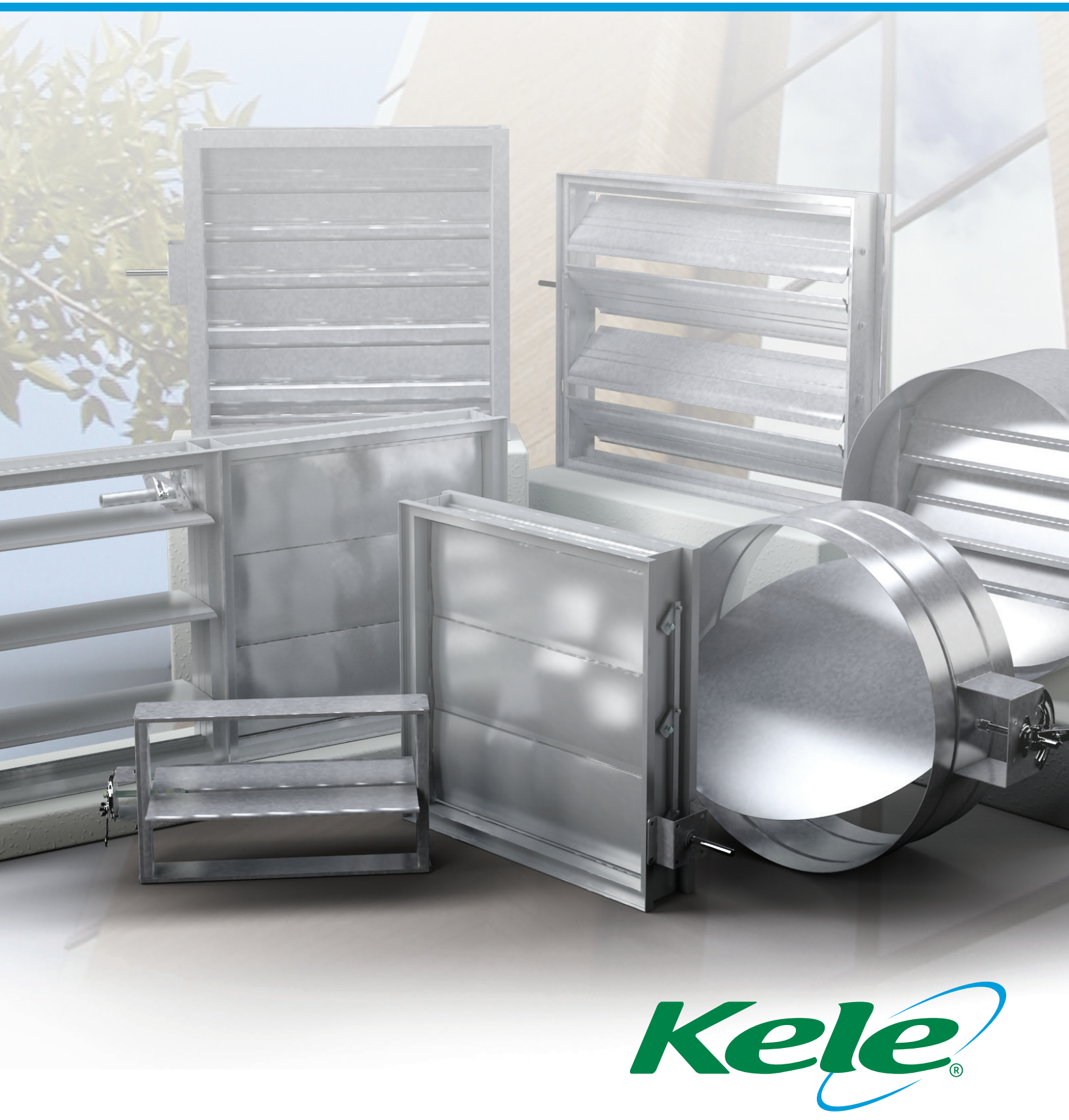
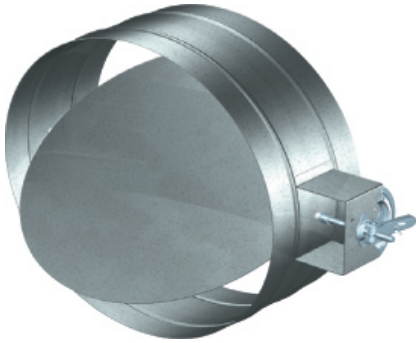
HVAC Control Dampers



Kele®

HVAC Control Dampers

Commercial control dampers are used in buildings to regulate the flow of air in an HVAC system. They can be used in intake, exhaust, or mixed air applications. There are two categories of control dampers – Commercial Volume Control Dampers and Balancing Dampers.



