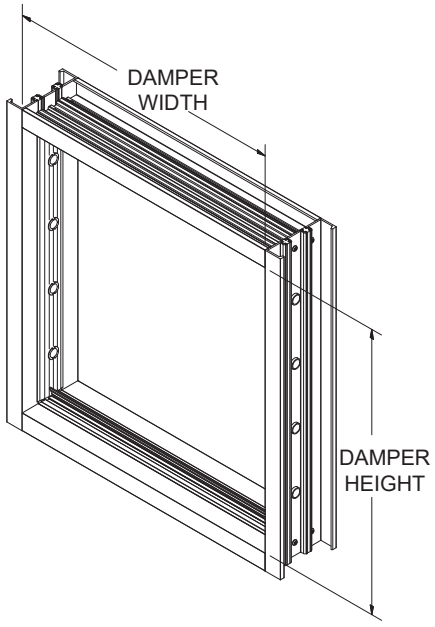
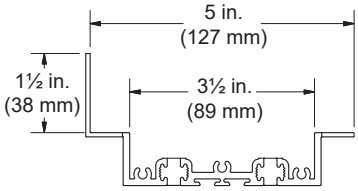
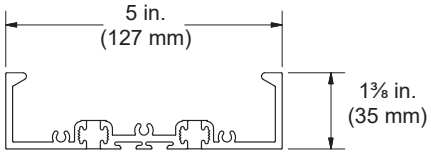


Figure 12

Reverse Flange



Quick Connect



Note: Jackshaft shown for reference only. Quick connect frame is actual inside dimensions.

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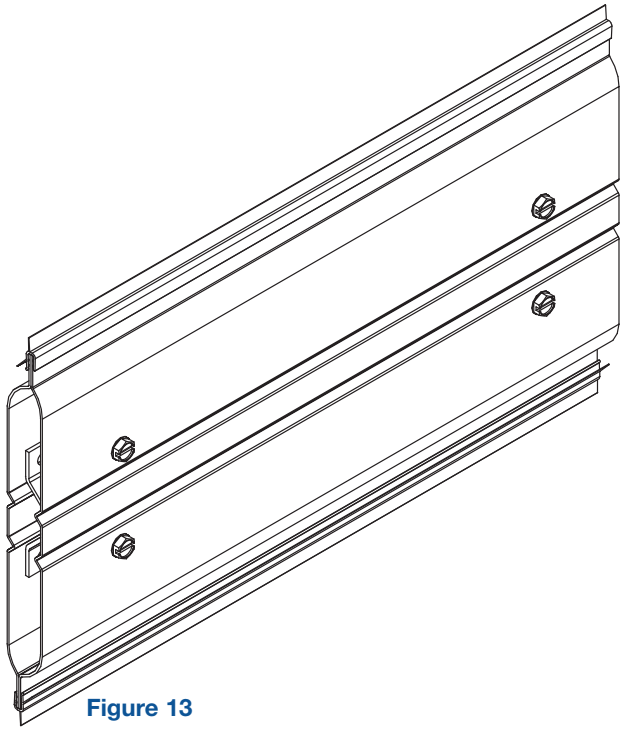

Figure 13

Fabricated Steel Airfoil

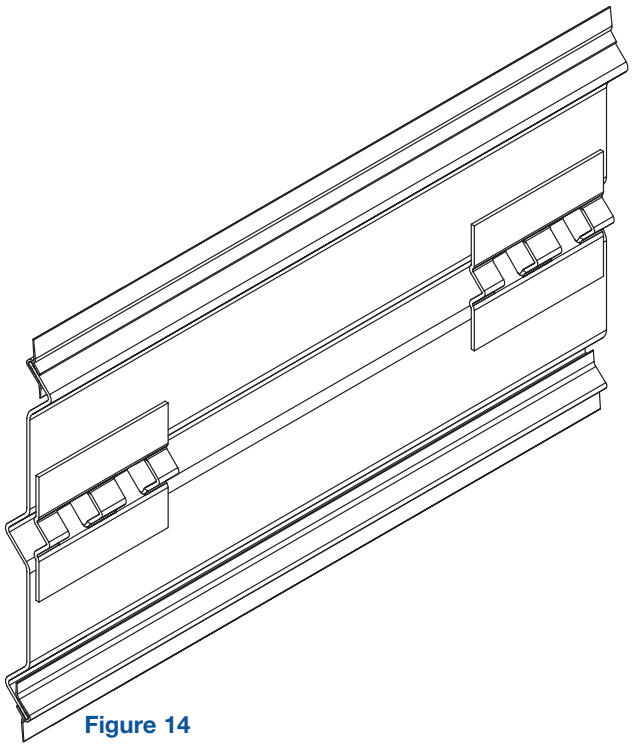

Figure 14

Fabricated Steel 3V

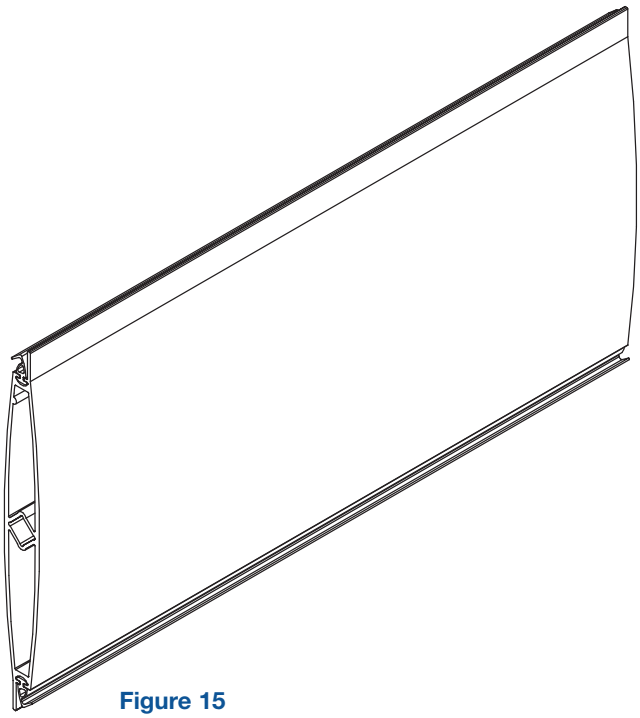

Figure 15

Extruded Aluminum Airfoil

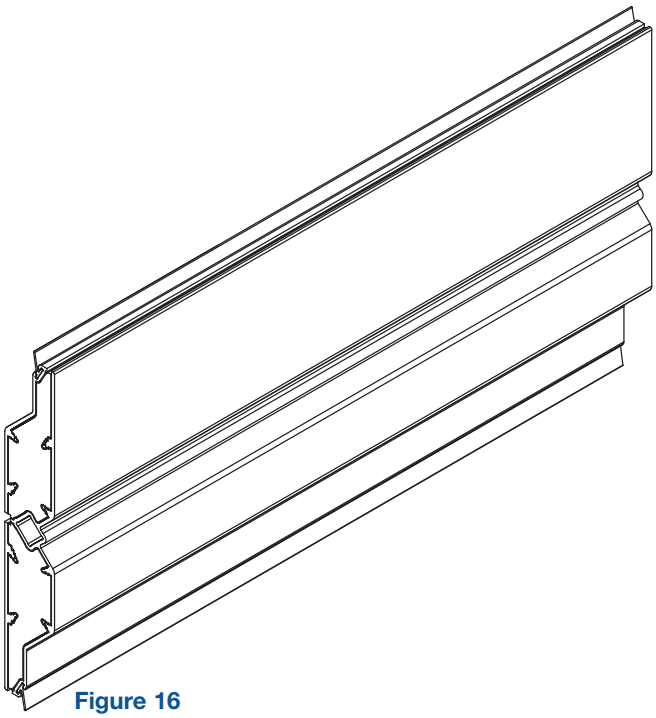

Figure 16

Extruded Aluminum Insulated Thermally Broken

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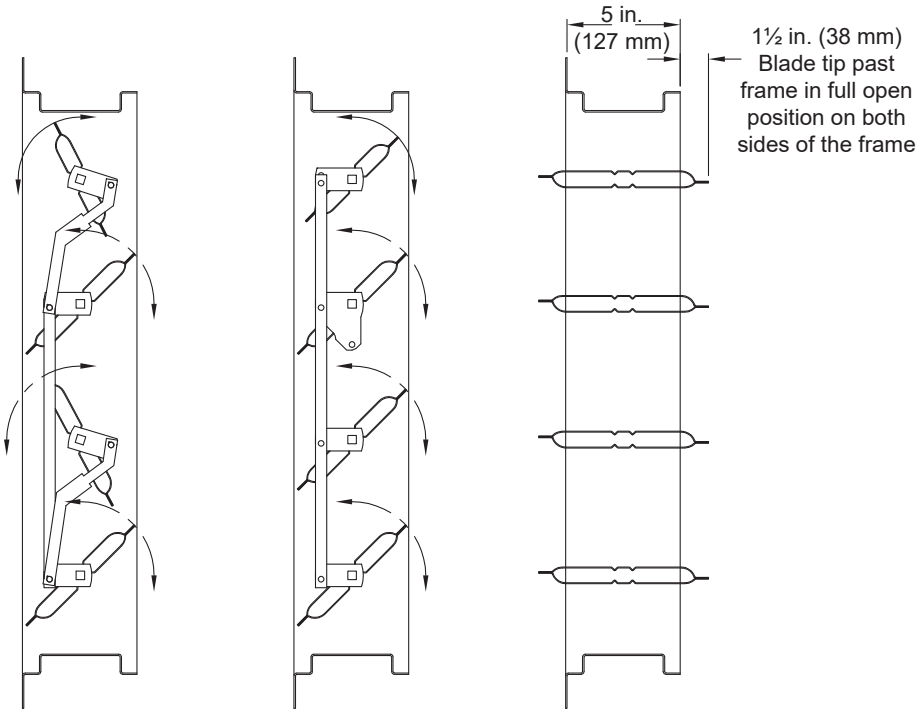

Opposed Blade
Shown in 45° position

Parallel Blade
Shown in 45° position

Opposed or Parallel
Blades fully open

Figure 17

Blade and Sweep Seal Detail

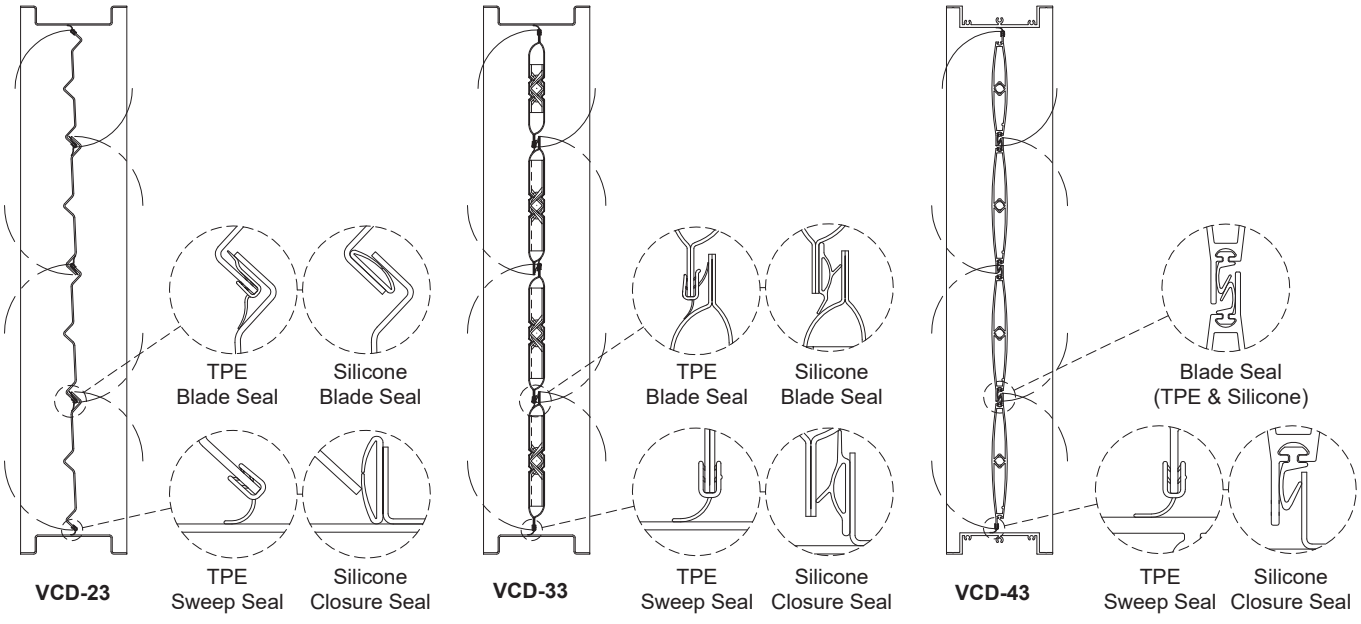

Figure 18

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VCD-20
No Jamb Seals
Space Washers

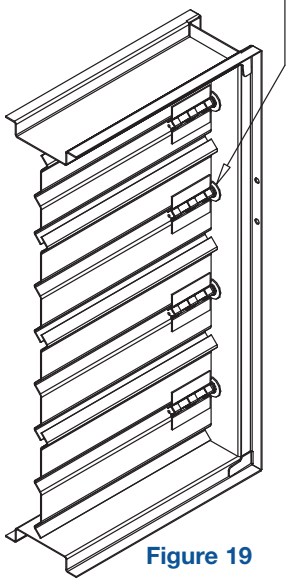

Figure 19

VCD-23
Jamb Seals
Sweep Seals
Blade Seals

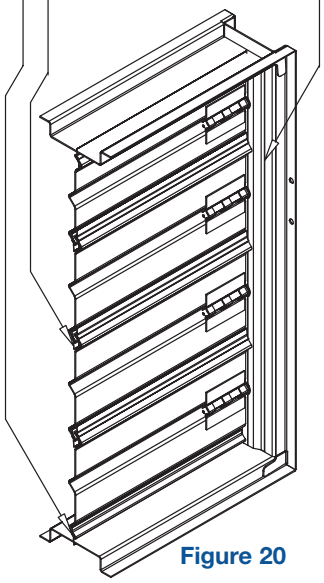

Figure 20

VCD-33
Jamb Seals
Sweep Seals
Blade Seals

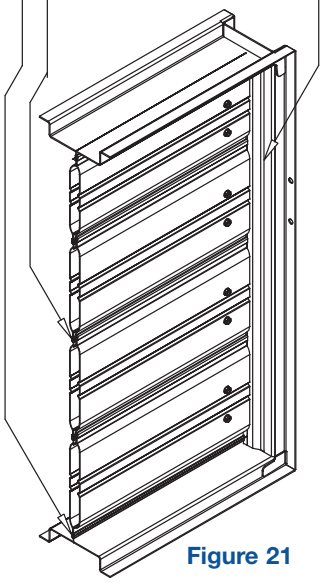

Figure 21

VCD-43
Jamb Seals
Sweep Seals
Blade Seals

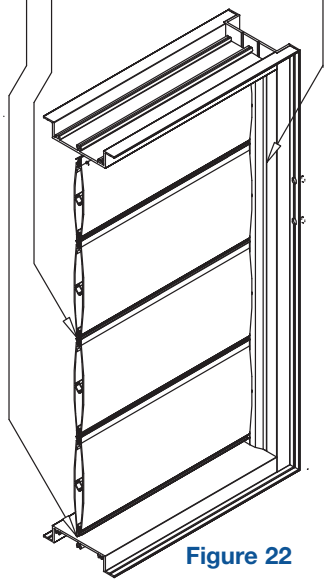

Figure 22

ICD-44
Stainless Jamb Seals
Blade Seals

ICD-45
Silicone Jamb Seals
Blade Seals

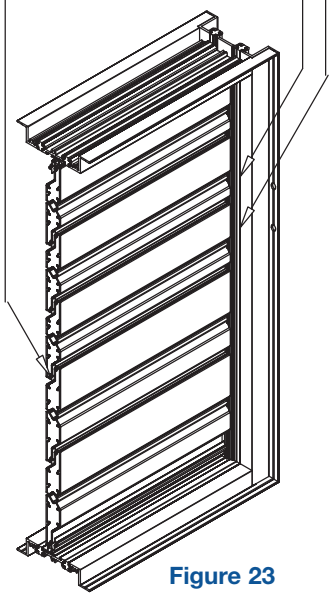

Figure 23

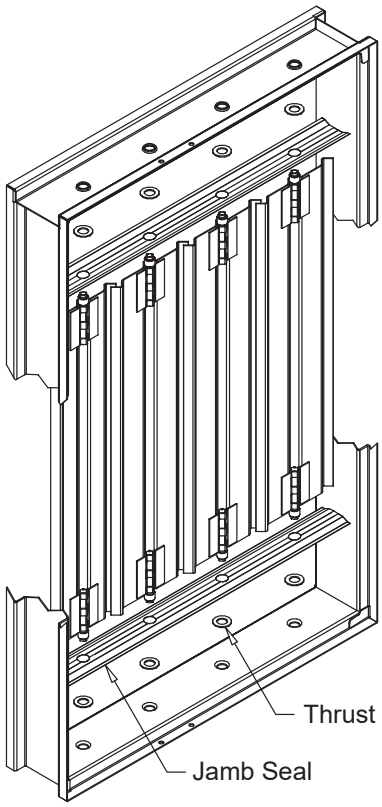

Figure 24

Vertical Blade Detail
Applicable On Models:
VCD-23V
VCD-33V
VCD-34V
VCD-43V

Note: Thrust washers used to support blade in vertical direction

Section 1: Jackshaft Height Based on Section Height

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Nominal Section Height	Actual Section Height	All VCD Models except VCD-40	VCD-40	All ICD Models
		Dim A		
6	5.75	2.88	2.88	-
7	6.75	3.38	3.38	3.88
8	7.75	3.88	3.88	4.88
9	8.75	4.38	3.03	5.38
10	9.75	2.88	3.00	3.88
11	10.75	3.38	3.50	4.88
12	11.75	3.38	4.00	4.88
13	12.75	3.88	10.66	5.38
14	13.75	3.88	10.63	5.38
15	14.75	4.38	11.13	11.88
16	15.75	4.38	11.63	12.88
17	16.75	4.88	10.78	13.88
18	17.75	13.88	10.75	14.88
19	18.75	14.38	11.25	15.38
20	19.75	15.88	11.75	12.88
21	20.75	16.38	10.91	13.88
22	21.75	16.88	10.88	14.88
23	22.75	18.38	11.38	15.38
24	23.75	18.88	10.53	15.38
25	24.75	15.88	11.03	13.88
26	25.75	16.38	11.00	14.88
27	26.75	16.38	11.50	15.38
28	27.75	17.38	18.16	15.38
29	28.75	18.38	18.13	15.38
30	29.75	18.88	18.63	14.88
31	30.75	18.88	19.13	15.38
32	31.75	16.38	18.28	15.38
33	32.75	16.38	18.25	15.38
34	33.75	16.38	18.75	15.38
35	34.75	18.38	19.25	15.38
36	35.75	16.88	18.41	15.38
37	36.75	18.88	18.38	15.38
38	37.75	18.88	18.88	15.38
39	38.75	16.38	18.03	15.38
40	39.75	17.38	18.53	15.38
41	40.75	18.38	18.5	15.38
42	41.75	18.88	19.00	15.38
43	42.75	18.88	18.16	15.38
44	43.75	18.88	18.66	15.38
45	44.75	18.88	18.63	15.38
46	45.75	16.38	19.13	15.38
47	46.75	18.38	18.28	1538
48	47.75	16.38	18.25	15.38
49	48.75	18.88	18.75	15.38
50	49.75	16.88	19.25	15.381

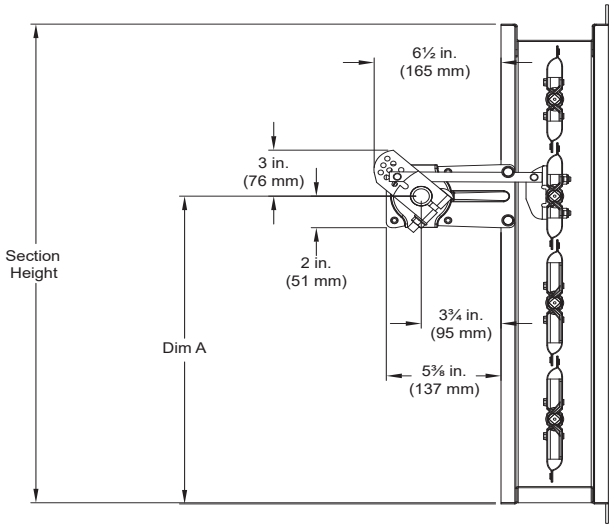

Figure 25

Note: When the nominal section height is fractional, add ½ of the fraction amount to "Dim A".

