GREENHECK

HCDR-351

Industrial Isolation Damper

Provides Tight Shutoff

Application and Design

Model HCDR-351 is a heavy duty round industrial isolation damper with a flanged style frame. It is designed to provide tight shutoff with very low leakage in HVAC or industrial process control systems. A variety of optional features makes model HCDR-351 extremely versatile, allowing its capabilities to be tailored to the application. Adjustable blade stops are external so there are no frame projections in the airstream. The HCDR-351 is not recommended for modulating service as seal rubs on frame near axle penetration.

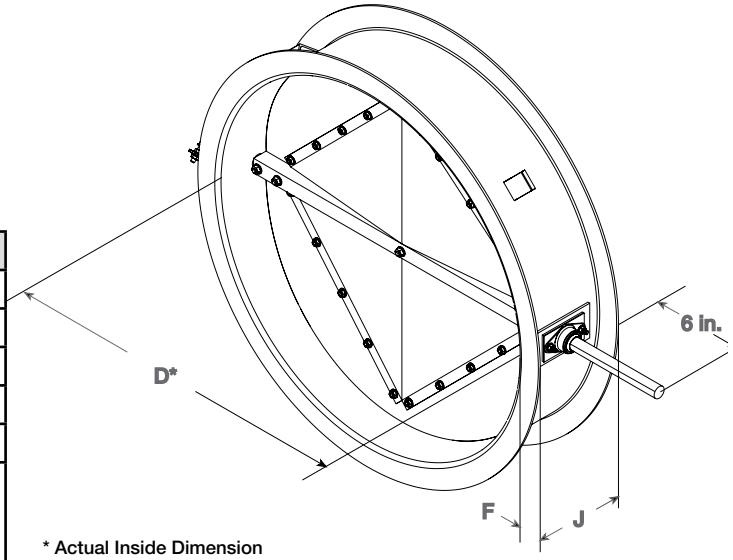
Ratings (See pages 2 and 3 for specific limitations)

Pressure: 20 in. wg (5 kPa) - differential pressure (through 36 in. [914mm] dia.)
15 in. wg (3.7 kPa) - differential pressure (through 60 in. [1524mm] dia.)

Velocity: 6500 fpm (33 m/s)

Temperature: -60°F to 400°F (-51°C to 204°C). Consult factory for other temperatures.

	Standard	Optional
Frame Material	Painted Steel	304SS, 316SS
Frame Type	Flanged Channel	
Blade Material	Painted Steel	304SS, 316SS
Blade Seals	EPDM	Silicone
Blade Type	Round, Formed Steel-Removable	
Axle Bearing	External Bronze	External Relubricable Ball, Outboard Bronze Sleeve, Outboard Relubricable Ball
Axle Material	Plated Steel	304SS, 316SS
Axle Seals	O-ring	-
Paint Finishes	Permatector™	Epoxy, Hi Pro Polyester, Hi Temperature Aluminum, Hi Temperature Silver, Industrial Epoxy

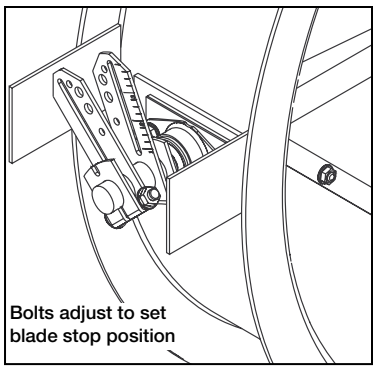


* Actual Inside Dimension

Diameter	*Minimum Size*	*Maximum Size*
Inches	4	60
mm	102	1524

Features

- Wide mounting flanges can be ordered with bolt holes, customized to match your requirements.
- Adjustable Blade stops are standard at the open and closed position of the blade. The blade stops are external to maximize internal free area and to minimize the pressure drop across the damper.
- Wide range of actuators available.



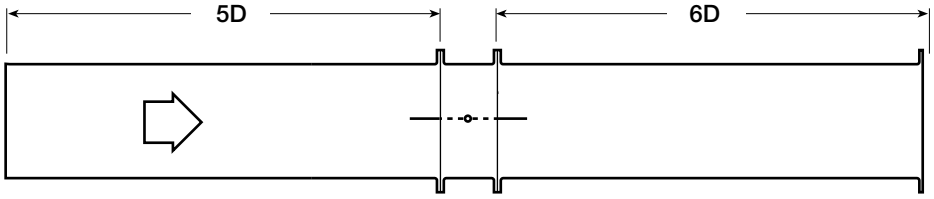
Diameter *D* Inches (mm)		Frame Depth *J* Inches (mm)	Frame & Flange Gauge (mm)	Flange Width *F* Inches (mm)	Axle Diameter Inches (mm)	Blade Thickness Gauge (mm)
Above	**Through**					
3.99 (101)	**12 (305)**	6 (152)	12 (2.7mm)	1.5 (38)	0.5 (13)	16 (1.5)
12 (305)	**24 (610)**	8 (203)	10 (3.5)	1.5 (38)	0.75 (19)	12 (2.7)
24 (610)	**32 (813)**	8 (203)	0.188 (4.7)	2 (51)	0.75 (19)	10 (3.5)
32 (813)	**42 (1066)**	8 (203)	0.188 (4.7)	2 (51)	1 (25)	10 (3.5)
42 (1066)	**48 (1219)**	8 (203)	0.25 (6)	2 (51)	1 (25)	10 (3.5)
48 (1219)	**60 (1524)**	8 (203)	0.25 (6)	2.5 (64)	1.5 (38)	10 (3.5)

Installation Instructions available at www.greenheck.com

AMCA Test Figure 5.3

Figure 5.3 Illustrates a fully ducted damper. This configuration has low pressure drop because entrance and exit losses are minimized by straight duct runs upstream and downstream of the damper.