VOLUME CONTROL DAMPERS

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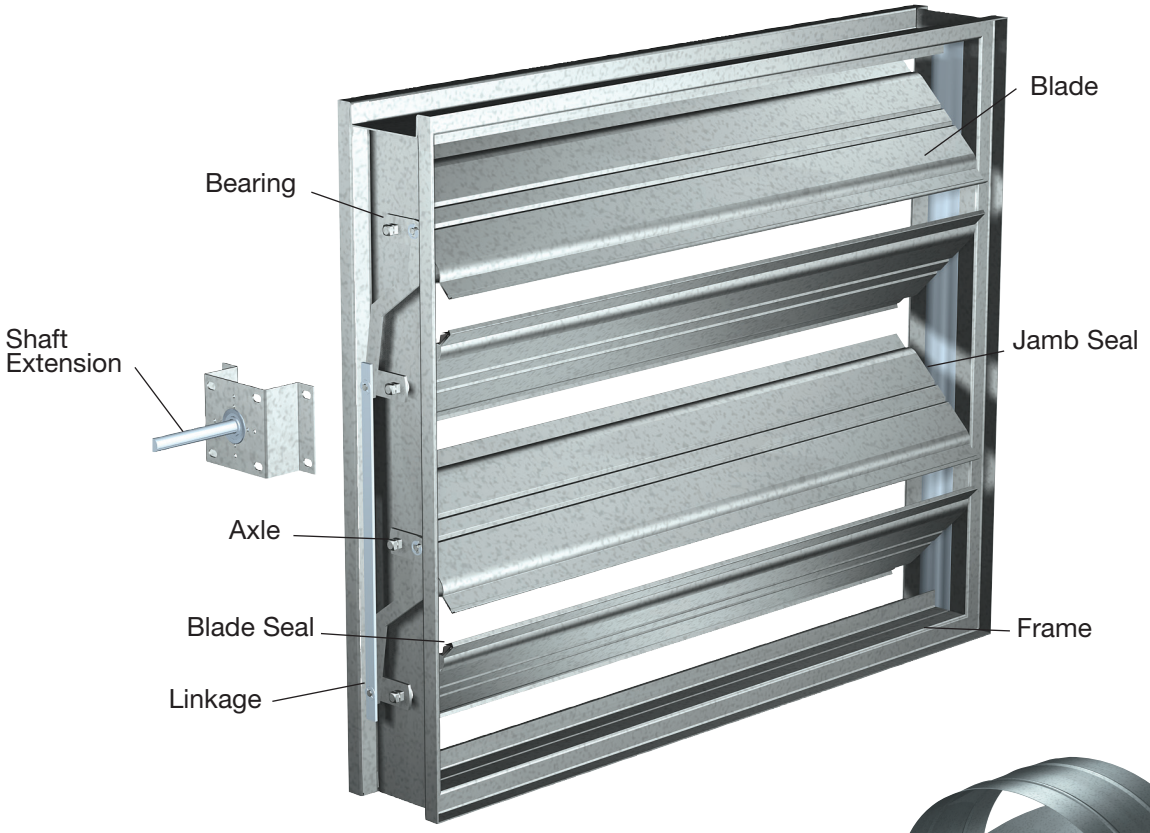
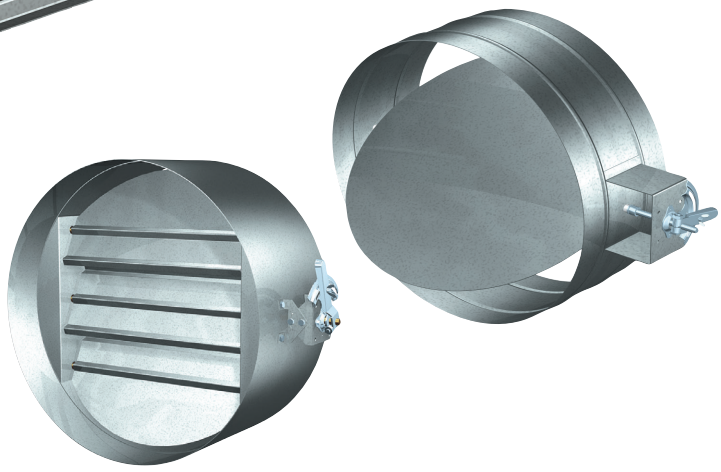
Commercial Volume Control Dampers

Commercial control dampers regulate the flow of air in the same manner as manual balancing dampers. In addition, they can be used as a positive shutoff or for automatic control.
Kele offers the following types of commercial volume control dampers:

- Rectangular Volume control – KVCD series
- Round volume control – KVCDR series
- Insulated control – KICD series*





** More information on the KICD series can be found on the back cover.*

Variable Symmetric Blade Design (VSB)

Kele's Variable Symmetric Blade design (VSB), uses two principles to increase damper performance. First, all damper blades are symmetric about their axis. Second, any combination of 4, 5, 6, and 7 in. (102, 127, 152, and 178mm) blade widths are used in a single damper. These two features are part of Kele's standard construction and provide the following advantages:

- *Increases Mounting Flexibility* - Symmetrical blades have identical operating characteristics regardless of airflow direction. This allows a Kele control damper to be mounted in either direction of flow, an advantage when installing with space constraints.
- *Increases Free Area* - Traditional damper designs with a single blade width require oversized blade stops, limiting free area when the blades are open (Figure 1). Kele is able to reduce height or eliminate blade stops, which maximizes free area and increases damper performance (Figure 2).
- *Reduces Actuator Torque* - If an unsymmetrical blade closes against airflow, a large amount of torque is needed because the air distribution is unbalanced. Kele's VSB design balances airflow on each side of a symmetrical blade, reducing the torque required to operate the damper (Figure 3). The use of symmetrical blades allows Kele to reduce the size and quantity of actuators used on dampers (Figure 4).