The nominal section height shown in table applies to the width on VCD-xxV models.

Example: A VCD-40 with nominal section height of 16.375.
0.188 + 11.63 = 11.818

Nominal Section Height	Actual Section Height	All VCD Models except VCD-40	VCD-40	All ICD Models
		Dim A		
51	50.75	18.88	18.41	15.38
52	51.75	18.88	18.38	15.38
53	52.75	16.38	18.88	15.38
54	53.75	16.38	18.53	15.38
56	55.75	16.38	18.50	15.38
57	56.75	18.88	19.00	15.38
58	57.75	18.88	18.16	15.38
59	58.75	18.88	18.13	15.38
60	59.75	16.38	18.63	15.38
61	60.75	18.88	19.13	15.38
62	61.75	16.38	18.28	15.38
63	62.75	18.88	18.25	15.38
64	63.75	16.88	18.75	15.38
65	64.75	18.88	19.25	15.38
66	65.75	18.88	18.41	15.38
67	66.75	18.88	18.38	15.38
68	67.75	18.88	18.88	15.38
69	68.75	18.88	18.03	15.38
70	69.75	18.88	18.00	15.38
71	70.75	18.88	18.50	15.38
72	71.75	18.88	19.00	15.38
73	72.75	18.88	18.16	15.38
74	73.75	16.38	18.13	15.38

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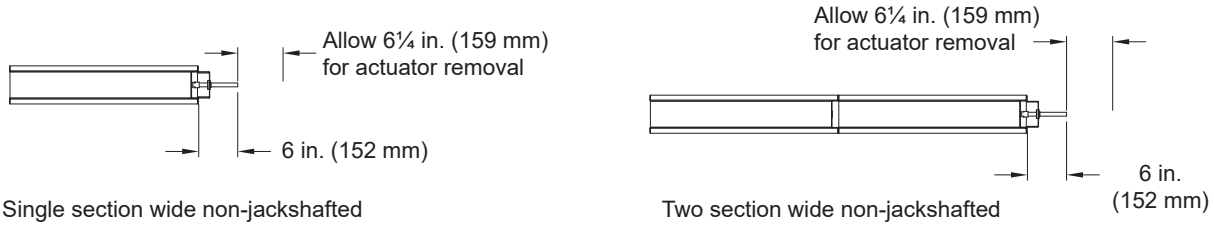
Top View



Single section wide non-jackshafted with external actuator

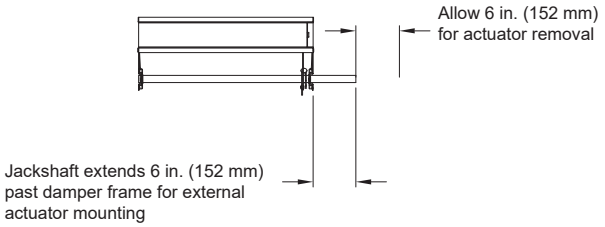
Two section wide non-jackshafted with external actuator

Figure 26

External vs. Internal Jackshaft for Actuator Mounting

Top View

Single section wide jackshafted with external actuator



Multi-section wide jackshafted with external actuator

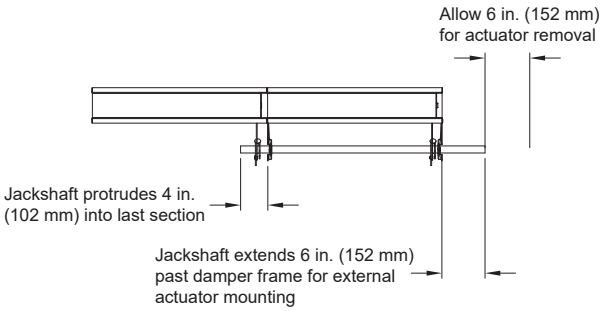
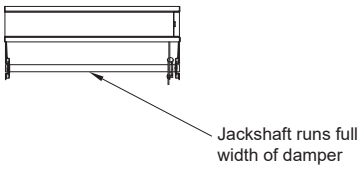


Figure 27

Single section wide jackshafted with internal actuator



Multi-section wide jackshafted with internal actuator

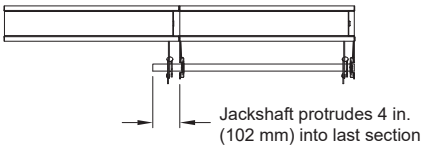


Figure 28

Note: All one section wide dampers with factory supplied actuators are built with ½ in. jackshaft. Dampers more than one section wide or dampers with customer supplied actuators are built with 1 in. jackshaft.

Single section wide non-jackshafted with internal mount (no actuator provided)

Figure 29

Note: Dampers with internally mounted actuators and no jackshaft are supplied with a blade lever.

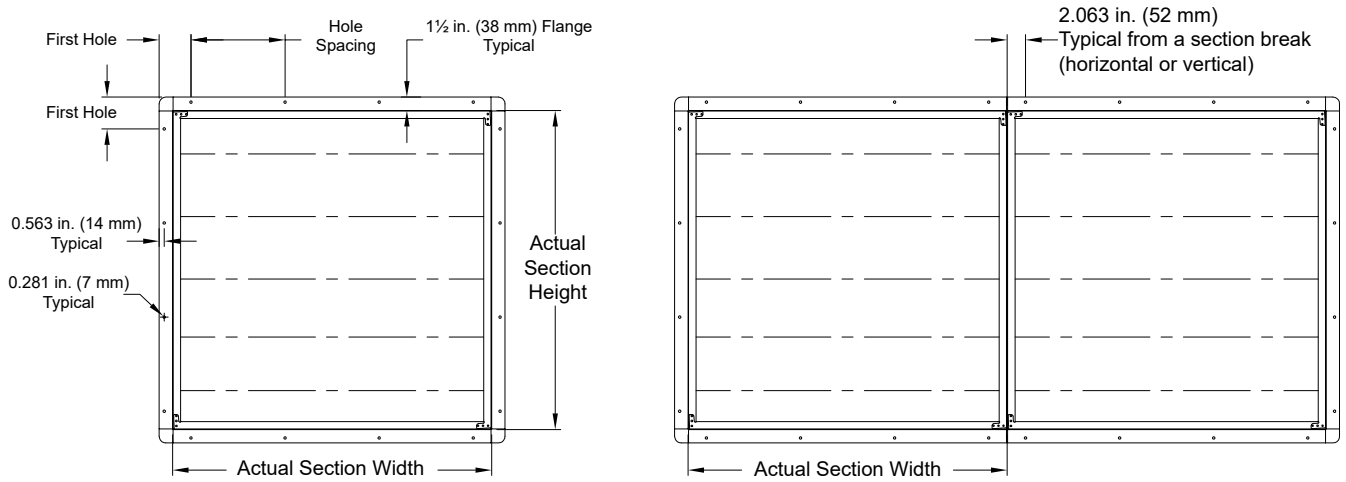


Figure 30

The same formula/locations are used in the horizontal & vertical directions	
Actual Section Dimension*	**Flange Hole Quantity**
<7.75	1
>= 7.75 & < 24.75	2
>= 24.75 & < 40.75	3
>= 40.75 & < 56.75	4
>=56.75	5
Actual Section Dimension*	**First Hole from Edge of Flange**
< 7.75	(Actual Section Dimension/2) + 1.5
>=7.75	3.563
Actual Section Dimension*	**Hole Spacing**
<7.75	N/A
>=7.75	Holes evenly spaced across section

* Dimensions are in inches.

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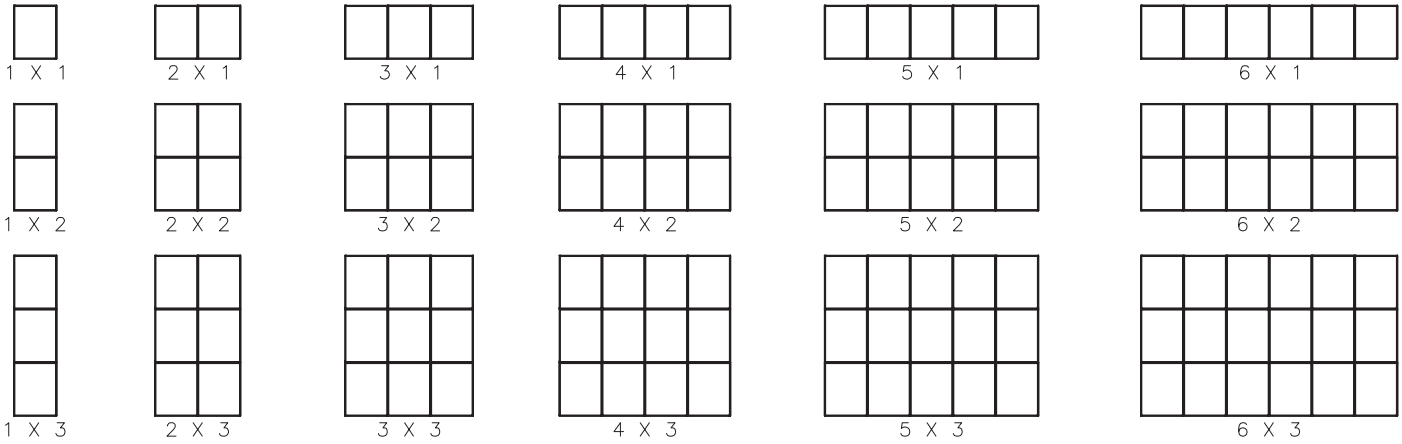

Figure 31

VCD-23V			
		Maximum Nominal Damper Width (in.)	
		74	148
Maximum Nominal Damper Height (in.)	48	1 x 1	2 x 1
	96	1 x 2	2 x 2

VCD-33V & VCD-34V			
		Maximum Nominal Damper Width (in.)	
		74	148
Maximum Nominal Damper Height (in.)	60	1 x 1	2 x 1
	120	1 x 2	2 x 2

VCD-43V			
		Maximum Nominal Damper Width (in.)	
		74	148
Maximum Nominal Damper Height (in.)	60	1 x 1	2 x 1
	120	1 x 2	2 x 2

ICD-44 & ICD-45				
		Maximum Nominal Damper Width (in.)		
		60	120	180
Maximum Nominal Damper Height (in.)	78	1 x 1	2 x 1	3 x 1
	156	1 x 2	2 x 2	3 x 2

VCD-20 & VCD-23							
		Maximum Nominal Damper Width (in.)					
		48	96	144	192	240	288
Maximum Nominal Damper Height (in.)	74	1 x 1	2 x 1	3 x 1	4 x 1	5 x 1	6 x 1
	148	1 x 2	2 x 2	3 x 2	4 x 2	5 x 2	6 x 2
	222	1 x 3	2 x 3	3 x 3	4 x 3	5 x 3	6 x 3

VCD-33, 34, 40, 42 & VCD-43							
		Maximum Nominal Damper Width (in.)					
		60	96	144	192	240	288
Maximum Nominal Damper Height (in.)	74	1 x 1	2 x 1	3 x 1	4 x 1	5 x 1	6 x 1
	148	1 x 2	2 x 2	3 x 2	4 x 2	5 x 2	6 x 2
	222	1 x 3	2 x 3	3 x 3	4 x 3	5 x 3	6 x 3

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

22-2FER-2

(1) (2) (3) (4) (5) (6) (7)

(1) Number of sections wide

(2) Number of sections high

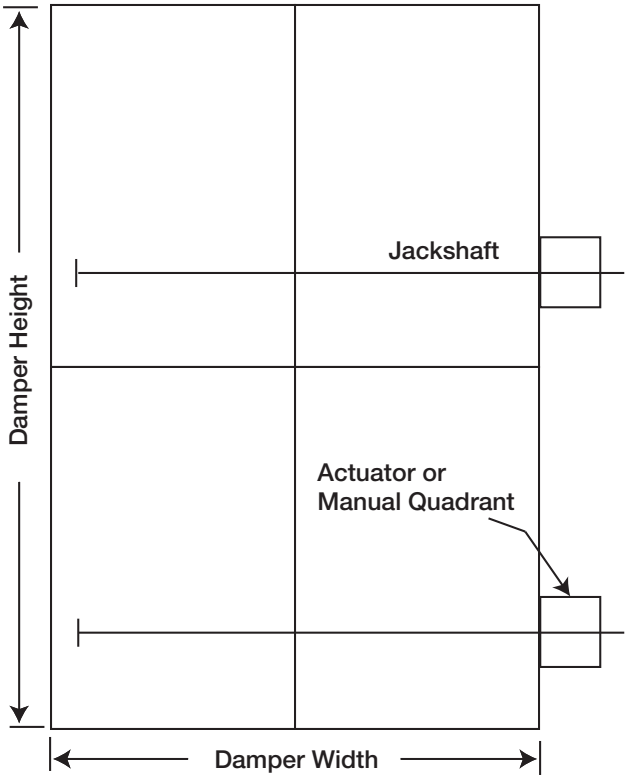
(3) Number of actuators or manual quadrants

(4) Who supplies the actuators or manual quadrants
- F - Factory
- C - Customer Supplied (field mounted)

(5) Actuator or manual quadrant mounting
- E - External
- I - Internal
- B - Both internal and external

(6) Actuator or manual quadrant location
- L - Left hand drive
- R - Right hand drive
- B - Both right and left

(7) Number of jackshafts



Vertical blade and face & bypass dampers are provided with a configuration ID number that describes the construction of the damper.

Sections Wide x Sections High

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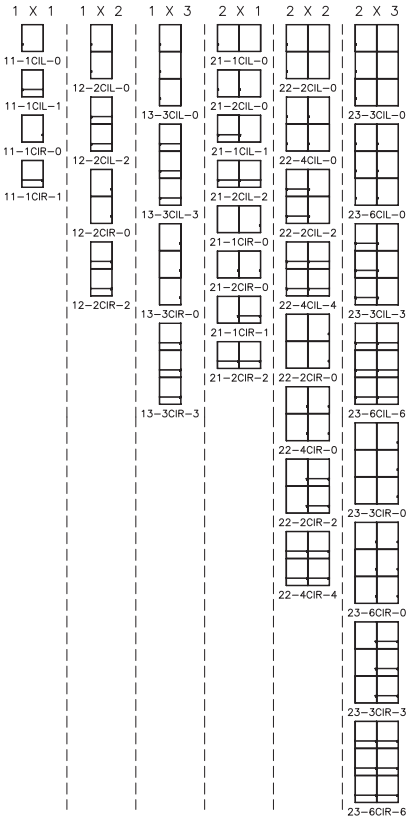