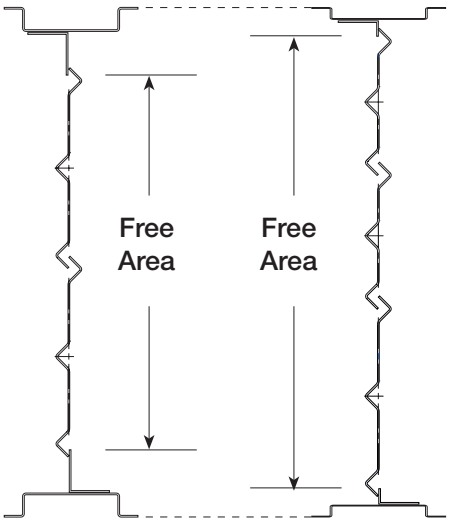
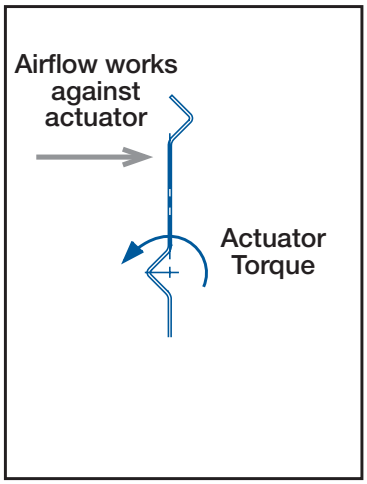


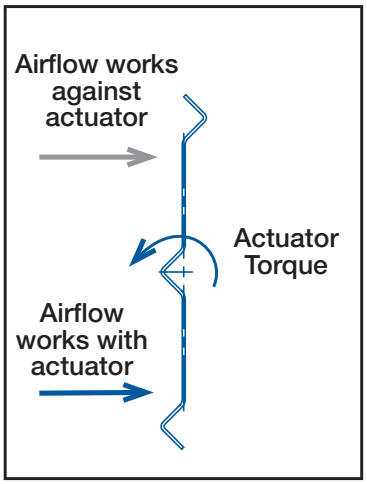
Figure 1

Figure 2



Unbalanced Blade
Requires Higher Torque

Figure 3

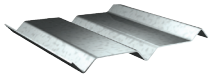


Balanced Blade
Requires Less Torque

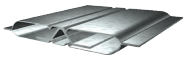
Figure 4

Blades

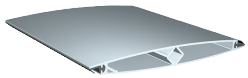
- *3V* blades are fabricated from a single thickness of 16 ga. (1.5mm) galvanized or stainless steel, incorporating three longitudinal V-Type grooves running the full length of the blade to increase strength. This blade is standard on models KVCD-18, 20, 20V, 23, 23V, and KSEVCD-23, designed for low to medium velocity and pressure applications.
- *Airfoil* blades are constructed of double-skin galvanized steel, stainless steel, or heavy-gauge extruded aluminum. This blade design results in lower resistance to airflow and increased strength that is typically used in high pressure systems. Airfoil blades are standard on models KVCD-33, 33V, 34, 40, 42, 42V, 43, 43V and KSEVCD-33.



3V Blade



Steel Airfoil Blade

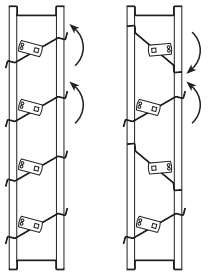


Aluminum Airfoil Blade

Parallel Versus Opposed Blade Operation

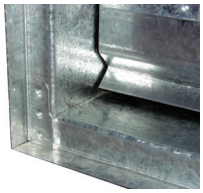
Kele control dampers are offered with either parallel or opposed blades. Each style has distinguishing characteristics in regard to the type of operation required.

- *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 when the damper operates in two positions, open or closed.
- *Opposed blade operation* - Adjacent damper blades rotate opposite one another under opposed blade configuration. Opposed blade configuration is typically used on dampers that modulate airflow.



Frame

Kele control dampers utilize a 5 in. x 1 in. (127mm x 25mm) hat channel frame made of 16 ga. (1.5mm) steel, 16 ga. (1.5mm) stainless steel, or 0.125 in. (3mm) aluminum. Each frame is built with four separate pieces of material and joined by our Tog-L-Loc® process resulting in the following advantages:

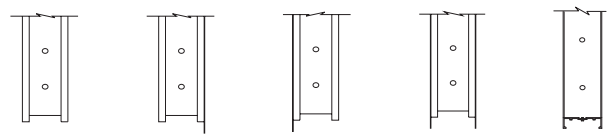


Tog-L-Loc®
Reinforced Corner

- *Rigid frame* - When two pieces of 16 ga. (1.5mm) steel are joined by the Tog-L-Loc® system, the joint has an equivalent thickness of 10 ga. (3.5mm) steel.
- *Increased corrosion resistance* - High temperatures from welding remove the galvanized finish from damper frames. The Tog-L-Loc® process does not use heat, so Kele damper frames have greater corrosion resistance by retaining the galvanized coating.
- *Optimal free area* - On dampers that are 17 in. (432mm) high or less, Kele uses a low profile top and bottom frame section to maximize free area.
- *Square frame* - Many damper manufacturers construct each frame from a single piece of sheet metal, formed into shape by bending at three corners and spot welding in one. This type of construction can produce weak corners that are not necessarily 90º, resulting in a frame that is out-of-square. Symptoms of out-of-square frames include blades that do not close properly and reduced leakage performance. Using four separate frame components (top, bottom, and two sides), Kele's Tog-L-Loc® process results in four sturdy, 90º joints. This ensures that each Kele damper is square and provides optimum performance in the field.

There are five frame options available:

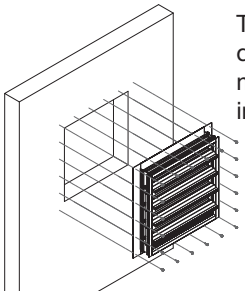
- Channel Frame (standard)
- Single Flange
- Single Reverse Flange
- Double Flange
- Quick Connect (KVCD-43, -43V; KICD Series)



Design and Construction Features

Frame Options

The channel frame style allows a damper to be insert mounted into an opening without being concerned about the linkage sticking out past the frame. The single and single reverse flange frame can be insert mounted or directly mounted to the wall, mating surface or bulkhead. The quick connect frame design is extruded to match up to a TDC, TDF, or Ductmate connection to allow the damper to be cleated to the ductwork.



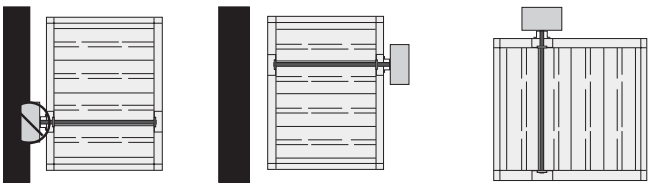
This illustration depicts how to mount a damper into a plenum wall.

Linkage

Traditional damper linkages are found in the airstream, adding to the pressure drop of the damper blades and frame. Kele control dampers have blade linkages concealed in the frame to prevent additional pressure drop and unwanted noise. With standard plated steel construction (stainless steel optional), the linkage is engineered to accurately control each and every blade without need for adjustment.

No Top or Bottom

Kele's standard control dampers are designed for installation in any position with the blades horizontal. The damper can be turned over so the actuator is on the left or right side. Optional vertical blade models can be turned with the actuator at the top or bottom.

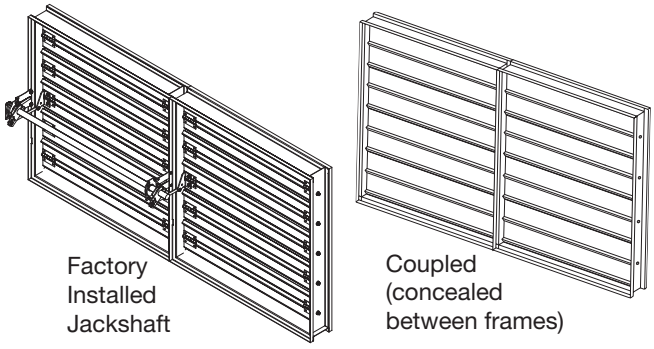


Standard

Vertical Blade

Multi-Section Dampers

Each of Kele's KVCD control dampers have a maximum size for a single damper section or panel. These sections vary from 48 in. wide x 60 in. high (1219mm x 1524mm) to 60 in. wide x 74 in. high (1524mm x 1880mm). Dampers larger than a single section will be made up of equal size sections which, depending upon model and size, may be shipped as a single complete assembly or as separate sections for field assembly. Multi-section damper assemblies are supplied with a coupler or factory installed jackshaft so all sections operate together.



Factory Installed Jackshaft

Coupled (concealed between frames)

Damper assemblies (larger than one section) are not designed to be structurally self-supporting. Additional horizontal bracing is recommended for support. Vertical bracing should be installed if required to hold against system pressure.

Optional Paint Finishes

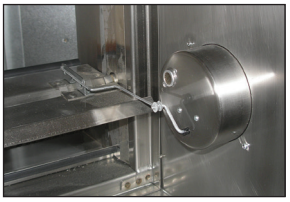
A wide variety of paint finishes are available including:

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

Contact Kele sales representative for standard color offering.

Optional 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.



Actuator Options

Kele has a wide range of manual, electric, and pneumatic actuators for use with control dampers. Actuators can be installed at the factory or shipped loose with the necessary linkage and brackets required for mounting. Each damper and actuator is cycle tested in our factory before the final product is shipped, ensuring Kele quality and trouble free operation in the field. Kele can also ship actuators direct from our distribution center.