Figure 32

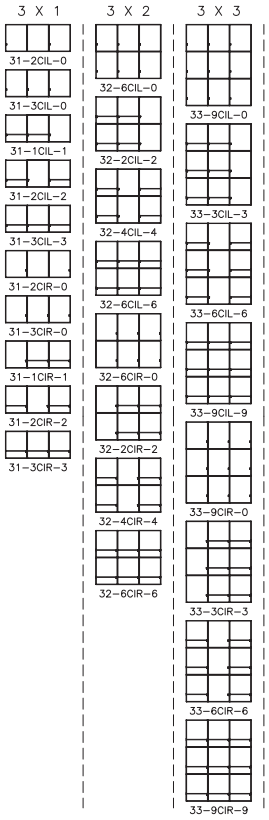

Figure 33

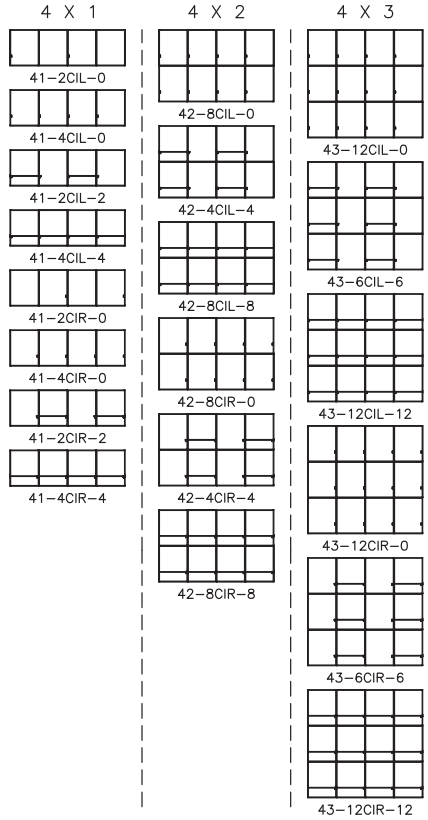

Figure 34

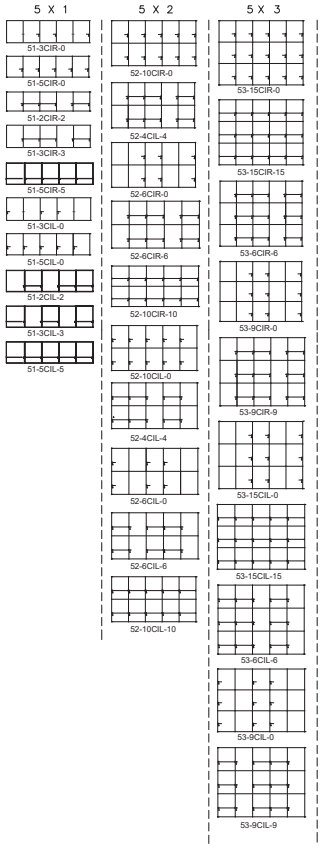

Figure 35

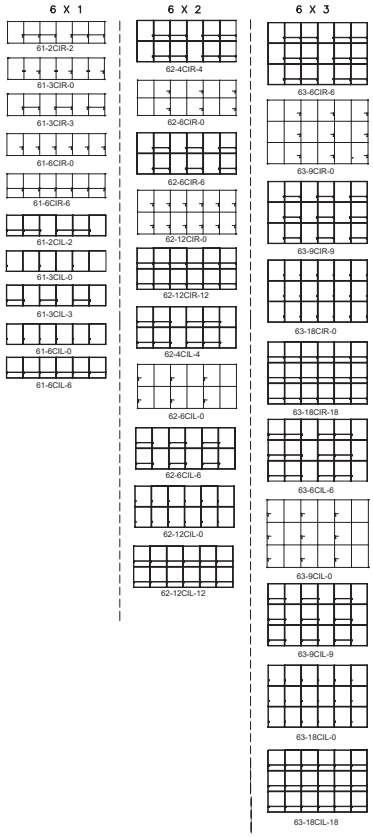

Figure 36

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Sections Wide x Sections High

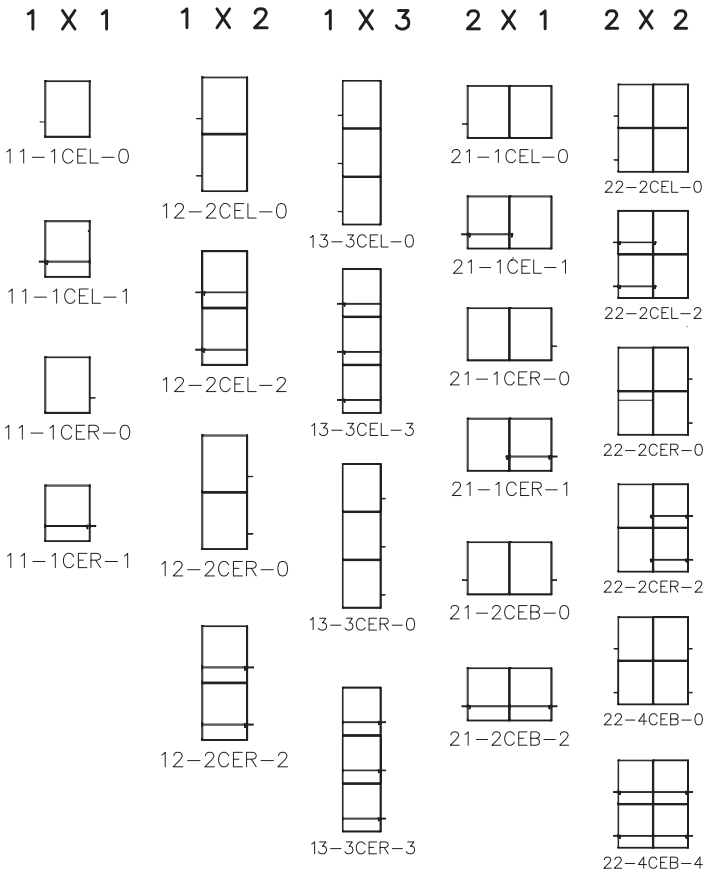


Figure 37

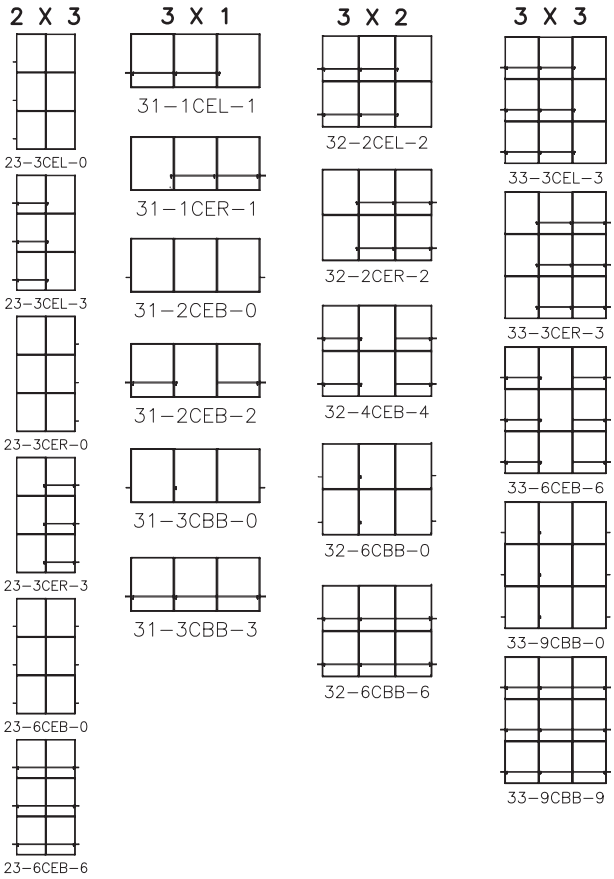
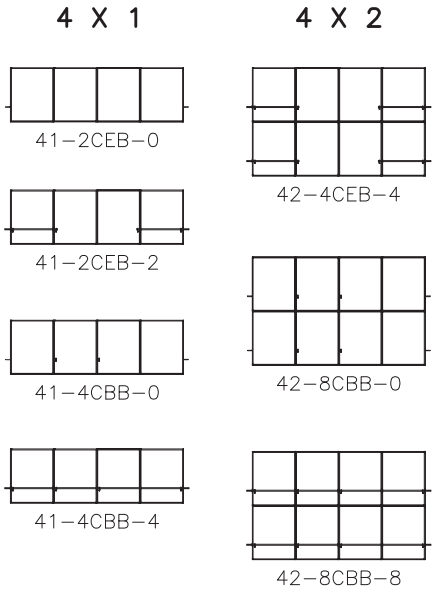


Figure 38



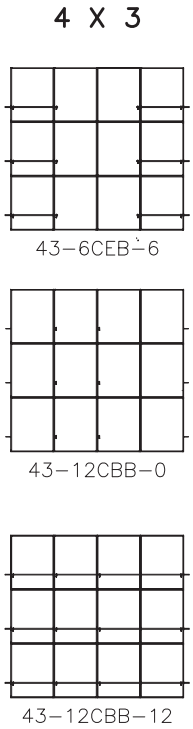


Figure 39

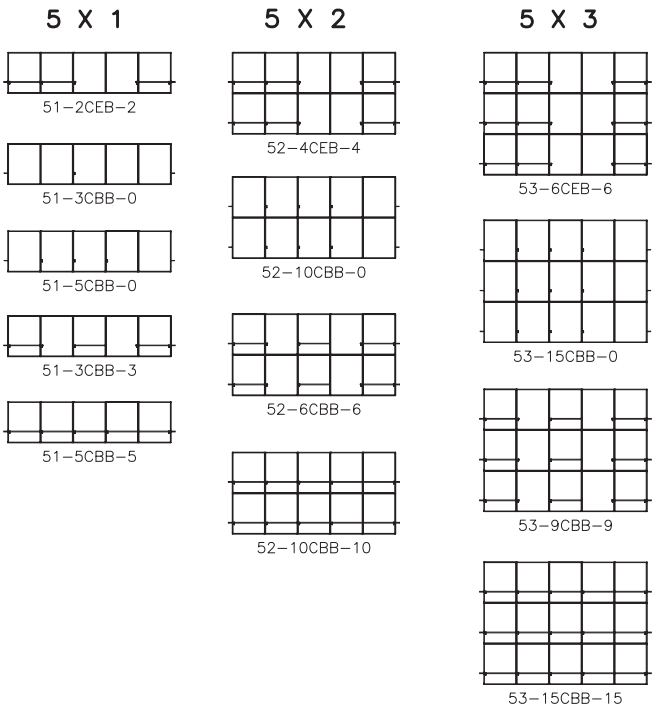


Figure 40

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Sections Wide x Sections High

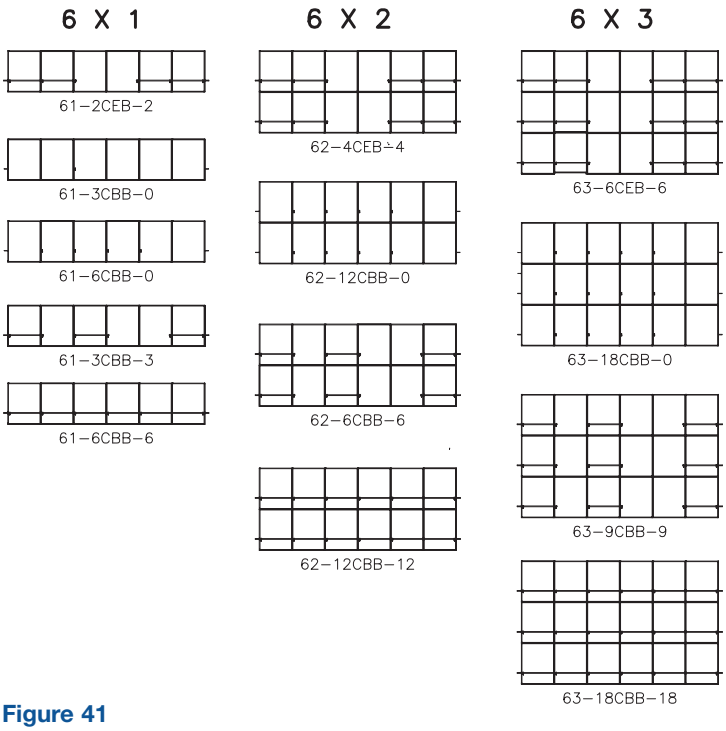

Figure 41

Sleeved Damper

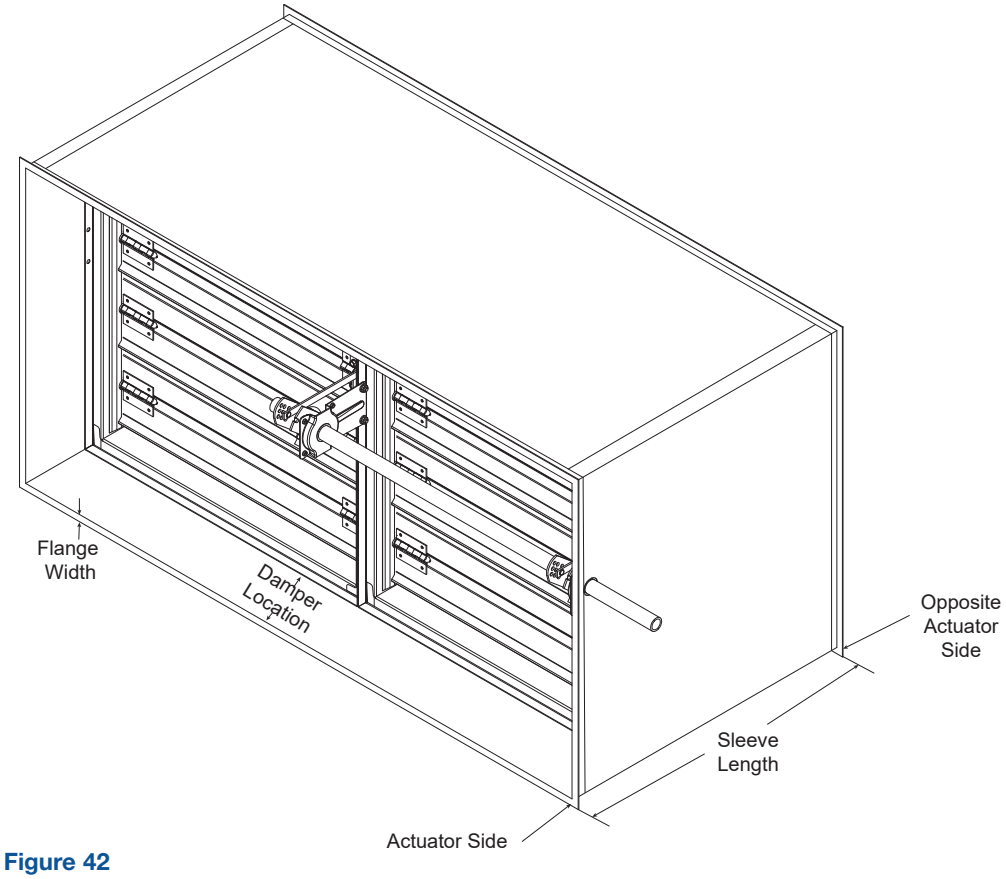

Figure 42

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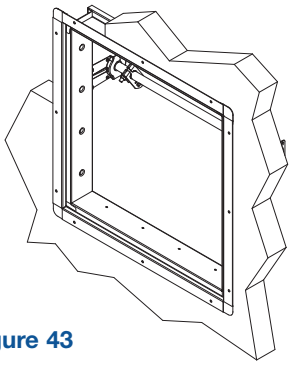


Figure 43

Reversed Flange - Insert Mount
Internal mounted actuator required for installation.

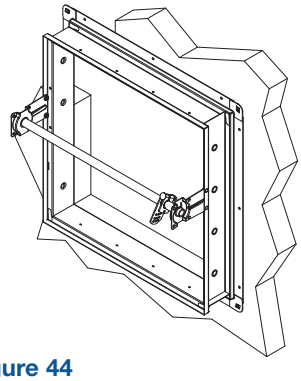


Figure 44

Reversed Flange - Flange Mount
Any jackshaft and actuator position will work for this installation.

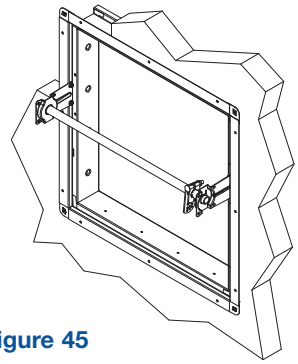


Figure 45

Single Flange - Insert Mount
Jackshafting and/or internal mounted actuator required for installation.

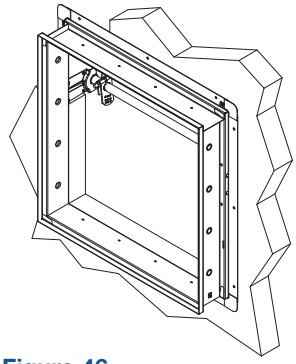


Figure 46

Single Flange - Flange Mount
External jackshafted will not work for this installation.

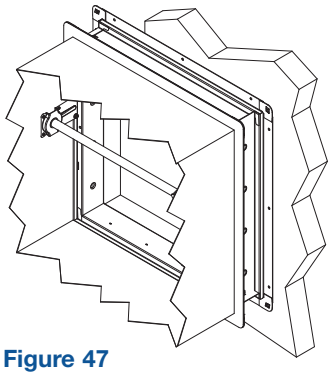


Figure 47

Double Flange - Flange Mounted
Internal mounted actuator is not required for this installation.

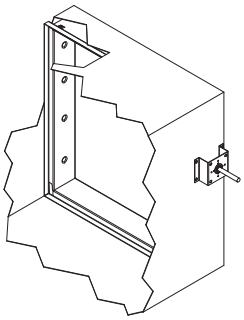
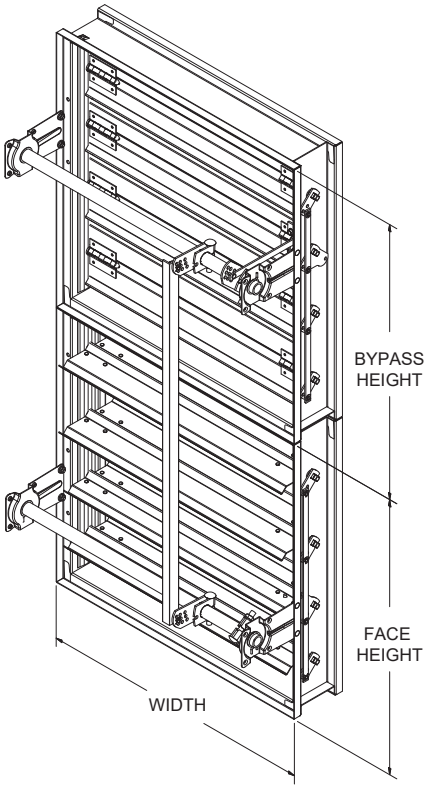


Figure 48

Channel Frame - Insert Mount
Shown as external non-jackshaft. Jackshafting and internal mounted actuator is optional.

Face & Bypass Dampers

Vertical style



NOTE - Drawing shown with bypass damper above face damper. Bypass damper below face damper is optional.
Face and bypass width and height dimensions are actual.

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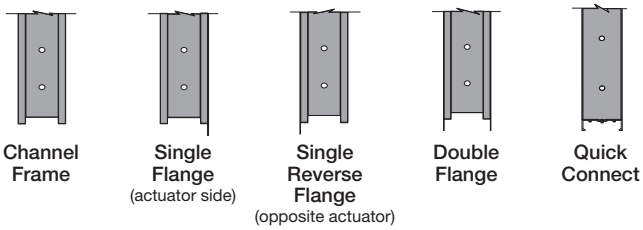
When sizing the damper, with the exception of the “Quick Connect” frame style and damper flanges, the frame of the damper will be included in the selected dimensions. Quick Connect frame uses inside dimension.

Greenheck has several damper frame types available to provide the user mounting flexibility and labor savings during installation.

- Channel Frame – Designed to be insert mounted inside of a duct (required when sleeve option is chosen).
- Single Flange Frame – Either insert mounted for a framed look and space savings, or flange mounted against the wall when jackshaft orientation is not a concern, speed of mounting, and exposed linkage is desired.