Manual Hand Quadrant

Location
- Internal or External

Manual Hand Quadrant

Actuator Manufacturers Available From Factory

- Kele, Belimo, Honeywell, Johnson Controls, Schneider Electric, Siemens

Factory Installed or Supplied Actuator Options and Specifications*

Electric Actuator

Power Supply
- 24 VDC, 24 VAC, 120 VAC, and 240 VAC
- Frequency

Operation
- Spring Return (spring will drive damper to original starting point)
- Power Open or Power Closed

Operating Mode
- Two-position (damper position is open or closed)
- Modulating (damper position determined by modulating control signal)
- Floating (damper can be stopped anywhere between open and closed)

Fail Direction (for spring return only)
- Open or Closed

Location
- Internal or External

Control Signal (for modulating only)
- 0-10 VDC, 2-10 VDC or 4-20 mAdc

NEMA Enclosure
- 1, 3, 4, 4X, or 7 (specify one per application)

Accessories
- Auxiliary Switches
- Transformers

Electric, External Mount


Electric, Internal Mount

Pneumatic Actuator

Power Supply
- 20 psi

Operation
- Spring Return (spring will drive damper to original starting point)

Operating Mode
- Two-position (damper position is open or closed)
- Modulating (damper position determined by modulating pressure signal)

Fail Direction (for spring return only)
- Open or Closed

Location
- Internal or External

Control Signal (for modulating only)
- 3-15 psi

Accessories
- Solenoid Valves or Positioners


Pneumatic

** Actuators shipped from Kele distribution may have more options.*

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

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

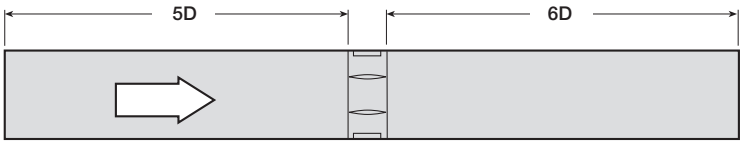


Figure 5.3

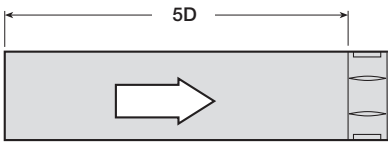


Figure 5.2

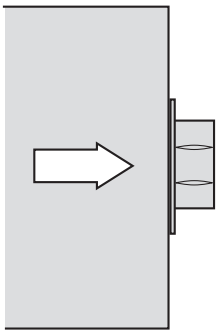


Figure 5.5

Round Duct Conversion Formula

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

D = Duct length
W = Damper width
H = Damper height

Performance

Three common code energy standards that pertain to dampers are:

- ASHRAE Standard 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings
- California Title 24
- IECC - International Energy Conservation Code

Here are the primary requirements for dampers based on each standard:

ASHRAE Standard 90.1 - (2010 edition) states that maximum damper leakage at 1 in. wg for a :

- Non-motorized damper is 20 cfm/ft^2 or
- Motorized damper is 4 cfm/ft^2. (See Table 6.4.3.4.3 from ASHRAE Standard 90.1)

California Title 24 - (2013 edition, section 140.4.4) states that the dampers shall be certified in accordance with AMCA Publication 511 to have a maximum leakage of 10 cfm/ft^2 at 1 in. wg. The dampers have been tested and are able to open and close against the rated airflow and pressure of the system after 60,000 damper opening and closing cycles.

IECC - (2012, section C402.4.5.2) states that outdoor air supply and exhaust opening be supplied with Class 1A motorized dampers with a maximum leakage rate of 4 cfm/ft^2 at 1 in. wg when tested in accordance with AMCA 500D.

Kele's volume control dampers meets the requirements of ASHRAE, California Title 24 and IECC.

Data

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/ft² @ 1 in. wg (Class 1A is only defined at 1 in. wg).
- Leakage Class 1 - 4 cfm/ft² @ 1 in. wg
  - 8 cfm/ft² @ 4 in. wg
  - 11 cfm/ft² @ 8 in. wg
  - 12.6 cfm/ft² @ 10 in. wg

Maximum Leakage cfm/sq. ft. (cmh/sq.m)		
Model	Pressure	
	@ 1 in. wg (.25 kPa)	@ 4 in. wg (1 kPa)
KVCD-18	Class 1A	N/A
KVCD-23, 23V, 33, 34, 40, 42, 42V, 43, 43V	Class 1A	Class 1
KVCDR-53	Class 1	Class 1
KVCDRM-53	Class 1	Class 1

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

KVCD-18	Leakage Class*	
Maximum Damper Width	1 in. wg (0.25 kPa)	2 in. wg (0.5 kPa)
48 in. (1219mm)	1A	1

KVCD-23, KSEVCD-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. (1219mm)	1A	1	1

KVCD-40	Leakage Class*					
Maximum Damper Width	1 in. wg (0.25 kPa)	2 in. wg (0.5 kPa)	3 in. wg (0.75 kPa)	4 in. wg (1 kPa)	5 in. wg (1.25 kPa)	6 in. wg (1.5 kPa)
36 in. (914mm)	1A	1	1	1	1	1
48 in. (1219mm)	1A	1	1	1	2	N/A
60 in. (1524mm)	1A	2	2	N/A	N/A	N/A

KVCD-42, 43	Leakage Class*			
Maximum Damper Width	1 in. wg (0.25 kPa)	4 in. wg (1 kPa)	8 in. wg (2 kPa)	10 in. wg (2.5 kPa)
60 in. (1524mm)	1A	1	1	1

Torque - data is based on a torque of 7.0 in-lb/ft² (0.79 N·m) applied to close and seat the damper during the test.