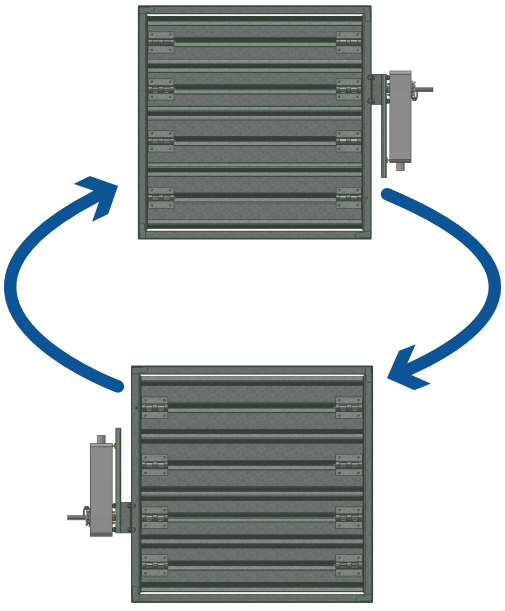
- Reverse Flange Frame – Either insert mounted for a clean framed look (internal actuator mount) as well as space savings, or flange mounted against the wall when available space is not a concern, speed of mounting and exposed linkage is desired.
- Double Flange Frame – Can be selected when flange mounting is required and the user is uncertain of the jackshaft orientation and left or right hand mount is required. The most forgiving flange frame type when a flange is required, but the user may not necessarily know the actuator location required.
- Quick Connect Frame – Used when it is desired to flange mount a frame against a surface and connect a piece of ductwork utilizing TDC/TDF/Ductmate or Dyn-o-mate on the mating end of the ductwork. The frame is the mirror image of these duct connections and allows the damper frame to be “cleated” into place. This frame also provides maximum free area as the frame is designed to be completely out of the airstream.

No Top or Bottom

Control dampers are rated for airflow in both directions which allows the damper to be mounted in any postion with the blades horizontal. The damper can be rotated so the actuator is on the left or right side.

For vertical blade damper models, the blades woud run vertically and the actuator would be at the top or bottom.

Rotate the damper from left hand to right hand and vice versa.



Flip the damper from right hand drive to left hand drive and vice versa.

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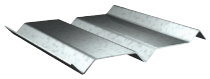
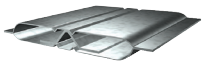
Depending on the airflow velocity and static pressure of the application, Greenheck has numerous damper blade types available to meet the system requirements.



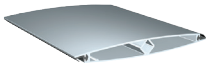
3V Blade

- Fabricated from a single thickness galvanized steel or stainless steel
- Three V-type grooves running the full length of the blade to increase strength
- Low to medium velocity and pressure applications



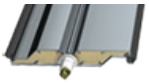
Fabricated Airfoil Blade

- Constructed of double-skin galvanized steel or stainless steel
- This blade design results in lower resistance to airflow and increased strength
- High velocity and pressure applications



Extruded Aluminum Airfoil Blade

- Constructed of heavy gauge extruded aluminum
- This blade design results in lower resistance to airflow and increased strength
- High velocity and pressure applications

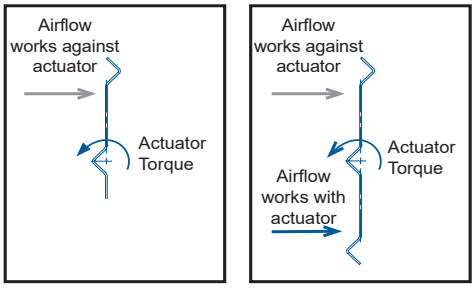


Insulated and Thermally Broken Extruded Aluminum Blade

- Extruded aluminum airfoil blades with thermal breaks and insulated with polyurethane foam
- Used in harsh environments/high temperature differentials

Variable Symmetric Blade Design

- Blades are symmetric about their axis
- Combination of 4, 5, 6, and 7 in. (102, 127, 152, and 178 mm) blade widths may be used in a single damper
- Reduces the need for closure strips which optimizes pressure drop performance
- Damper are rated for airflow in both directions
- Extensive testing has shown that utilizing various blade sizes will reduce the required actuator torque, which leads to a reduction in the size and quantity of actuators needed to operate a damper. This ultimately results in lower initial costs for the building owner, as well as a reduction in on-going electrical power consumption.



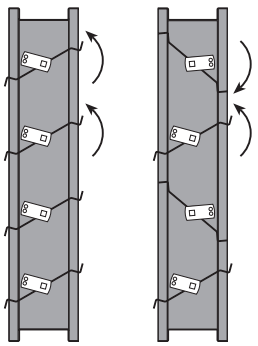
Unbalanced Blade Requires Higher Torque

Balanced Blade Requires Less Torque

Parallel Versus Opposed Blade Operation

Greenheck control dampers are offered with either parallel or opposed blades. Each style has distinguishing characteristics in regard to the type of operation required.

- Parallel blade operation - This configuration requires the damper blades to rotate in the same direction, parallel to one another. Parallel blade orientation is typically used on dampers where the blades in either fully open or fully close.
- Opposed blade operation - Adjacent damper blades rotate opposite one another under opposed blade configuration. Opposed blade configuration is typically used on dampers that regulate airflow.



Parallel Blades

Opposed Blades

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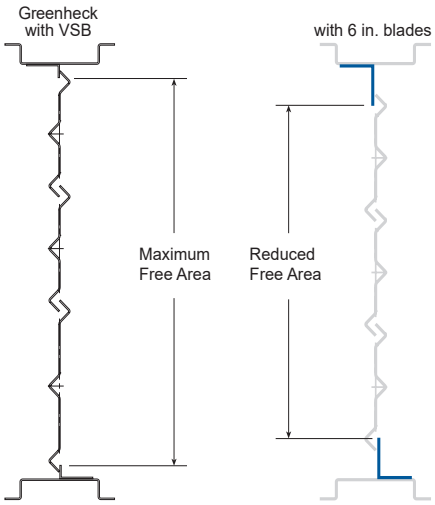
Free Area

Greenheck manufactures dampers with a variable blade spacing utilizing 4 blade widths (4, 5, 6, and 7 in.). This is to either eliminate the closure strip or minimize the closure strip height maintaining maximum free area.

Greenheck also utilizes “low profile” frames when the damper height is <= 17 in. which provides a .335 in. offset at the top and bottom of the damper frame vs. the typical 1 in. that most competitors use providing another full 1 in. of free area in the damper opening when the blades are full open. (See diagram on below).

Free area varies based on the size of the damper with the smallest damper sizes having a slightly smaller percentage of free area than larger sizes.

Interpolate between sizes to approximate free area percentage if damper size is between what is published in table.



Free Area Percentage					
	Damper Model				
Size W x H (inches)	VCD-20	VCD-23	VCD-33	VCD-42 & VCD-43	ICD-44 & ICD-45
12 x 12	67%	64%	67%	63%	73%
24 x 24	75%	73%	75%	74%	73%
36 x 36	78%	77%	79%	79%	74%
48 x 48	79%	78%	82%	81%	74%
48 x 74	80%	79%	82%	82%	75%
60 x 74	NA	NA	83%	83%	NA

Pressure Drop

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 an 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 an HVAC system.

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.

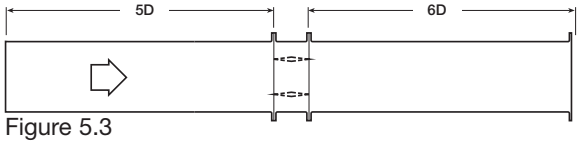


Figure 5.3

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.

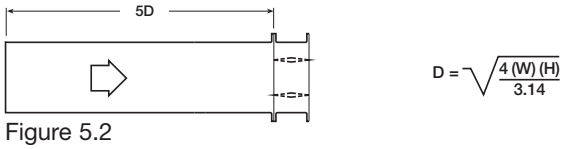


Figure 5.2

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

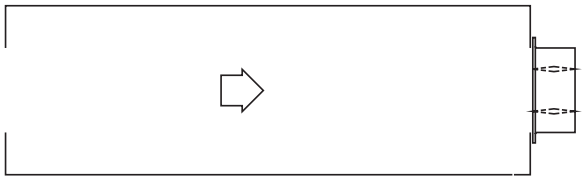


Figure 5.5

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Models VCD-20, 23, & SEVCD-23

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.01	.01	.03	.01	.01	.03	.01	.01	.03	.01	.01	.03	.01	.01	.03
1000	.05	.03	.13	.03	.02	.12	.02	.02	.12	.04	.03	.14	.03	.03	.12
1500	.11	.08	.30	.06	.04	.26	.05	.03	.28	.08	.07	.32	.07	.06	.28
2000	.19	.13	.53	.10	.07	.47	.09	.06	.50	.15	.12	.57	.12	.10	.49
2500	.29	.20	.82	.16	.11	.75	.14	.09	.78	.22	.18	.90	.18	.16	.77
3000	.41	.29	1.19	.23	.16	1.04	.19	.13	1.12	.32	.26	1.29	.26	.22	1.12
3500	.55	.40	1.62	.30	.21	1.41	.27	.19	1.53	.43	.36	1.76	.36	.30	1.53
4000	.72	.51	2.10	.40	.28	1.90	.35	.25	2.00	.56	.46	2.30	.47	.39	2.01

VCD-20 & 23

- Galvanized 3V blade
- Blade and jamb seals VCD-23

SEVCD-23

- 316 stainless steel 3V blade
- 316 stainless steel construction
- Blade and jamb seals

Model VCD-23V

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.01	.01	.03	.01	.01	.03	.01	.01	.02	.01	.01	.03	.01	.01	.03
1000	.05	.03	.13	.03	.02	.12	.02	.02	.10	.03	.03	.12	.04	.03	.12
1500	.11	.08	.30	.06	.04	.26	.05	.03	.22	.07	.06	.28	.08	.07	.27
2000	.19	.13	.53	.10	.07	.47	.09	.06	.40	.12	.10	.49	.15	.12	.47
2500	.29	.20	.82	.16	.11	.75	.14	.09	.62	.18	.16	.77	.22	.18	.75
3000	.41	.29	1.19	.23	.16	1.04	.19	.13	.90	.26	.22	1.12	.32	.26	1.07
3500	.55	.40	1.62	.30	.21	1.41	.27	.19	1.23	.36	.30	1.53	.43	.36	1.45
4000	.72	.51	2.10	.40	.28	1.90	.35	.25	1.62	.47	.39	2.01	.56	.46	1.91

VCD-23V

- Vertical 3V blade
- Blade and jamb seals

Models VCD-33, 34, & SEVCD-33

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	.5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.01	.01	.03	.01	.01	.03	.01	.01	.02	.01	.01	.03	.01	.01	.03
1000	.03	.02	.12	.03	.01	.11	.02	.01	.09	.03	.02	.11	.02	.02	.11
1500	.07	.05	.27	.06	.03	.26	.04	.02	.21	.07	.04	.24	.04	.04	.24
2000	.13	.08	.48	.10	.05	.45	.07	.04	.38	.11	.08	.43	.08	.07	.44
2500	.19	.12	.74	.15	.09	.71	.11	.06	.58	.17	.12	.67	.12	.11	.68
3000	.26	.17	1.07	.21	.13	1.02	.15	.08	.85	.23	.17	.96	.16	.15	.97
3500	.35	.23	1.46	.28	.17	1.40	.20	.12	1.15	.31	.22	1.31	.21	.20	1.32
4000	.45	.30	1.91	.36	.22	1.89	.26	.15	1.52	.39	.29	1.71	.27	.25	1.73

VCD-33 & 34

- Galvanized airfoil blade
- Insulated airfoil VCD-34
- Blade and jamb seals

SEVCD-33

- 316 stainless steel airfoil blade
- 316 stainless steel construction
- Blade and jamb seals

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Models VCD-33V, 34V

VCD-33V

- Vertical galvanized airfoil blade
- Blade and jamb seals

VCD-34V

- Vertical galvanized insulated airfoil blade
- Blade and jamb seals

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.01	.01	.03	.01	.01	.03	.01	.01	.03	.01	.01	.03	.01	.01	.03
1000	.05	.03	.13	.03	.02	.12	.02	.02	.12	.03	.03	.12	.04	.03	.12
1500	.11	.08	.30	.06	.04	.26	.05	.03	.28	.07	.06	.28	.08	.07	.27
2000	.19	.13	.53	.10	.07	.47	.09	.06	.50	.12	.10	.49	.15	.12	.47
2500	.29	.20	.82	.16	.11	.75	.14	.09	.78	.18	.16	.77	.22	.18	.75
3000	.41	.29	1.19	.23	.16	1.04	.19	.13	1.12	.26	.22	1.12	.32	.26	1.07
3500	.55	.40	1.62	.30	.21	1.41	.27	.19	1.53	.36	.30	1.53	.43	.36	1.45
4000	.72	.51	2.10	.40	.28	1.90	.35	.25	2.00	.47	.39	2.01	.56	.46	1.91

Model VCD-40

VCD-40

- Extruded aluminum airfoil blade
- Blades contained within the frame
- Blade and jamb seals

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.08	.05	.10	.01	.01	.03	.01	.01	.03	.01	.01	.03	.06	.03	.08
1000	.31	.20	.40	.05	.02	.12	.04	.02	.11	.05	.03	.12	.23	.13	.29
1500	.69	.45	.88	.11	.05	.29	.09	.04	.26	.11	.07	.27	.52	.29	.63
2000	1.19	.76	1.54	.19	.10	.52	.16	.07	.46	.20	.12	.49	.91	.51	1.12
2500	1.84	1.19	2.41	.30	.15	.80	.24	.10	.72	.30	.19	.76	1.43	.81	1.76
3000	2.67	1.7	3.45	.43	.22	1.14	.35	.15	1.04	.43	.26	1.11	2.05	1.16	2.52
3500	3.59	2.29	4.75	.58	.3	1.6	.48	.20	1.43	.59	.36	1.53	2.82	1.59	3.40
4000	4.64	2.97	6.09	.76	.40	2.14	.62	.27	1.87	.77	.46	2.00	3.69	2.09	4.52

Model VCD-42

VCD-42

- Extruded aluminum airfoil blade
- Galvanized frame
- Blade and jamb seals

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.05	.03	.07	.01	.01	.04	.01	.01	.02	.01	.01	.03	.03	.02	.05
1000	.18	.12	.28	.05	.03	.17	.04	.02	.12	.01	.04	.18	.11	.06	.19
1500	.43	.28	.62	.12	.06	.37	.09	.05	.28	.14	.09	.40	.25	.14	.44
2000	.76	.49	1.11	.22	.11	.66	.17	.08	.50	.25	.16	.72	.44	.25	.78
2500	1.19	.77	1.73	.34	.17	1.04	.26	.13	.78	.39	.25	1.12	.69	.39	1.21
3000	1.71	1.11	2.50	.49	.24	1.50	.38	.19	1.13	.57	.36	1.62	1.0	.57	1.75
3500	2.33	1.51	3.41	.66	.33	2.04	.51	.26	1.53	.77	.49	2.21	1.36	.77	2.38
4000	3.04	1.98	4.45	.87	.43	2.66	.67	.34	2.01	1.01	.64	2.88	1.78	1.01	3.11

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Model VCD-43

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.01	.01	.04	.01	.01	.03	.01	.01	.03	.01	.01	.03	.01	.01	.03
1000	.06	.03	.14	.04	.02	.12	.03	.01	.10	.06	.03	.11	.03	.02	.11
1500	.13	.07	.31	.10	.04	.27	.06	.02	.22	.13	.06	.25	.06	.04	.26
2000	.23	.14	.55	.18	.08	.48	.12	.04	.39	.23	.11	.46	.10	.08	.46
2500	.35	.21	.86	.28	.13	.75	.18	.06	.61	.36	.17	.72	.16	.12	.72
3000	.50	.29	1.23	.40	.19	1.07	.26	.09	.87	.51	.25	1.05	.23	.18	1.02
3500	.68	.39	1.67	.54	.26	1.47	.35	.13	1.19	.71	.34	1.43	.30	.24	1.40
4000	.88	.51	2.19	.70	.34	1.91	.46	.17	1.56	.93	.45	1.87	.39	.31	1.83

VCD-43

- Extruded aluminum airfoil blade
- Aluminum frame
- Blade and jamb seals

Model VCD-43V

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.01	.01	.04	.01	.01	.03	.01	.01	.03	.01	.01	.03	.01	.01	.03
1000	.06	.03	.14	.04	.02	.12	.03	.01	.10	.03	.02	.11	.06	.03	.11
1500	.13	.07	.31	.10	.04	.27	.06	.02	.22	.06	.04	.26	.13	.06	.25
2000	.23	.14	.55	.18	.08	.48	.12	.04	.39	.10	.08	.46	.23	.11	.46
2500	.35	.21	.86	.28	.13	.75	.18	.06	.61	.16	.12	.72	.36	.17	.72
3000	.50	.29	1.23	.40	.19	1.07	.26	.09	.87	.23	.18	1.02	.51	.25	1.02
3500	.68	.39	1.67	.54	.26	1.47	.35	.13	1.19	.30	.24	1.40	.71	.34	1.40
4000	.88	.51	2.19	.70	.34	1.91	.46	.17	1.56	.39	.31	1.83	.93	.45	1.83

VCD-43V

- Vertical extruded aluminum airfoil blade
- Aluminum frame
- Blade and jamb seals

Models ICD-44 & ICD-45

Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.03	.01	.05	.02	.01	.05	.01	.01	.03	.01	.01	.04	.03	.01	.05
1000	.11	.04	.23	.08	.03	.21	.05	.02	.14	.06	.02	.18	.14	.06	.22
1500	.25	.09	.52	.19	.08	.47	.11	.04	.33	.14	.06	.42	.32	.14	.51
2000	.45	.17	.93	.34	.14	.84	.21	.08	.58	.25	.10	.74	.57	.25	.90
2500	.71	.26	1.44	.53	.22	1.32	.33	.12	.91	.40	.17	1.16	.89	.40	1.41
3000	1.03	.38	2.08	.77	.32	1.90	.47	.18	1.31	.57	.24	1.68	1.29	.58	2.04
3500	1.40	.52	2.83	1.05	.43	2.59	.64	.24	1.79	.78	.33	2.28	1.76	.79	2.78
4000	1.83	.67	3.70	1.37	.57	3.39	.84	.32	2.34	1.02	.43	2.98	2.30	1.03	3.70

ICD-44/45

- Thermally broken extruded aluminum airfoil blade
- Thermally broken aluminum frame - ICD-45
- Blade and jamb seals

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Model AMD-23

AMD-23

- Air measuring station with a 3V blade control damper

Dimension inches	12 x 12			24 x 24			36 x 36			12 x 48			48 x 12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.05	.04	.07	.03	.03	.05	.03	.03	.05	.04	.03	.06	.03	.03	.05
1000	.15	.12	.25	.10	.09	.20	.09	.07	.17	.11	.10	.20	.11	.09	.20
1500	.31	.24	.54	.21	.17	.41	.18	.14	.36	.23	.20	.43	.22	.19	.42
2000	.52	.40	.92	.36	.28	.71	.31	.23	.62	.39	.34	.74	.38	.33	.72
2500	.80	.60	1.41	.54	.43	1.10	.46	.35	.96	.58	.51	1.13	.57	.50	1.11
3000	1.12	.84	2.02	.76	.60	1.54	.64	.48	1.36	.81	.72	1.59	.79	.71	1.56
3500	1.51	1.12	2.73	1.01	.80	2.09	.86	.64	1.84	1.10	.97	2.14	1.06	.96	2.12
4000	1.92	1.44	3.53	1.32	1.03	2.76	1.12	.82	2.40	1.43	1.26	2.78	1.38	1.24	2.77

Model AMD-33

AMD-33

- Air measuring station w/airfoil blade control damper

Dimension inches	12 x 12			24 x 24			36 x 36			12 x 48			48 x 12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.04	.04	.07	.03	.03	.05	.03	.03	.05	.03	.03	.06	.04	.03	.05
1000	.13	.12	.24	.10	.09	.19	.08	.07	.16	.10	.10	.19	.10	.09	.19
1500	.27	.24	.50	.22	.17	.41	.16	.14	.34	.21	.20	.41	.21	.19	.41
2000	.44	.40	.86	.39	.28	.71	.26	.23	.57	.36	.34	.71	.36	.33	.71
2500	.66	.60	1.33	.62	.43	1.10	.39	.35	.88	.54	.51	1.09	.55	.50	1.10
3000	.93	.84	1.89	.89	.60	1.56	.53	.48	1.24	.76	.72	1.54	.77	.71	1.55
3500	1.25	1.12	2.57	1.21	.80	2.13	.71	.64	1.67	1.02	.97	2.08	1.03	.96	2.10
4000	1.59	1.44	3.30	1.58	1.03	2.80	.91	.82	2.19	1.33	1.26	2.70	1.34	1.24	2.75

Model AMD-42

AMD-42

- Air measuring station w/ aluminum airfoil blade control damper

Dimension inches	12 x 12			24 x 24			36 x 36			12 x 48			48 x 12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.05	.03	.07	.01	.01	.04	.01	.01	.02	.01	.01	.03	.03	.02	.05
1000	.18	.12	.28	.05	.03	.17	.04	.02	.12	.01	.04	.18	.11	.06	.19
1500	.43	.28	.62	.12	.06	.37	.09	.05	.28	.14	.09	.40	.25	.14	.44
2000	.76	.49	1.11	.22	.11	.66	.17	.08	.50	.25	.16	.72	.44	.25	.78
2500	1.19	.77	1.73	.34	.17	1.04	.26	.13	.78	.39	.25	1.12	.69	.39	1.21
3000	1.71	1.11	2.50	.49	.24	1.50	.38	.19	1.13	.57	.36	1.62	1.00	.57	1.75
3500	2.33	1.51	3.41	.66	.33	2.04	.51	.26	1.53	.77	.49	2.21	1.36	.77	2.38
4000	3.04	1.98	4.45	.87	.43	2.66	.67	.34	2.01	1.01	.64	2.88	1.78	1.01	3.11

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Model AMD-42V

Dimension inches	12 x 12			24 x 24			36 x 36			12 x 48			48 x 12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.05	.03	.07	.01	.01	.04	.01	.01	.02	.03	.02	.05	.01	.01	.03
1000	.18	.12	.28	.05	.03	.17	.04	.02	.12	.11	.06	.19	.01	.04	.18
1500	.43	.28	.62	.12	.06	.37	.09	.05	.28	.25	.14	.44	.14	.09	.40
2000	.76	.49	1.11	.22	.11	.66	.17	.08	.50	.44	.25	.78	.25	.16	.72
2500	1.19	.77	1.73	.34	.17	1.04	.26	.13	.78	.69	.39	1.21	.39	.25	1.12
3000	1.71	1.11	2.5	.49	.24	1.5	.38	.19	1.13	1.00	.57	1.75	.57	.36	1.62
3500	2.33	1.51	3.41	.66	.33	2.04	.51	.26	1.53	1.36	.77	2.38	.77	.49	2.21
4000	3.04	1.98	4.45	.87	.43	2.66	.67	.34	2.01	1.78	1.01	3.11	1.04	.64	2.88

AMD-42V

- Air measuring station with an aluminum airfoil vertical blade control damper

Leakage

Most models of dampers have blade seals which seal with blade to blade contact as well as “sweep” blade to top (head) and blade to bottom (sill) of the damper. Most Greenheck damper models also have jamb seals which seal the end of the blade to the inside frame (jamb) of the damper. (See damper cutaway drawing, figures 19-24). The combination of blade seals, sweep seals, and jamb seals give applicable Greenheck damper models the Class 1A and Class 1 leakage rating on dampers built to the maximum section width.

Damper leakage (with blades fully closed) meets Class 1A and Class 1 requirements at appropriate pressures.

Test Information

Air leakage is based on operation between 32° and 120°F (0 and 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.

*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

AMD-23, VCD-23, SEVCD-23	Leakage Class*		
Maximum Damper Width	1 in. wg (0.25 kPa)	4 in. wg (1 kPa)	5 in. wg (1.2 kPa)
48 in. (1219 mm)	1A	1	1

AMD-33, VCD-33, 34, -43; SEVCD-33	Leakage Class*		
Maximum Damper Width	1 in. wg (0.25 kPa)	4 in. wg (1 kPa)	8 in. wg (2 kPa)
60 in. (1524 mm)	1A	1	1

ICD-44, 45	Leakage Class*		
Maximum Damper Width	1 in. wg (0.25 kPa)	4 in. wg (1 kPa)	8 in. wg (2 kPa)
48 in. (1219 mm)	1A	1	1

Leakage Class cfm/sq. ft. (cmh/sq.m)		
Model	Pressure	
	@ 1 in. wg (.25 kPa)	@ 4 in. wg (1 kPa)
AMD-42, 42-V; VCD-23V, 34V, 43V	Class 1A	Class 1
VCD-40	Class 1A	Class 1
VCD-33, 42	Class 1A	Class 1
VCDR-53	Class 1	Class 1
VCDRM-53	Class 1	Class 1

For more information, go to www.greenheck.com.

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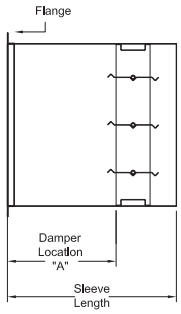
Seals

Greenheck damper models supplied with blade seals ship standard with Thermoplastic Elastomer (TPE) seals, but models have the option to select silicone for applications where the damper will be exposed to temperatures between 200 - 250°F, or there is a desire to attach the seal to the blade with the pressure sensitive adhesive.

Factory Sleeve/Flange Option

Greenheck control dampers are available with factory sleeves installed in lengths up to 48 in. (1219 mm). Sleeves are constructed out of a material thickness selection of 20, 16, 14, & 10 gauge (.091 - 3.25 mm). When dampers are installed in factory supplied sleeves, the “damper location” specifies the location of the damper from the end of the sleeve to the closest edge of the damper frame.

The factory supplied sleeves can also be selected with factory mounted flanges added to one or both ends of the sleeve. The optional flanges can be selected in dimensions of .75 in., 1 in., 1.5 in., and 2 in. and will be attached flush to the end(s) of the sleeve as selected.

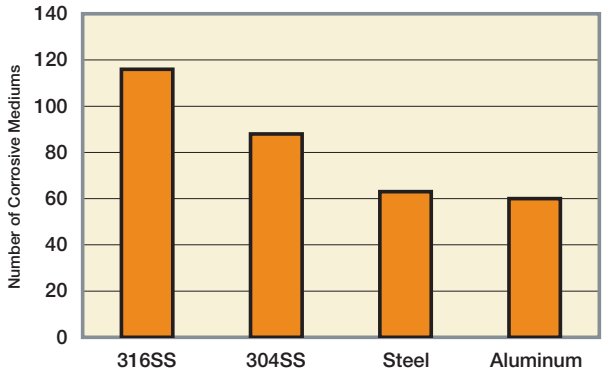


Stainless Steel

Greenheck has stainless steel dampers available in both 304 and 316 stainless alloys depending on what level of corrosion resistance the application requires.

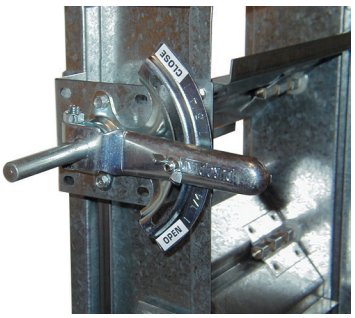
The 304 stainless steel material can be selected as an option to a standard commercial damper model where higher levels of corrosion resistance than can be obtained by using galvanized steel is required, but less than severe environments that require the use of 316 stainless steel.

The 316 stainless steel dampers are available to be utilized in “severe environment” applications where higher levels of corrosion resistance than can be obtained with either galvanized or 304 stainless steel are required. Building specifications will indicate if this level of corrosion protection is required.



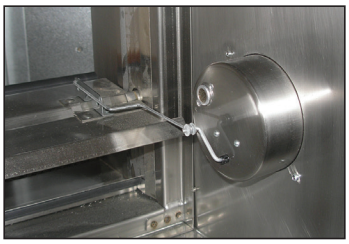
Extension Pins & Standoff Brackets

Extension pins and standoff brackets are utilized to drive a single section damper where a jackshaft is not necessary and cost prohibitive. Standoff brackets can be utilized to both ensure that the extension pin remains in place, as well as provide a surface to mount the actuator brackets for ease of actuator or manual hand quadrant installation.



Open Close Indicator - OCI

The OCI contains two single pole, single throw switches used to indicate damper blade position. The switches provide positive open and closed signals when used in conjunction with remote indicator lights. Switches are physically linked to a damper blade and therefore give a true representation of the damper’s position.



Paint Finishes

A wide variety of paint finishes are available including:

- Anodize
- Industrial Epoxy
- Baked Enamel
- Kynar®/Hylar®
- Hi-Pro Polyester

See color charts on www.greenheck.com for standard color offering.

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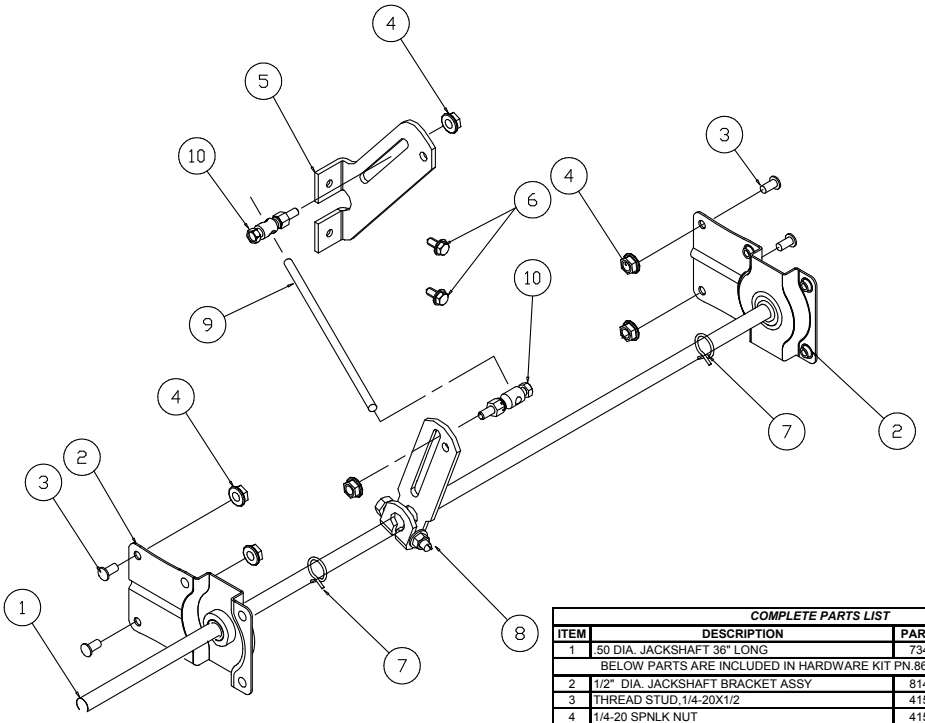
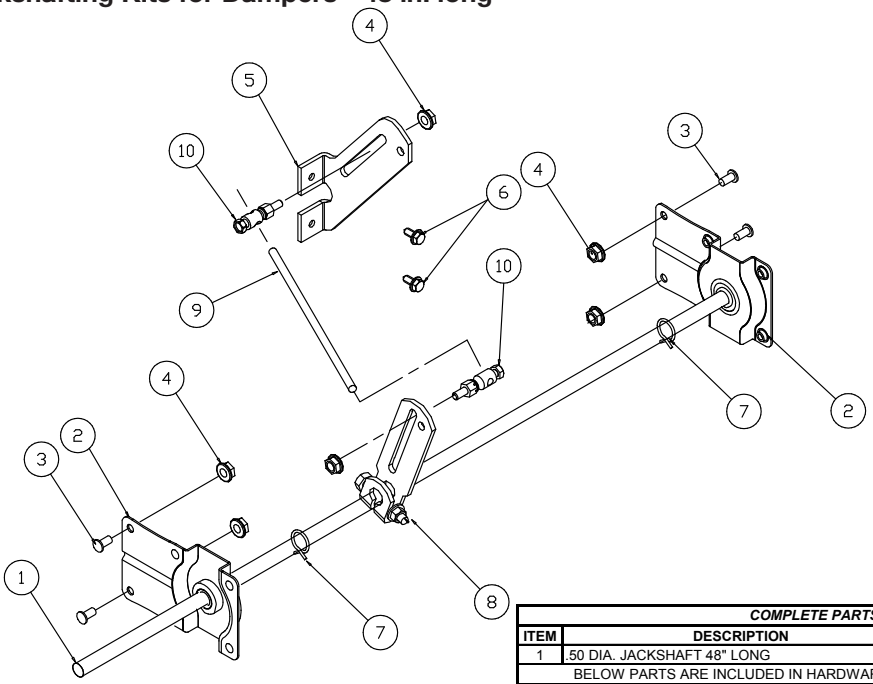
½ in. Jackshafting Kits for Dampers - 36 in. long



COMPLETE PARTS LIST				
ITEM	DESCRIPTION	PART NO.	DWG NO.	QTY
1	.50 DIA. JACKSHAFT 36" LONG	734097	322145	1
	BELOW PARTS ARE INCLUDED IN HARDWARE KIT PN.860057 DWG. 322146			
2	1/2" DIA. JACKSHAFT BRACKET ASSY	814968	D1140	2
3	THREAD STUD,1/4-20X1/2	415609		4
4	1/4-20 SPNLK NUT	415455		4
5	BLADE BRACKET	653629	D0276	1
6	MS 1/4- 20 x1/2" (HWH) TCS ZP	415264	-	2
7	.50 DIA HOSE CLAMPS	451786		2
8	.50 DIA CRANKARM ASSEMBLY	812097	D0721	1
9	5/16" DIA LINK ROD 18" LONG	656472	D0722	1
10	BALL SWIVEL	451554	-	2
11	SHIPPING BOX	445039		1

½ in. Jackshafting Kits for Dampers - 48 in. long



COMPLETE PARTS LIST				
ITEM	DESCRIPTION	PART NO.	DWG NO.	QTY
1	.50 DIA. JACKSHAFT 48" LONG	734096	322144	1
	BELOW PARTS ARE INCLUDED IN HARDWARE KIT PN.860057 DWG. 322146			
2	1/2" DIA. JACKSHAFT BRACKET ASSY	814968	D1140	2
3	THREAD STUD,1/4-20X1/2	415609		4
4	1/4-20 SPNLK NUT	415455		4
5	BLADE BRACKET	653629	D0276	1
6	MS 1/4- 20 x1/2" (HWH) TCS ZP	415264	-	2
7	.50 DIA HOSE CLAMPS	451786		2
8	.50 DIA CRANKARM ASSEMBLY	812097	D0721	1
9	5/16" DIA LINK ROD 18" LONG	656472	D0722	1
10	BALL SWIVEL	451554	-	2
11	SHIPPING BOX	445039		1

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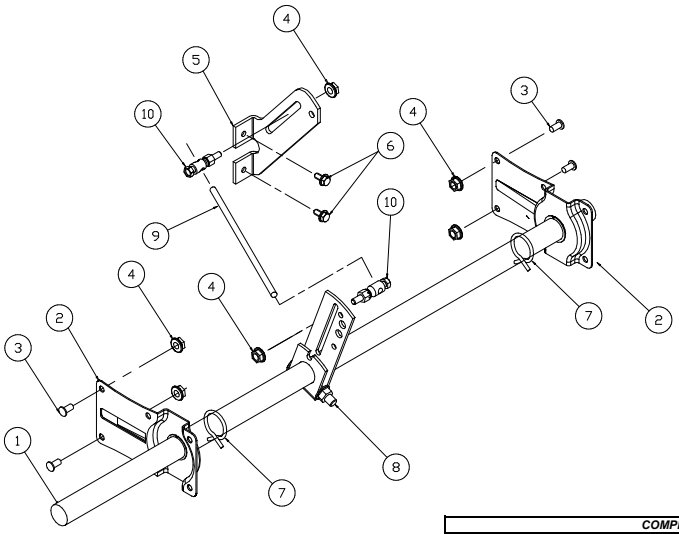
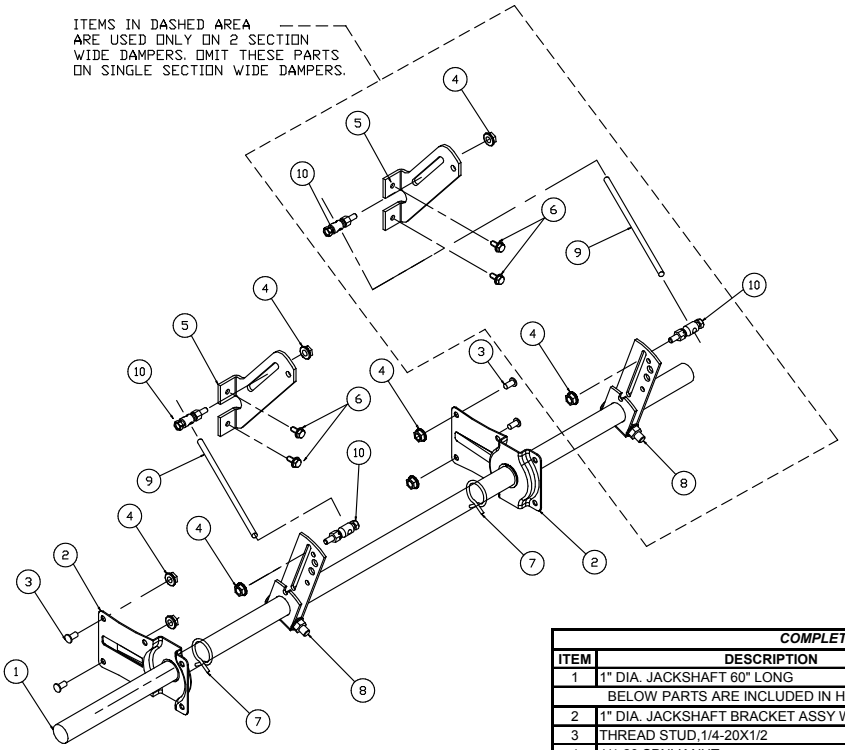
1 in. Jackshafting Kits for Dampers - 48 in. long