KVCD-33, 34 KSEVCD-33	Leakage Class*			
Maximum Damper Width	1 in. wg (0.25 kPa)	4 in. wg (1 kPa)	8 in. wg (2 kPa)	10 in. wg (2.5 kPa)
60 in. (1524mm)	1A	1	1	1

Pressure Drop Data

KVCD-18, 20, 23

- Galvanized 3V blade
- Economic KVCD-20 and VCD-18
- Blade and jamb seals VCD-18 and 23

KSEVCD-23

- 316 stainless steel 3V blade
- 316 stainless steel construction
- 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	.02	.01	.01	.03	.01	.01	.03
1000	.05	.03	.13	.03	.02	.12	.02	.02	.10	.04	.03	.12	.03	.03	.12
1500	.11	.08	.30	.06	.04	.26	.05	.03	.22	.08	.07	.27	.07	.06	.28
2000	.19	.13	.53	.10	.07	.47	.09	.06	.40	.15	.12	.47	.12	.10	.49
2500	.29	.20	.82	.16	.11	.75	.14	.09	.62	.22	.18	.75	.18	.16	.77
3000	.41	.29	1.19	.23	.16	1.04	.19	.13	.90	.32	.26	1.07	.26	.22	1.12
3500	.55	.40	1.62	.30	.21	1.41	.27	.19	1.23	.43	.36	1.45	.36	.30	1.53
4000	.72	.51	2.10	.40	.28	1.90	.35	.25	1.62	.56	.46	1.91	.47	.39	2.01

KVCD-20V and 23V

- Vertical 3V blade
- Blade and jamb seals 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

KVCD-33 and 34

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

KSEVCD-33

- 316 stainless steel airfoil blade
- 316 stainless steel construction
- 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	.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

Pressure Drop Data

KVCD-33V

- Vertical galvanized 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	.02	.01	.01	.03	.01	.01	.03
1000	.03	.02	.12	.03	.01	.11	.02	.01	.09	.02	.02	.11	.03	.02	.11
1500	.07	.05	.27	.06	.03	.26	.04	.02	.21	.04	.04	.24	.07	.04	.24
2000	.13	.08	.48	.10	.05	.45	.07	.04	.38	.08	.07	.44	.11	.08	.43
2500	.19	.12	.74	.15	.09	.71	.11	.06	.58	.12	.11	.68	.17	.12	.67
3000	.26	.17	1.07	.21	.13	1.02	.15	.08	.85	.16	.15	.97	.23	.17	.96
3500	.35	.23	1.46	.28	.17	1.40	.20	.12	1.15	.21	.20	1.32	.31	.22	1.31
4000	.45	.30	1.91	.36	.22	1.89	.26	.15	1.52	.27	.25	1.73	.39	.29	1.71

KVCD-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

KVCD-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

Pressure Drop Data

KVCD-42V

- Vertical 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	.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	2.50	.49	.24	1.50	.38	.19	1.13	1.0	.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

KVCD-43

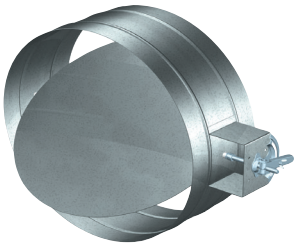
- Extruded aluminum airfoil blade
- Aluminum frame
- Blade and jamb seals

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	.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	.04	.03	.11	.03	.02	.11
1500	.13	.07	.31	.10	.04	.27	.06	.02	.22	.10	.06	.25	.06	.04	.26
2000	.23	.14	.55	.18	.08	.48	.12	.04	.39	.17	.11	.46	.10	.08	.46
2500	.35	.21	.86	.28	.13	.75	.18	.06	.61	.26	.17	.72	.16	.12	.72
3000	.50	.29	1.23	.40	.19	1.07	.26	.09	.87	.38	.25	1.05	.23	.18	1.02
3500	.68	.39	1.67	.54	.26	1.47	.35	.13	1.19	.52	.34	1.43	.30	.24	1.40
4000	.88	.51	2.19	.70	.34	1.91	.46	.17	1.56	.68	.45	1.87	.39	.31	1.83

KVCD-43V

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

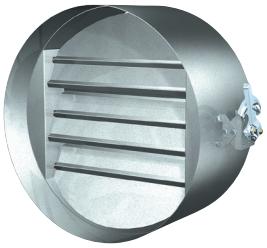
Dimension inches	12x12			24x24			36x36			12x48			48x12		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg														
500	.01	.01	.04	.01	.01	.03	.01	.01	.03	.01	.01	.03	.01	.01	.03
1000	.06	.03	.14	.04	.02	.12	.03	.01	.10	.03	.02	.11	.04	.03	.11
1500	.13	.07	.31	.10	.04	.27	.06	.02	.22	.06	.04	.26	.10	.06	.25
2000	.23	.14	.55	.18	.08	.48	.12	.04	.39	.10	.08	.46	.17	.11	.46
2500	.35	.21	.86	.28	.13	.75	.18	.06	.61	.16	.12	.72	.26	.17	.72
3000	.50	.29	1.23	.40	.19	1.07	.26	.09	.87	.23	.18	1.02	.38	.25	1.05
3500	.68	.39	1.67	.54	.26	1.47	.35	.13	1.19	.30	.24	1.40	.52	.34	1.43
4000	.88	.51	2.19	.70	.34	1.91	.46	.17	1.56	.39	.31	1.83	.68	.45	1.87