COMPLETE PARTS LIST				
ITEM	DESCRIPTION	PART NO.	DWG NO.	QTY
1	1" DIA. JACKSHAFT 48" LONG	734095	322142	1
	BELOW PARTS ARE INCLUDED IN HARDWARE KIT PN.860062		DWG. 322204	
2	1" DIA. JACKSHAFT BRACKET ASSY W NYLINER	834292	D142927	2
3	THREAD STUD,1/4-20X1/2	415609		4
4	1/4-20 SPNLK NUT	415455		4
5	BLADE BRACKET	653629	D0276	1
6	MS 1/4- 20 x1/2" (HWH) TCS ZP	415264	-	2
7	1" DIA HOSE CLAMPS	451809		2
8	1" CRANKARM ASSEMBLY	816252	D0721	1
9	5/16" DIA LINK ROD 18" LONG	656472	D0722	1
10	BALL SWIVEL	451554	-	2
11	SHIPPING BOX	445039		1

1 in. Jackshafting Kits for Dampers - 60 in. long



COMPLETE PARTS LIST				
ITEM	DESCRIPTION	PART NO.	DWG NO.	QTY
1	1" DIA. JACKSHAFT 60" LONG	733765	322085	1
	BELOW PARTS ARE INCLUDED IN HARDWARE KIT PN.850062		DWG. 322095	
2	1" DIA. JACKSHAFT BRACKET ASSY W NYLINER	834292	D142927	2
3	THREAD STUD,1/4-20X1/2	415609		4
4	1/4-20 SPNLK NUT	415455		8
5	BLADE BRACKET	653629	D0276	2
6	MS 1/4- 20 x1/2" (HWH) TCS ZP	415264	-	4
7	1" DIA HOSE CLAMPS	451809		2
8	1" CRANKARM ASSEMBLY	816252	D0721	2
9	5/16" DIA LINK ROD 18" LONG	656472	D0722	2
10	BALL SWIVEL	451554	-	4
11	SHIPPING BOX	445039	-	1

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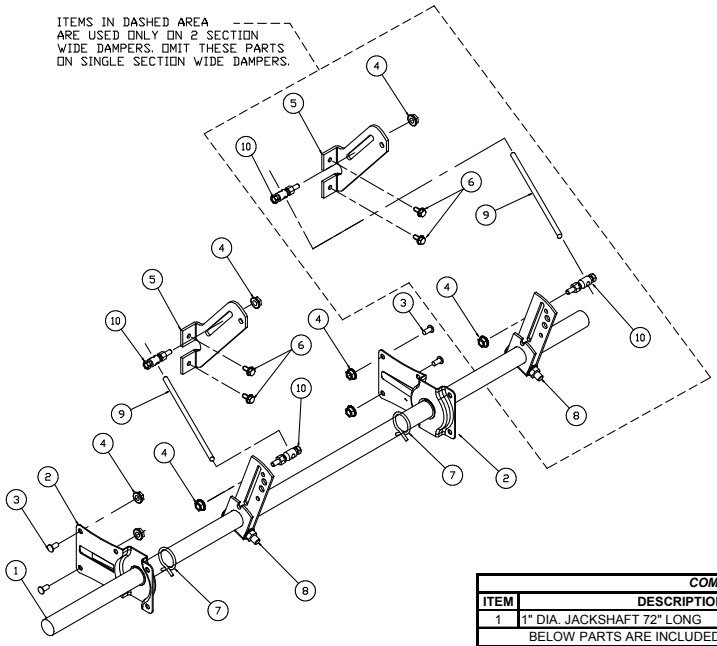
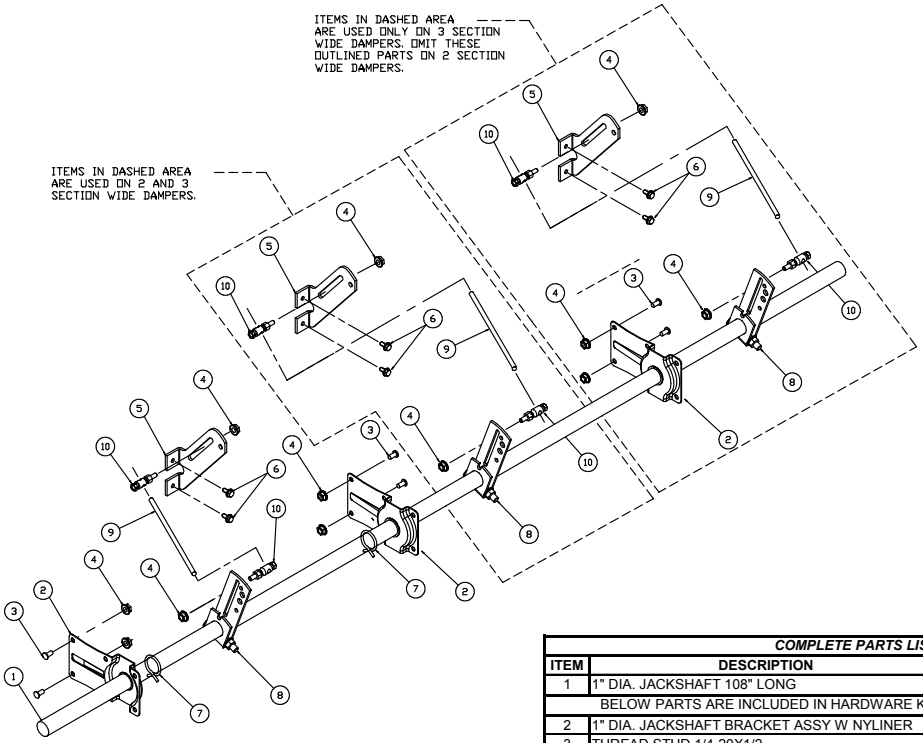
1 in. Jackshafting Kits for Dampers - 72 in. long



COMPLETE PARTS LIST				
ITEM	DESCRIPTION	PART NO.	DWG NO.	QTY
1	1" DIA. JACKSHAFT 72" LONG	733766	322088	1
	BELOW PARTS ARE INCLUDED IN HARDWARE KIT PN.850057 DWG. 322095			
2	1" DIA. JACKSHAFT BRACKET ASSY W NYLINER	834292	D142927	2
3	THREAD STUD,1/4-20X1/2	415609		4
4	1/4-20 SPNLK NUT	415455		8
5	BLADE BRACKET	653629	D0276	2
6	MS 1/4- 20 x1/2" (HWH) TCS ZP	415264	-	4
7	1" DIA HOSE CLAMPS	451809		2
8	1" CRANKARM ASSEMBLY	816252	D0721	2
9	5/16" DIA LINK ROD 18" LONG	656472	D0722	2
10	BALL SWIVEL	451554	-	4
11	SHIPPING BOX	445039		1

1 in. Jackshafting Kits for Dampers - 108 in. long



COMPLETE PARTS LIST				
ITEM	DESCRIPTION	PART NO.	DWG NO.	QTY
1	1" DIA. JACKSHAFT 108" LONG	733767	322090	1
	BELOW PARTS ARE INCLUDED IN HARDWARE KIT PN.860062 DWG. 322095			
2	1" DIA. JACKSHAFT BRACKET ASSY W NYLINER	834292	D142927	3
3	THREAD STUD,1/4-20X1/2	415609		6
4	1/4-20 SPNLK NUT	415455		12
5	BLADE BRACKET	653629	D0276	3
6	MS 1/4- 20 x1/2" (HWH) TCS ZP	415264	-	6
7	1" DIA HOSE CLAMPS	451809		2
8	1" CRANKARM ASSEMBLY	816252	D0721	3
9	5/16" DIA LINK ROD 18" LONG	656472	D0722	3
10	BALL SWIVEL	451554	-	6
11	SHIPPING BOX	445039	-	1

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Step 1
Determine if the actuators need to be electric or manual.

Step 2
If the actuators are to be electric, determine what voltage (120 Vac, 24 Vac, etc.) and what Hertz (50 or 60 cycles/sec.) are required. If the voltage requirement is not the same as the actuator, (i.e. the motor is 120 Vac and the requirement is 460 Vac) a transformer is needed.

Step 3
If the actuator is manual, then refer to the 'Manual Hand Quadrant' section.

Step 4
If the actuator is electric, then the operation type must be determined:

- Two position – spring return: This type of actuator will power to either the open or the closed position. When the power supply is removed (or turned off), the actuator will fail to the initial position by means of a spring.
- Two position (power open – power closed): This type of actuator will power in either direction. When the power supply is removed (or turned off), the actuator will fail in place.
- Floating (power open – power closed): This type of actuator is powered in both directions and will stop in any position. No spring is used.
- Modulating – spring return: This type of actuator will power in either direction and will spring return upon power loss much like the two position actuators. The difference is that a control signal (4-20 mAdc, 0-10 Vdc, etc.) is used. The control signal acts much like a valve; as the signal is increased or decreased, the actuator will open or close or vice versa.
- Modulating (power open – power closed): This type of actuator is the same as the floating, except for its response to a control signal input (4-20 mAdc, 0-10 Vdc, etc.).

See tables on the following pages for more information.

Step 5
Once the actuator operation is determined, then the fail position must be known. There are two options:

- Power open – fail close
- Power close – fail open

If a non-spring return actuator is required, then the fail positions above would become "fail in place".

Step 6
Auxiliary Switch – Separate switch in the actuator which can be wired to either make a circuit (normally open) or break a circuit (normally closed) when actuated. The actuation point is adjustable for Belimo actuators.

Step 7
Determine if the actuator is to be:

- Internally mounted: The actuator is mounted in the airstream.
- Externally mounted: The actuator is mounted out of the airstream at factory in a sleeve or external sideplate.
- External kit: The actuator is installed out of the airstream in the field.

Step 8
The final step is to determine which actuator will best operate the damper. An actuator selection table can be found on the following pages. Contact your local representative or Greenheck for further assistance.

Model	Description	Part #
NEMA Housings		
Greenheck NEMA 4X housing kit (w/galv. mounting components)	Used on most brands of direct mount actuators	878264
Greenheck NEMA 4X housing kit (w/SS mounting components)	Used on most brands of direct mount actuators	878265
Belimo NEMA 7 housing kit (for ½ in. jackshaft)	Used on Belimo direct mount actuators	1022113
Belimo NEMA 7 housing kit (for 1 in. jackshaft)	Used on Belimo direct mount actuators	1022114
Transformers		
120V to 24V Transformer	Primary 120 VAC, secondary 24 VAC, Compatible on any 24 VAC actuator	385338
Multi-Voltage Transformer	Primary 480/277/240/208, secondary 120 VAC, Compatible on any 120 VAC actuator	385709

Actuator Selection for Control Dampers									
				VCD Actuator Limitations*					
Model	Voltage	Frequency (Hz)	Torque (in. lbs.)	Maximum Damper Sq/Ft		VCDR	Description	Actuator Part #	External Mount
				With Seals	Without Seals	Max. Diameter (inches)			Actuator Kit # (includes actuator)
Two-position Spring Return*									
Belimo									
AFBUP	24 - 240	50/60	180	35	50	24		384376	863856
AFBUP-S			180	35	50	24	includes auxiliary SPDT end switches	384377	863857
TFB24 (TFB24-3)	24	50/60	22	4.5	6	24		384237	848933
TFB24-S (TFB24-3-S)	24	50/60	22	4.5	6	24	includes auxiliary SPDT end switches	384238	848934
FSLF24-S	24	50/60	30	7	12	24	includes auxiliary SPDT end switches	383394	832779
FSNF24	24	50/60	70	12	20	24		382889	834449
FSNF24-S	24	50/60	70	12	20	24	includes auxiliary SPDT end switches	382966	863862
LF24	24	50/60	35	7	12	24		381724	871844
LF24-S	24	50/60	35	7	12	24	includes auxiliary SPDT end switches	381725	871845
EFB24	24	50/60	270	35	50	24		475462	913978
EFB24-S	24	50/60	270	35	50	24	includes auxiliary SPDT end switches	475463	913980
EFB24-S N4	24	50/60	270	35	50	24	includes auxiliary SPDT end switches	475469	913981
NFBUP	24 - 240	50/60	90	17.5	20			1033833	-
NFBUP-S	24 - 240	50/60	90	17.5	20		includes auxiliary SPDT end switches	1033834	-
TFB120	100 - 240	50/60	22	4.5	6	24		384241	848931
TFB120-S	100 - 240	50/60	22	4.5	6	24	includes auxiliary SPDT end switches	384236	848932
EFB120	100 - 240	50/60	270	35	50	24		475466	913975
EFB120-S	100 - 240	50/60	270	35	50	24	includes auxiliary SPDT end switches	475467	913976
EFB120-S N4	100 - 240	50/60	270	35	50	24	includes auxiliary SPDT end switches	475472	913977
EFCX120-S N4	100 - 240	50/60	270	35	50	24	includes auxiliary SPDT end switches	386345	913986
FSLF120	120	50/60	30	7	12	24		383242	832776
FSLF120-S	120	50/60	30	7	12	24	includes auxiliary SPDT end switches	383392	832777
FSNF120	120	50/60	70	12	20	24		382888	834450
FSNF120-S	120	50/60	70	12	20	24	includes auxiliary SPDT end switches	382965	834453
LF120	120	50/60	35	7	12	24		381722	876283
LF120-S	120	50/60	35	7	12	24	includes auxiliary SPDT end switches	381723	876284
FSLF230-S	230	50/60	30	7	12	24	includes auxiliary SPDT end switches	383400	833250
FSNF230-S	230	50/60	70	12	20	24	includes auxiliary SPDT end switches	382964	834454
Consult factory for actuator applications on UL rated fire and smoke dampers.									

1 Unless otherwise specified, spring return actuators will be linked “power open - fail closed”, which is also called “normally closed” or “NC”. If “power closed - fail open” operation is desired, be sure to indicate this requirement. “Power closed - fail open” is also referred to as “normally open” or “NO”.

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Actuator Selection for Control Dampers									
				VCD Actuator Limitations*					
Model	Voltage	Frequency (Hz)	Torque (in. lbs.)	Maximum Damper Sq/Ft		VCDR	Description	Actuator Part #	External Mount
				With Seals	Without Seals	Max. Diameter (in)			Actuator Kit # (includes actuator)
Two-position Spring Return*									
Honeywell									
MS8103F1025	24	50/60	27	7	12	24		386685	881942
MS8103F1225	24	50/60	27	7	12	24	includes auxiliary SPDT end switches	386686	881943
MS8104F1010/B	24	50/60	20	7	12	24		385162	870666
MS8104F1210/B	24	50/60	20	7	12	24	includes auxiliary SPDT end switches	385163	870667
MS8110A1206	24	50/60	88	17.5	20	24	includes auxiliary SPDT end switches	383818	849415
MS8120F1002	24	50/60	175	31	50	24		382824	880349
MS8120F1200	24	50/60	175	31	50	24	includes auxiliary SPDT end switches	383255	831682
MS4104F1010/B	120	60	20	7	12	24		385158	870662
MS4104F1210/B	120	60	20	7	12	24	includes auxiliary SPDT end switches	385159	870663
MS4109F1010/B	120	60	88	10	20	24		385164	870668
MS4109F1210/B	120	60	88	10	20	24	includes auxiliary SPDT end switches	385165	870669
MS4120F1006	120	60	175	31	50	24		382823	880347
MS4120F1204	120	60	175	31	50	24	includes auxiliary SPDT end switches	383024	831681
MS4103F1225	120-230	50/60	27	7	12	24	includes auxiliary SPDT end switches	386688	881945
MS4604F1210/B	230	50/60	20	7	12	24	includes auxiliary SPDT end switches	385161	870665
MS4609F1210/B	230	60	88	10	20	24	includes auxiliary SPDT end switches	385167	870671
Siemens									
GJD121.1U	24	50/60	20	7	12	24		1036892	1037837
GJD126.1U	24	50/60	20	7	12	24	includes auxiliary SPDT end switches	1036893	1037838
GJD221.1U	120	50/60	20	7	12	24		1036894	1037835
GJD226.1U	120	50/60	20	7	12	24	includes auxiliary SPDT end switches	1036895	1037836
GRD121.1U	24	50/60	30	7	12	24		1036896	1037841
GRD126.1U	24	50/60	30	7	12	24	includes auxiliary SPDT end switches	1036897	1037842
GRD221.1U	120	50/60	30	7	12	24		1036898	1037839
GRD226.1U	120	50/60	30	7	12	24	includes auxiliary SPDT end switches	1036899	1037840
GVD121.1U	24	50/60	80	30	50	48		10335576	1035592
GVD126.1U	24	50/60	80	30	50	48	includes auxiliary SPDT end switches	10335577	1035593
GVD221.1U	120	50/60	200	30	50	48		10335574	1035590
GVD226.1U	120	50/60	200	30	50	48	includes auxiliary SPDT end switches	10335575	1035591

Consult factory for actuator applications on UL rated fire and smoke dampers.

1 Unless otherwise specified, spring return actuators will be linked “power open - fail closed”, which is also called “normally closed” or “NC”. If “power closed - fail open” operation is desired, be sure to indicate this requirement. “Power closed - fail open” is also referred to as “normally open” or “NO”.

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Actuator Selection for Control Dampers									
				VCD Actuator Limitations					
Model	Voltage	Frequency (Hz)	Torque (in. lbs.)	Maximum Damper Sq/Ft		VCDR	Description	Actuator Part #	External Mount
				With Seals	Without Seals	Maximum Diameter (inches)			Actuator Kit # (includes actuator)
Modulating Spring Return[1]									
Belimo									
AFB24-MFT	24	50/60	180	35	50	24		384374	863855
AFB24-MFT-S	24	50/60	180	35	50	24	includes auxiliary SPDT end switches	384375	863859
AFB24-SR	24	50/60	180	35	50	24		385250	872685
AFB24-SR-S	24	50/60	180	35	50	24	includes auxiliary SPDT end switches	385251	872686
LF24-SR-S	24	50/60	35	7	12	24	includes auxiliary SPDT end switches	383011	833253
NFB24-SR-S	24	50/60	90	17.5	20	24	includes auxiliary SPDT end switches	384373	849251
TFB24-MFT	24	50/60	22	4.5	6	24		385997	878054
TFB24-MFT-S	24	50/60	22	4.5	6	24	includes auxiliary SPDT end switches	385998	878055
TFB24-SR	24	50/60	22	4.5	6	24		384239	848935
TFB24-SR-S	24	50/60	22	4.5	6	24	includes auxiliary SPDT end switches	384240	848936
EFB24-SR	24	50/60	270	35	50	24		475464	913982
EFB24-SR-S	24	50/60	270	35	50	24	includes auxiliary SPDT end switches	475465	913984
EFB24-SR-S N4	24	50/60	270	35	50	24	includes auxiliary SPDT end switches	475471	913985
Honeywell									
MS4103K1023	24	50/60	27	7	12	24		386524	880740
MS7103K2223	24	50/60	27	7	12	24	includes auxiliary SPDT end switches	386525	880741
MS7510A2206	24	50/60	88	17.5	20	24	includes auxiliary SPDT end switches	383213	849414
MS7520A2015	24	50/60	175	31	50	24		383785	849417
MS7520A2213	24	50/60	175	31	50	24	includes auxiliary SPDT end switches	383784	849416
Modulating Non-Spring Return									
LMB24-SR	24	50/60	45	7	12	24		381728	833286
NMB24-SR	24	50/60	90	12	20	24		381138	833288
AMB24-SR	24	50/60	180	35	50	24		382131	833290
Floating PO/PC									
LMB24 (LMB24-3)	24	50/60	45	7	12	24		381726	833284
LMQB24-1	24	50/60	35	-	-	24		385363	-
AMB24-3	24	50/60	180	35	50	24		382132	833289
NMB24-3 (NMB24)	24	50/60	90	12	20	24		381601	833287
Manual Hand Quadrant									
½ in. diameter shaft - For use on all VCD's								811518	815607
1 in. diameter shaft - For use on all VCD's								842633	813938

1 Unless otherwise specified, spring return actuators will be linked “power open - fail closed”, which is also called “normally closed” or “NC”. If “power closed - fail open” operation is desired, be sure to indicate this requirement. “Power closed - fail open” is also referred to as “normally open” or “NO”.

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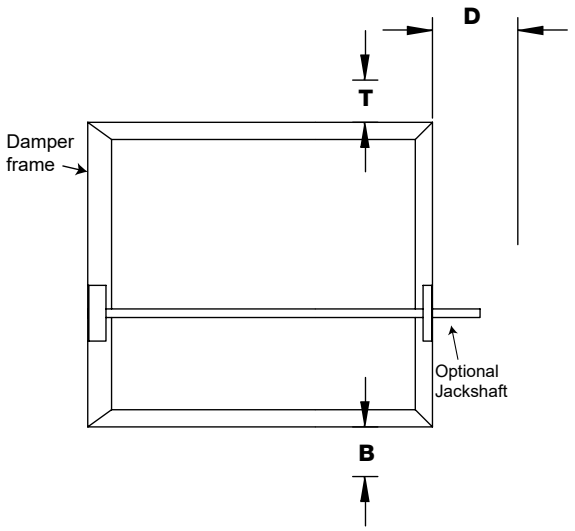
On dampers less than 18 in. (457mm) high, actuators may also require clearances above and/or below the damper frame. **"B" and "T" dimensions are worst case clearance requirements for some dampers less than 18 in. (457mm) high.** Not all damper sizes under 18 in. (457mm) high require these worst case clearances. If space availability above or below the damper is limited, each damper size should be individually evaluated.



Actuator Type/Model	Height	T	B	D
	Inches	Inches		
AFBUP (-S) and FSNF Series, Belimo MSxx20 Series, Honeywell	≥6 to <10	0	12¾	6¼
	≥10 to <18	0	2	6¼
	≥18	0	0	6¼
FSLF, LF and TFB Series, Belimo	≥6 to <10	0	3½	6¼
	≥10	0	0	6¼
MSxx04 & MSxx09 Series, Honeywell	≥6 to <9	0	4¾	6¼
	≥9	0	0	6¼
MS75xx Series, Honeywell	≥6 to <10	0	12¾	6¼
	≥10 to <18	0	7	6¼
	≥18	0	0	6¼
GRD and GVD Series, Siemens	≥6 to <10	0	12¾	6¼
	≥10 to <18	0	2	6¼
	≥18	0	0	6¼
GJD Series, Siemens	≥6 to <10	0	3½	6¼
	≥10 to <18	0	0	6¼
	≥18	0	0	6¼

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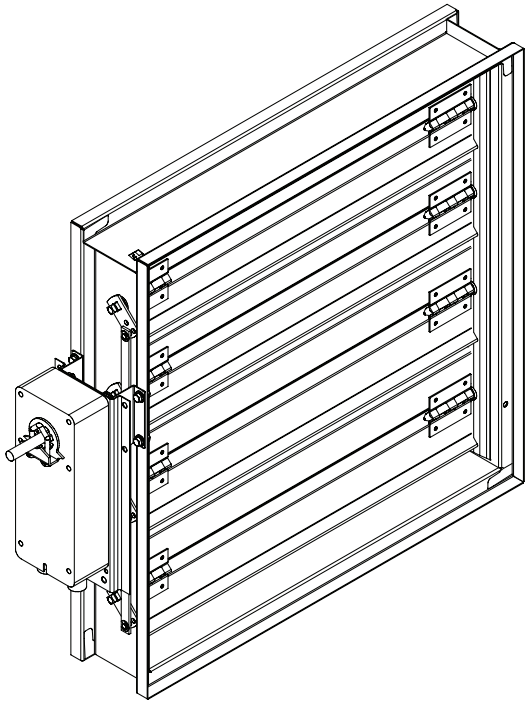
Actuator mounting and hardware requirements vary based on the specific damper configuration. Consult factory for specific mounting and hardware information when required.

For vertical blade damper models, the blades would run vertically and the actuator would be on the top or bottom.

Direct Drive External Left



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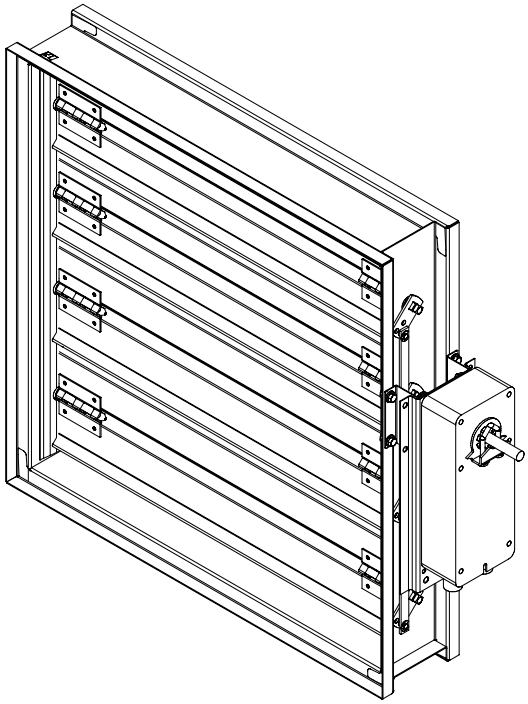

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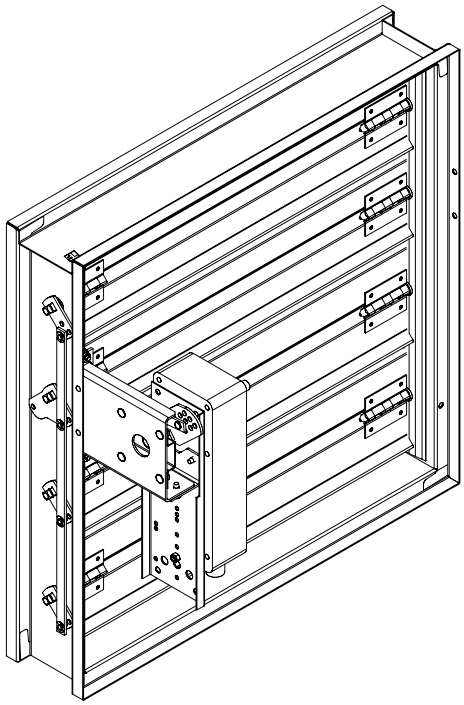

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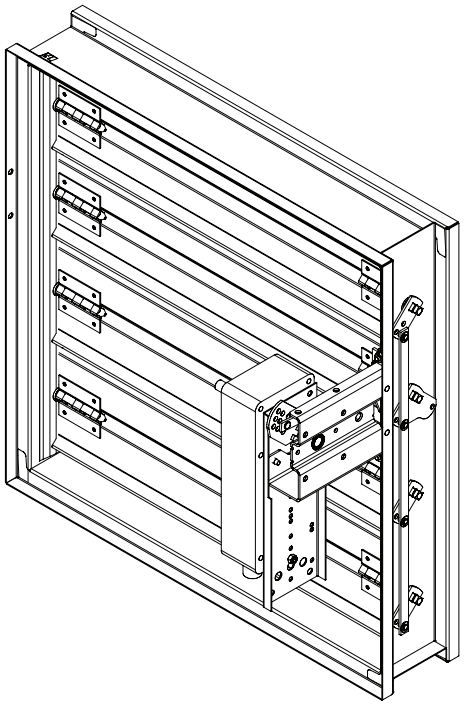

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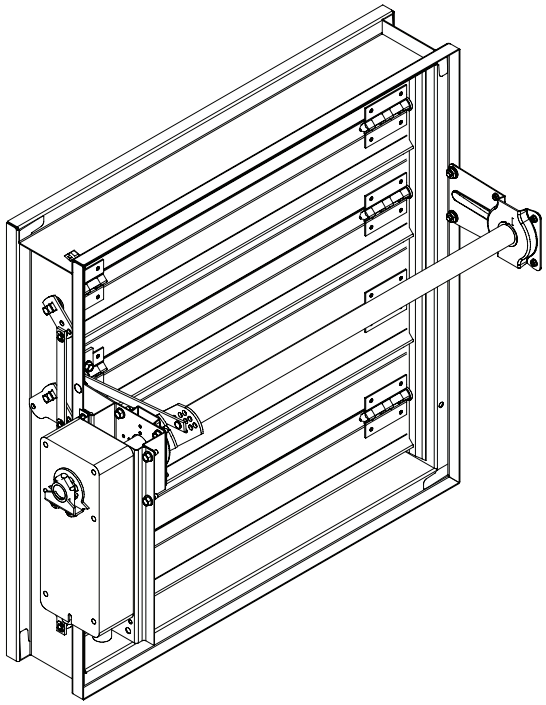
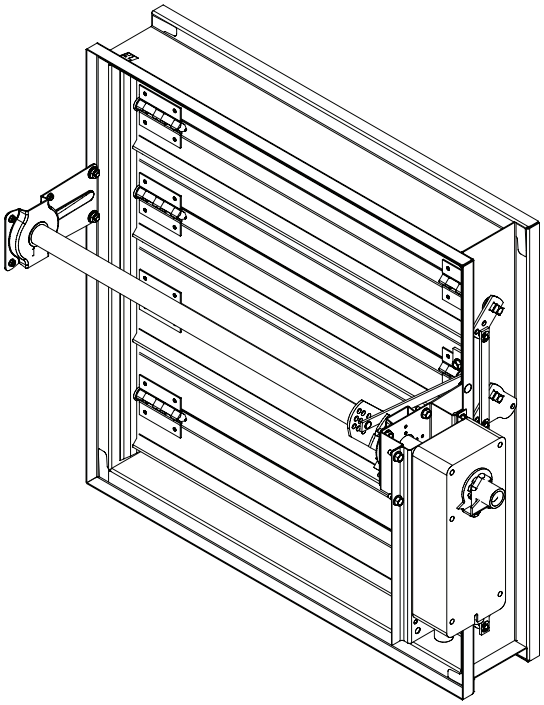
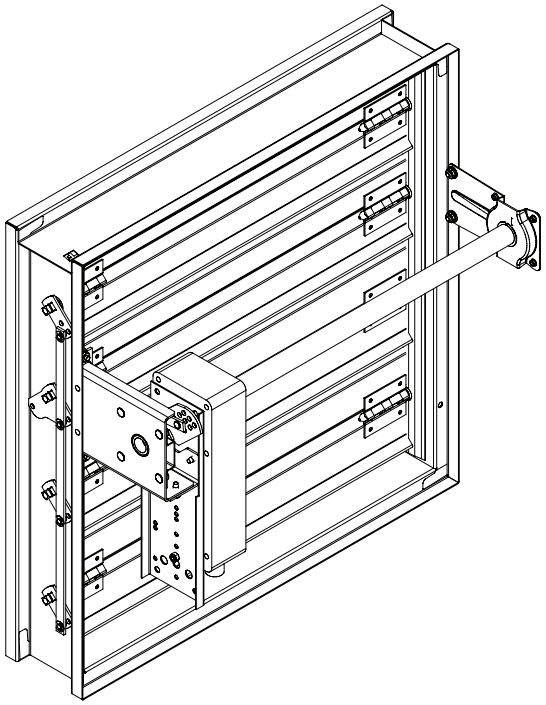
Jackshaft External Left



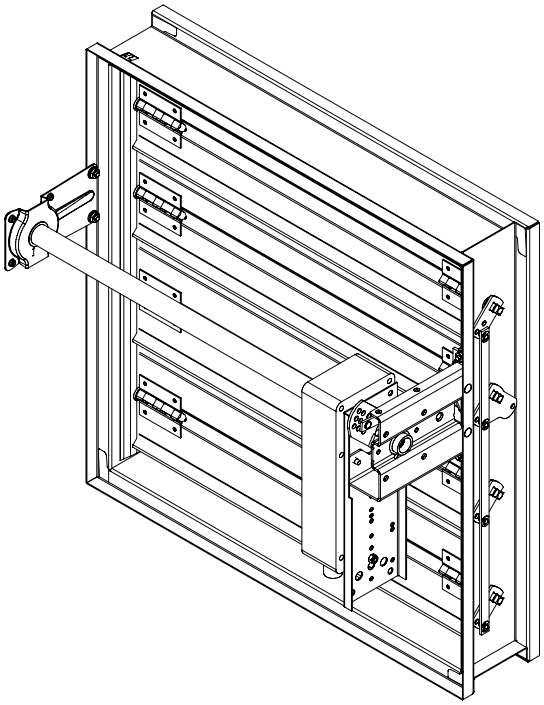
Jackhaft External Right



Jackshaft Internal Left



Jackshaft Internal Right



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The following charts are designed to aid in determining which model of Greenheck damper is required based on the blade and frame style, blade and frame material type and thickness, the required bearings, linkage, and seals, the maximum sizes, and most importantly the maximum pressure and velocity ratings.

Once the desired damper model is selected, the specific frame type and accessories can be chosen to ensure proper mounting into an opening as required.

	X = Standard O = Optional	VCD-20	VCD-23	VCD-23V	VCD-33	VCD-33V	VCD-34	VCD-34V	VCD-40
Blade Profile	Single Blade								
	3V	X	X						
	3V-Vertical Blade			X					
	Airfoil				X				X
	Airfoil-Vertical Blade					X			
	Airfoil-Insulated						X		
	Airfoil-Insulated Vertical Blade							X	
Frame Material	Galvanized	X	X	X	X	X	X	X	
	304 Stainless Steel	0	0	0	0	0	0	0	
	Aluminum								X
Blade Material	Galvanized	X	X	X	X	X	X	X	
	304 Stainless Steel	0	0	0	0	0	0	0	
	Aluminum								X
Frame Gauge	16	X	X	X	X	X	X	X	
	12	0	0	0	0	0	0	0	
	Aluminum								.125 (3.2)
Blade Seals	TPE		X	X	X	X	X	X	X
	Silicone		0	0	0	0	0	0	0
Jamb Seals	Stainless Steel		X	X	X	X	X	X	X
Bearings	Synthetic	X	X	X	X	X	X	X	X
	316 Stainless Steel	0	0	0	0	0	0	0	0
Axles	Steel	X	X	X	X	X	X	X	X
	316 Stainless Steel	0	0	0	0	0	0	0	0
Linkage Material	Steel	X	X	X	X	X	X	X	X
	316 Stainless Steel	0	0	0	0	0	0	0	0
Accessories	Sleeves	0	0	0	0	0	0	0	
	Transition (R)	0	0	0	0	0	0	0	
	Actuators*	0	0	0	0	0	0	0	0
	Flanges**	0	0	0	0	0	0	0	0
	Retaining Angles	0	0	0	0	0	0	0	0
Sizing inches (mm)	Minimum Size	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)
	Maximum Single Section Size	48x74 (1219x1880)	48x74 (1219x1880)	74x48 (1880x1219)	60x74 (1524x1880)	74x60 (1880x1524)	60x74 (1524x1880)	74x60 (1880x1524)	60x74 (1524x1880)
	Maximum Multi-Section Size	Unlimited	Unlimited	148x96 (3759x2438)	Unlimited	148x120 (3759x3048)	Unlimited	148x120 (3759x3048)	Unlimited
Ratings	Max. Velocity ft/min. (m/s)	3000 (15.2)	3000 (15.2)	3000 (15.2)	4000 (20.3)	4000 (20.3)	4000 (20.3)	4000 (20.3)	6000 (30.5)
	Max. Pressure - in. wg (kPa)	5 (1.2)	5 (1.2)	5 (1.2)	8 (2)	8 (2)	8 (2)	8 (2)	6 (1.5)

* Actuators include manual, 24V, 120V, and 240V. ** Flanges include single, reverse, and double flange. *** The inside of the blade is not painted on airfoil blade dampers.