KVCDR-50 and 53

- Insert type round single blade
- Blade seals KVCDR-53

Dimension inches	12			24		
AMCA figure	5.2	5.3	5.5	5.2	5.3	5.5
Velocity (ft/min)	Pressure Drop in. wg					
500	.01	.01	.02	.01	.01	.02
1000	.06	.02	.10	.04	.01	.09
1500	.13	.05	.22	.08	.03	.20
2000	.23	.08	.38	.15	.06	.36
2500	.37	.13	.60	.23	.09	.56
3000	.53	.19	.86	.33	.13	.81



KVCDRM-50 and 53

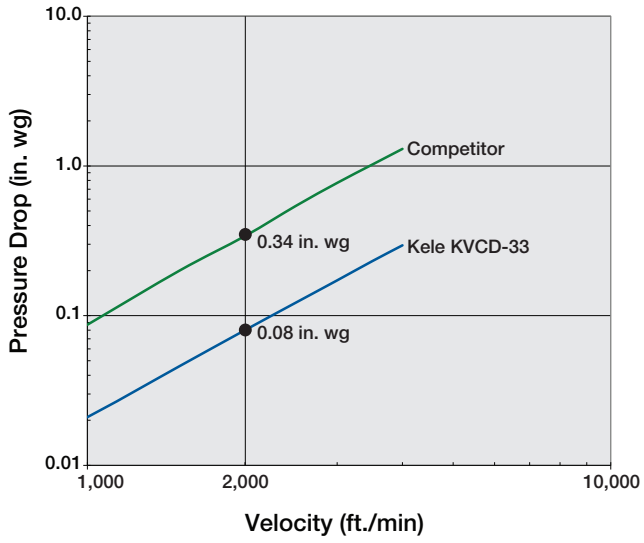
- Insert type round multi-blade
- Blade seals KVCDRM-53

Dimension inches	12			24			36		
AMCA figure	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	.03	.05	.03	.02	.04	.05	.05	.06
1000	.15	.11	.19	.13	.10	.15	.19	.20	.25
1500	.33	.25	.42	.29	.21	.33	.42	.44	.57
2000	.59	.45	.75	.51	.38	.59	.75	.79	1.01
2500	.93	.70	1.18	.79	.60	.92	1.18	1.23	1.58

Pressure Drop Comparison

Kele compared the pressure drop data of a KVCD-33 12 in. wide x 12 in. high (305mm x 305mm) versus a competitor's equivalent 12 in. wide x 12 in. high (305mm x 305mm) damper. Both dampers were installed in an identical system which drew 2000 ft./min. of airflow through them.
The results were dramatic!

Pressure Drop Data Comparison



Volume Control Damper Selection Guide

X = Standard O = Optional		KVCD-18	KVCD-20	KVCD-20V	KVCD-23	KVCD-23V	KVCD-33	KVCD-33V	KVCD-34	KVCD-40
Blade Profile	Single Blade									
	3V	X	X		X					
	3V-Vertical Blade			X		X				
	Airfoil						X			X
	Airfoil-Vertical Blade							X		
	Airfoil-Insulated								X	
Frame Material	Galvanized	X	X	X	X	X	X	X	X	
	304 Stainless Steel		O	O	O	O	O	O	O	
	316 Stainless Steel									
	Aluminum									X
Blade Material	Galvanized	X	X	X	X	X	X	X	X	
	304 Stainless Steel		O	O	O	O	O	O	O	
	316 Stainless Steel									
	Aluminum									X
Frame Gauge	20									
	16	X	X	X	X	X	X	X	X	
	12		O	O	O	O	O	O	O	
	Aluminum									.125 (3.2)
Blade Seals	TPE	X			X	X	X	X	X	X
	Silicone				O	O	O	O	O	O
Jamb Seals	304 Stainless Steel	X			X	X	X	X	X	X
	316 Stainless Steel									
Bearings	Synthetic	X	X	X	X	X	X	X	X	X
	Bronze	O	O	O	O	O	O	O	O	O
	304 Stainless Steel	O	O	O	O	O	O	O	O	O
	316 Stainless Steel									
Axles	Steel	X	X	X	X	X	X	X	X	X
	304 Stainless Steel		O	O	O	O	O	O	O	O
	316 Stainless Steel									
Linkage Material	Steel	X	X	X	X	X	X	X	X	X
	304 Stainless Steel		O	O	O	O	O	O	O	O
	316 Stainless Steel									
Accessories	Actuators‡	O	O	O	O	O	O	O	O	O
	Flanges†		O	O	O	O	O	O	O	O
	Retaining Angles	O	O	O	O	O	O	O	O	O
Sizing inches (mm)	Minimum Size	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)
	Maximum Single Section Size	48x60 (1219x1524)	48x74 (1219x1880)	74x48 (1880x1219)	48x74 (1219x1880)	74x48 (1880x1219)	60x74 (1524x1880)	74x60 (1880x1524)	60x74 (1524x1880)	60x74 (1524x1880)
	Maximum Multi-Section Size	72x60 (1829x1524)	Unlimited	148x96 (3759x2438)	Unlimited	148x96 (3759x2438)	Unlimited	148x96 (3759x2438)	Unlimited	Unlimited
Ratings	Max. Velocity ft/min. (m/s)	1500 (7.6)	3000 (15.2)	3000 (15.2)	3000 (15.2)	3000 (15.2)	4000 (20.3)	4000 (20.3)	4000 (20.3)	6000 (30.5)
	Max. Pressure in. wg (kPa)	2 (.5)	5 (1.2)	5 (1.2)	5 (1.2)	5 (1.2)	10 (2.5)	10 (2.5)	10 (2.5)	6 (1.5)

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

Volume Control Damper Selection Guide

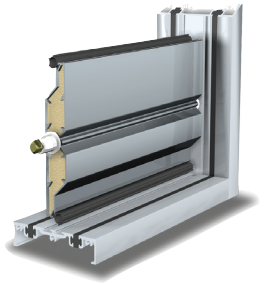
X = Standard O = Optional		KVCD-42	KVCD-42V	KVCD-43	KVCD-43V	KSEVCD-23	KSEVCD-33	KVCDR-50	KVCDR-53	KVCDRM-50	KVCDRM-53
Blade Profile	Single Blade							X	X		
	3V					X				X	X
	3V-Vertical Blade										
	Airfoil	X		X			X				
	Airfoil-Vertical Blade		X		X						
	Airfoil-Insulated										
Frame Material	Galvanized	X	X					X	X	X	X
	304 Stainless Steel							O	O	O	O
	316 Stainless Steel					X	X				
	Aluminum			X	X						
Blade Material	Galvanized							X	X	X	X
	304 Stainless Steel							O	O	O	O
	316 Stainless Steel					X	X				
	Aluminum	X	X	X	X						
Frame Gauge	20							X	X		
	16	X	X			X	X	O	O		
	14							O	O	X	X
	12	O	O								
	10									O	O
	Aluminum			.125 (3.2)	.125 (3.2)						
Blade Seals	EPDM								X		Vinyl
	TPE	X	X	X	X	X	X				
	Silicone	O	O	O	O	O	O		O		
Jamb Seals	304 Stainless Steel	X	X	X	X						X
	316 Stainless Steel					X	X				
Bearings	Synthetic	X	X	X	X						
	Bronze	O	O	O	O			X	X	X	X
	304 Stainless Steel	O	O	O	O			O	O	O	O
	316 Stainless Steel					X	X				
Axles	Steel	X	X	X	X			X	X	X	X
	304 Stainless Steel	O	O	O	O			O	O	O	O
	316 Stainless Steel					X	X				
Linkage Material	Steel	X	X	X	X					X	X
	304 Stainless Steel	O	O	O	O					O	O
	316 Stainless Steel					X	X				
Accessories	Actuators‡	O	O	O	O	O	O	O	O	O	O
	Flanges†	O	O	O	O	O	O				
	Retaining Angles	O	O			O	O				
Sizing inches (mm)	Minimum Size	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	6x6 (152x152)	4 (102)	4 (102)	10 (254)	10 (254)
	Maximum Single Section Size	60x74 (1524x1880)	74x60 (1880x1524)	60x74 (1524x1880)	74x60 (1880x1524)	48x74 (1219x1880)	60x74 (1524x1880)	24 (610)	24 (610)	36 (914)	36 (914)
	Maximum Multi-Section Size	Unlimited	148x96 (3759x2438)	288 x 222 (7315 x 5639)	148x96 (3759x2438)	Unlimited	Unlimited	NA	NA	NA	NA
Ratings	Max. Velocity ft/min. (m/s)	6000 (30.5)	6000 (30.5)	6000 (30.5)	6000 (30.5)	3000 (15.2)	4000 (20.3)	3000 (15.2)	3000 (15.2)	2500 (12.7)	2500 (12.7)
	Max. Pressure in. wg (kPa)	6 (1.5)	6 (1.5)	10 (2.5)	6 (1.5)	5 (1.2)	10 (2.5)	4 (1)	4 (1)	5 (1.2)	5 (1.2)

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

KICD - Insulated Control Damper

Kele's KICD 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/m^2 @ .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



Cross section of thermally broken frame and blade

AMCA Certified Energy Efficiency Performance

A damper's Thermal Efficiency Ratio (E) is a comparison of the thermal performance of the tested damper with a standard reference damper. A damper that is twice as efficient as the reference damper would have an E of 100%.

Insulated Control Damper Selection Guide

X = Standard O = Optional		KICD-44	KICD-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

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