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	X = Standard O = Optional	VCD-42	VCD-43	VCD-43V	SEVCD-23	SEVCD-33	VCDR-50	VCDR-53	VCDRM-53
Blade Profile	Single Blade						X	X	
	3V				X				X
	3V-Vertical Blade								
	Airfoil	X	X			X			
	Airfoil-Vertical Blade			X					
	Airfoil-Insulated								
Frame Material	Galvanized	X					X	X	X
	304 Stainless Steel						O	O	O
	316 Stainless Steel				X	X			
	Aluminum		X	X					
Blade Material	Galvanized						X	X	X
	304 Stainless Steel						O	O	O
	316 Stainless Steel				X	X			
	Aluminum	X	X	X					
Frame Gauge	20						X	X	
	16	X			X	X	O	O	
	14								< 22 in. diameter
	12	O							
	10								= or > 22 in. diameter
	Aluminum		.125 (3.2)	.125 (3.2)					
Blade Seals	TPE	X	X	X	X	X			Vinyl
	Silicone	O	O	O	O	O		X	
Jamb Seals	Stainless Steel	X	X	X					X
	316 Stainless Steel				X	X			
Bearings	Synthetic	X	X	X					
	Bronze						X	X	
	316 Stainless Steel	O	O	O	X	X	O	O	X
Axles	Steel	X	X	X			X	X	
	316 Stainless Steel	O	O	O	X	X	O	O	X
Linkage Material	Steel	X	X	X					X
	316 Stainless Steel	O	O	O	X	X			O
Accessories	Sleeves	O			O	O			
	Transition (R)	O			O	O			
	Actuators*	O	O	O	O	O	O	O	O
	Flanges**	O	O	O	O	O			
	Retaining Angles	O			O	O			
Sizing inches (mm)	Minimum Size	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	4 (102)	4 (102)	10 (254)
	Maximum Single Section Size	60x74 (1524x1880)	60x74 (1524x1880)	74x60 (1880x1524)	48x74 (1219x1880)	60x74 (1524x1880)	24 (610)	24 (610)	36 (914)
	Maximum Multi-Section Size	Unlimited	288 x 222 (7315 x 5639)	148x120 (3759x3048)	Unlimited	Unlimited	NA	NA	NA
Ratings	Max. Velocity ft/min. (m/s)	6000 (30.5)	6000 (30.5)	6000 (30.5)	3000 (15.2)	4000 (20.3)	3000 (15.2)	3000 (15.2)	2500 (12.7)
	Max. Pressure in. wg (kPa)	6 (1.5)	8 (2)	8 (2)	5 (1.2)	8 (2)	4 (1)	4 (1)	5 (1.2)

* Actuators include manual, 24V, 120V, and 240V. ** Flanges include single, reverse, and double flange. *** The inside of the blade is not painted on airfoil blade dampers.

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The face and bypass dampers are used in applications where two dampers are connected together allowing one damper to open while the other damper closes. The FBV-23 is a vertical style (stacked).

in. (mm)	FBV-23
Minimum Size - in. (mm)	8 x 6 (203 x 152)
Maximum Single Section Size in. (mm)	48 x 74 (1219 x 1880)
Maximum Multi-Section Size in. (mm)	96 x 74 (2438 x 1880)
Max. Velocity - ft/min. (m/s)	3000 (15.2)
Max. Pressure - in. wg (kPa)	5 (1.2)

Style	Blade Profile	Blade & Frame Material	Blade & Frame Gauge	Blade Seals		Jamb Seals	Bearings		Axle & Linkage		Accessories
Vertical	3V	Galvanized	16 ga.	TPE	Silicone	Stainless Steel	Synthetic	316 SS	Steel	316SS	Actuator*
X	X	X	X	X	O	X	X	O	X	O	O

X = Standard
O = Optional
* Actuators include manual, 24V, 120V, and 240V.

Severe Environment Dampers

Severe environment dampers are made from 316 stainless steel material as a standard product offering. They offer an excellent corrosion-resistant option for a variety of applications such as:

- Paper mills
- Wastewater treatment plants
- Natatoriums
- Laboratories
- Maritime
- Computer clean rooms

SEVCD-23

in. (mm)	SEVCD-23	SEVCD-33
Minimum Size - in. (mm)	6 x 6 (152 x 152)	6 x 6 (152 x 152)
Maximum Single Section Size in. (mm)	48 x 74 (1219 x 1880)	48 x 74 (1219 x 1880)
Maximum Multi-Section Size in. (mm)	Unlimited	Unlimited
Max. Velocity - ft/min. (m/s)	3000 (15.2)	4000 (20.3)
Max. Pressure - in. wg (kPa)	5 (1.2)	8 (2)

SEVCD-33

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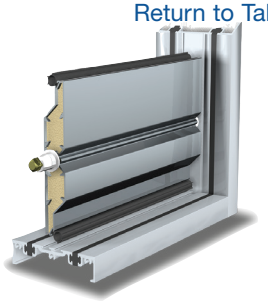
Greenheck's ICD dampers were developed for applications where it is necessary to minimize the thermal transfer and reduce condensation. ICD series dampers meet Class 1A leakage of less than 3 cfm/sq. ft. @ 1 in. wg (55 cmh/m² @ .25 kPa). ICD series dampers can be used in applications down to -70°F (-56°C) and up to 200°F (93°C) for:

- Cold food storage warehouses
- Buildings/warehouse
- Rooftop intake or exhaust



		ICD-44	ICD-45
Maximum Velocity - ft/min. (m/s)		4000 (20.3)	4000 (20.3)
Maximum Pressure - in. wg (kPa)		8 (2)	8 (2)
Thermal Efficiency Ratio (E)		593%	941%
Temperature Range - °F (C°)		-70 to 200 (-56 to 93)	-70 to 200 (-56 to 93)
Frame	**Insulated Thermally Broken Aluminum**	-	X
	Aluminum	X	-
Frame Type	**Channel**	X	O
	Quick Connect	O	X
	Reverse Flange	O	O
	Single Flange	O	O
Blade Action	**Parallel**	O	O
	Opposed	X	X
Blade Type	**Insulated Thermally Broken**	X	X
Blade Material	**Extruded Aluminum Airfoil**	X	X
Blade Seal	**Silicone**	X	X
Jamb Seal	**Stainless Steel**	X	-
	Silicone	O	X

X = Standard O = Options

AMCA Certified Energy Efficiency Performance

Greenheck Model ICD-44 has a Thermal Efficiency Ratio of 593%.
Greenheck Model ICD-45 has a Thermal Efficiency Ratio of 941%.

A damper's Thermal Efficiency Ratio (E) is a comparison of the thermal performance of the tested damper with that of a standard reference damper, which is a 3V blade damper with blade and jamb seals. A damper with the same thermal efficiency as the reference damper would have an E of 0%. A damper that is twice as efficient as the reference damper would have an E of 100%.

Test Information

Testing was conducted on a 36 in. x 36 in. (914mm x 914mm) sample in AMCA 500-D figure 5.10 per AMCA standard 500-D's Thermal Efficiency test.

Torque

Data are based on a torque of 9.0 in.lb./ft² (0.56 N·m) applied to close and seat the damper during the test.

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How do differential pressure-based airflow measuring products work?

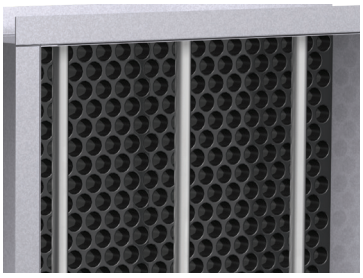
Differential pressure-based airflow measuring products use an array of air pressure pick-ups to compare the total pressure going through the airflow station with the static pressure in the station. The design of the pressure pick-up assembly amplifies the difference between these two pressures. The resulting differential pressure is an amplified "velocity pressure" which is proportional to the velocity going through the flow station.

Airflow volume is then calculated using the formula:

$$Q = Area * K * P^{m}$$

Q	=	airflow (CFM)
Area	=	the face area of the damper
K	=	a damper-specific flow coefficient that is provided with the unit
P	=	amplified velocity pressure measured by the supplied pressure transducer
m	=	a damper-specific exponent that is provided with the unit

Transducer



Pressure Pick-Up Tubes

Differential Pressure Products

AMS Series

The AMS is an accurate airflow measuring station furnished with a properly sized pressure transducer that outputs a 0-10 VDC signal proportional to airflow. A field supplied controller can use the transducer's voltage signal along with the flow formula (provided) to control a modulating actuator to a target set point.

The AMS is available with a factory supplied controller that accepts a target flow set point (either analog or digital). 0-10 VDC outputs are available for actual airflow reading and modulation of an external airflow control device, such as a damper or a Variable Frequency Drive (VFD).

AMS

AMD Series

The AMD series combines the functionality of an accurate airflow measuring station and a low leakage control damper into one compact assembly that both measures and controls airflow volume to a target set-point. These models come standard with a modulating actuator and a properly sized pressure transducer that outputs a signal proportional to airflow. A field supplied controller can use the transducer's voltage signal along with the flow formula (provided) to regulate a modulating actuator to the target set point.

The AMD series is available with a factory supplied controller that accepts an analog input that is proportional to a target flow set point. The controller outputs a 0-10 VDC signal which is proportional to the airflow volume.

AMD-23

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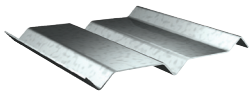
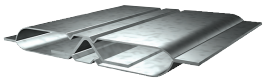
Blade Styles

3V blades are fabricated from a single thickness of galvanized steel incorporating three longitudinal V-type grooves running the full length of the blade to increase strength.

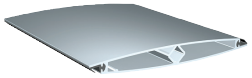
Airfoil blades are constructed of double-skin galvanized steel or extruded aluminum. This blade design results in lower resistance to airflow and increased strength for use in pressure systems.



3V Blade
AMD-23



Fabricated Airfoil
AMD-33



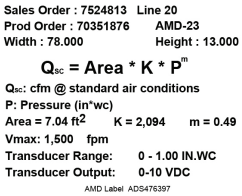
Extruded Airfoil
AMD-42
AMD-42V

Blade Operation

Damper blades operate parallel to one another for precise airflow volume control.

No Field Calibration

Greenheck's AMD series require no field calibration. The AMD series is supplied with a label that provides a formula to convert pressure to a flow value used to program the controller.



AMD Label

		AMS	AMD-23	AMD-33 AMD-42	AMD-42V
Velocity range ft/min (m/s)	Minimum	300 (1.5)	300 (1.5)	300 (1.5)	300 (1.5)
	Maximum	3000 (15.2)	2000 (10.2)	3000 (15.2)	3000 (15.2)
Accuracy		5%	5%	5%	5%
Temperature range °F (°C)	Minimum	-20° (-29°)	-20° (-29°)	-20° (-29°)	-20° (-29°)
	Maximum	180° (82°)	180° (82°)	180° (82°)	180° (82°)
Factory supplied transducer		✓	✓	✓	✓
Factory supplied controller		O	O	O	O
Airflow straightener		✓	✓	✓	✓
Minimum Unit depth inches (mm)		8 (203)	12 (305)	12 (305)	12 (305)
Minimum Size inches (mm)		6 x 6 (152 x 152)	6 x 6 (152 x 152)		
Maximum size inches (mm)		60 x 72 (1524 x 1829)	144 x 148 (3658 x 3759)	144 x 148 (3658 x 3759)	74 x 48 (1880 x 1219)

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EM Series

EM series dampers are extruded aluminum backdraft dampers that open by air pressure differential and close by gravity.

EM dampers are an extruded medium series damper rated for velocities of 2500 to 3500 ft/min. (12.7 to 17.8 m/s) and pressure of 4 to 10 in. wg (1 kPa to 2.5 kPa).

Options available are:

- Flanges 1½ in. (38mm)
- Adjustable pressure controller (APC) used for field-setting of relief pressure
- Paint finishes

GM Series

GM dampers have a galvanized steel frame with extruded aluminum blades.

Flanged EM Series with APC (Adjustable Pressure Controller)

Commercial Backdraft (EM and GM Series) Quick Selection Guide

Model	Material		Counter-balance Weights	Mounting Position	Airflow Direction	Flange	Maximum Velocity ft/min. (m/s)	Maximum Back Pressure in. wg (kPa)	Start-Open Pressure* in. wg (kPa)
	Frame	Blade							
EM-10	Aluminum	Aluminum	Std	H	Vertical Up	No	3500 (17.8)	10 (2.5)	0.05 (0.01)
EM-11			Std	H	Vertical Up	Discharge	3500 (17.8)	10 (2.5)	0.05 (0.01)
EM-12			Std	H	Vertical Up	Intake	3500 (17.8)	10 (2.5)	0.05 (0.01)
EM-30			Opt	V	H	No	3500 (17.8)	10 (2.5)	0.03 (0.01)[1] 0.01 (0.002)[2]
EM-31			Opt	V	H	Discharge	3500 (17.8)	10 (2.5)	0.03 (0.01)[1] 0.01 (0.002)[2]
EM-32			Opt	V	H	Intake	3500 (17.8)	10 (2.5)	0.03 (0.01)[1] 0.01 (0.002)[2]
EM-40			Std	H	Vertical Down	No	3500 (17.8)	10 (2.5)	0.07 (0.017)
EM-41			Std	H	Vertical Down	Discharge	3500 (17.8)	10 (2.5)	0.07 (0.017)
EM-42			Std	H	Vertical Down	Intake	3500 (17.8)	10 (2.5)	0.07 (0.017)
GM-30	Galvanized Steel	Aluminum	Std	V	H	No	2500 (13)	4 (1)	0.03 (0.01)[1] 0.01 (0.002)[2]
GM-31			Std	V	H	Discharge	2500 (13)	4 (1)	0.03 (0.01)[1] 0.01 (0.002)[2]
GM-32			Std	V	H	Intake	2500 (13)	4 (1)	0.03 (0.01)[1] 0.01 (0.002)[2]

H = Horizontal; V = Vertical; N/A = Not Available; Opt = Optional; Std = Standard; [1] = w/o weights; [2] = w/ weights
* Note that start-open is the pressure at which damper blades just begin to rotate, blades are not fully open at this point. Damper size and bearing selection may cause start-open pressure to vary from this value.

Section 7
Competitor Cross Reference

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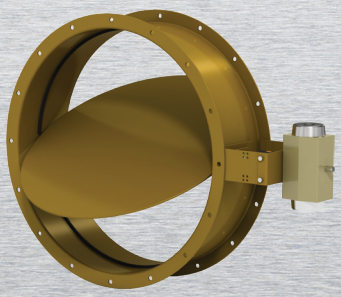
Greenheck	Ruskin	Tamco	United Enertech
Backdraft			
EM-10	BD6; CBD6	7000CW	CB-601
EM-11	BD6; CBD6	7000CW	CB-601
EM-12	BD6; CBD6	7000CW	CB-601
EM-30	CBD6	7000CW	CB-601
EM-31	CBD6	7000CW	CB-601
EM-32	CBD6	7000CW	CB-601
EM-40	CBD6	7000CW	CB-601
EM-41	CBD6	7000CW	CB-601
EM-42	CBD6	7000CW	CB-601
GM-30	-	-	-
GM-31	-	-	-
GM-32	-	-	-
Commercial Control			
ICD-44	TED50	9000	
ICD-45	TED50; TED50XT; TED50DC	9000 BF	TB-155/156
VCD-20	CD35; CD355	-	CD-110; CD-111
VCD-23	CD36; CD356	-	CD-110; CD-111
VCD-23V	-	-	-
SEVCD-23	-	-	-
VCD-33	CD60; CD60DC	-	CD-160; CD-161; CD-170; CD-171
VCD-33V	CD60V	-	-
SEVCD-33	CD60SS	-	-
VCD-34	IL35; TED40	-	-
VCD-34V	-	-	-
VCD-40	CD40; CD403	-	CD-145; CD-146
VCD-42	-	-	-
VCD-43	CD50; CD504; CD50DC; CD50IF; CD450	1000; 1500	CD-150; CD-151
VCD-43V	CD50V; CD450V	-	-
VCDR-50	CDR25	-	RI
VCDR-53	CDR25; CDRS15; CDRS25	-	RI
VCDRM-53	-	-	R-PB/OB
Face & Bypass			
FBV-23	CD36	-	CD-110; CD-111
Air Measuring			
AMS	AMS	-	-
AMD-23	-	-	-
AMD-33	-	-	-
AMD-42	AMS050	-	-
AMD-42V	-	-	-

Heavy Duty Industrial Control Dampers

Industrial control dampers are for control and shut-off applications. There is a wide variety of configurations, options, accessories, and actuators available. These control dampers are capable of pressures up to 30 in. wg and velocities up to 7000 fpm.

HCD Series

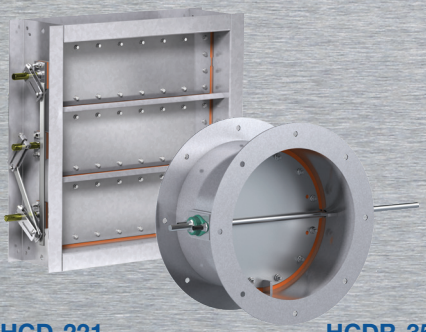


HCDR Series

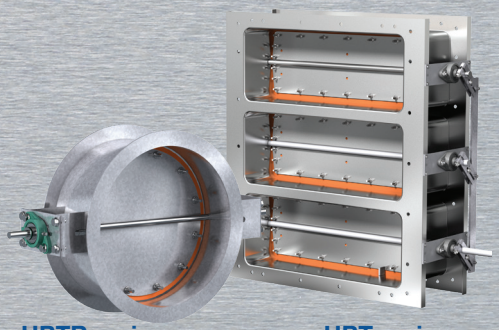
LEARN MORE

Isolation Dampers

Greenheck has the largest offering of isolation dampers in the industry. These dampers are designed to provide tight shutoff with leakage as low as zero. Each is equipped with shaft seals to prevent leakage through the damper frame and silicone blade seals.



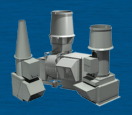
HCD-221 HCDR-351

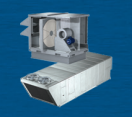


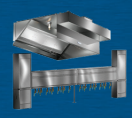
HBTR series HBT series

Low Leakage
HCDR-351 - less than 1 cfm/ft² at 10 in. wg
HCD-221 - 2.5 cfm/ft² at 10 in. wg

Zero Leakage
HBTR series - zero leakage up to 40 in. wg
HBT series - zero leakage up to 20 in. wg







Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

GREENHECK
Building Value in Air.

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