AMCA Test Figure 5.3

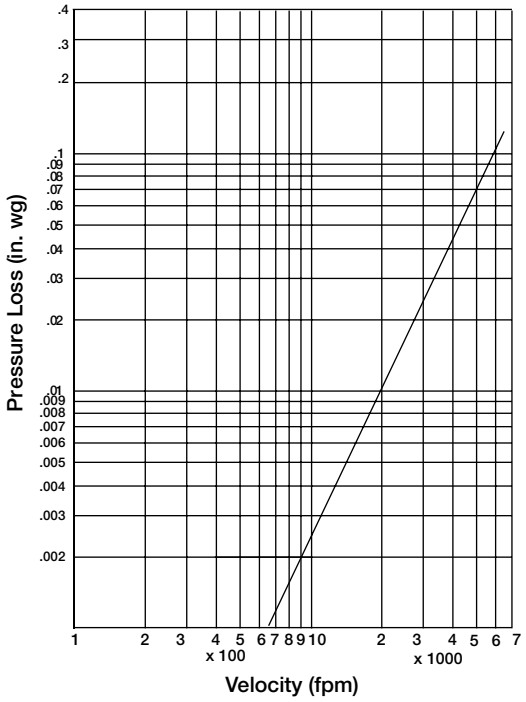


Pressure Drop Data

This pressure drop data was conducted in accordance with AMCA Standard 500-D using Test Figure 5.3. All data has been corrected to represent standard air at a density of 0.075 lb/ft^3(1.2 kg/m^3).

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

Pressure Drop
36 in. (914mm) dia. Damper



Leakage Data

Total damper leakage can be determined by the following formula:

Leakage (CFM) = (Diameter) x (0.0911) x (PMF),

where the 'Diameter' is in inches and the 'PMF' is the 'Pressure Multiplier Factor'. The PMF is shown in the table below for pressures through 20 in. wg (4981 Pa)

Pressure - in. wg.	Pressure Multiplier Factor
1	0.316
2	0.447
3	0.5477
4	0.6325
5	0.7071
6	0.7746
7	0.8367
8	0.8944
9	0.9487
10	1.0
11	1.0489
12	1.0954
13	1.1402
14	1.1832
15	1.2247
16	1.2649
17	1.3038
18	1.3416
19	1.3784
20	1.4142

Torque

The elastomer seal contact with the frame creates significant torque, especially at full closed. High velocities also cause torque on the wide blade which varies with square of the velocity through damper. The torque required to operate a given damper size can be determined as follows:

Torque = X + (Y or Z, which ever is larger),

where: 'X' is the Axle Seal Friction = (see table below)

'Y' is the Seal Torque = 0.7 x (damper diameter in inches)^2

'Z' is the Velocity Torque = 5.63 x 10^{-10} x (Velocity in fpm)^2 x (damper diameter in inches)^3

'X' Axle Seal Torque - in. lb. (Nm)		
Axle Diameter Inches (mm)	**O-Ring in. (Nm)**	**Double Gland in. (Nm)**
1/2 in. (13mm)	5 (.56)	10 (1.13)
3/4 in. (19mm)	10 (1.13)	20 (2.26)
1 in. (25mm)	15 (1.69)	30 (3.39)
1 1/2 in. (38mm)	25 (2.82)	50 (5.65)
Size actuator at a minimum of 125% of damper torque requirement.		

Example:

24 in. Diameter, O-Ring Axle Seals, and 3,000 fpm.
'X' = 10 in. lb.
'Y' = 403 in. lb.
'Z' = 70 in. lb.
Damper torque requirement: 'X' + 'Y' = 413 in. lb.
Actuator torque requirement: 413 x 1.25 = 516 in. lb.

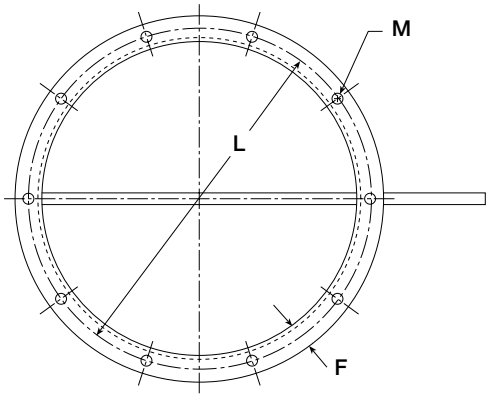
Frame Construction Options

Bolt Holes:

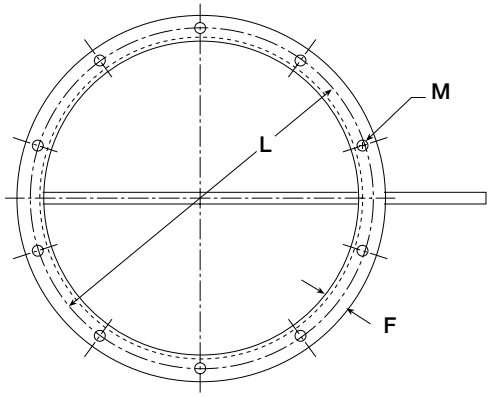
Standard - Does not include bolt holes
Optional - Bolt holes in both flanges.

Greenheck recommended bolt hole pattern is shown in the table below. Customer must specify bolt holes that are parallel to the axle centerline (P) or that straddle the axle centerline (S) as shown in the diagrams below. Greenheck can also provide bolt hole sizes and patterns other than those shown below.

Bolt Holes
Parallel to Axle Centerline (P)

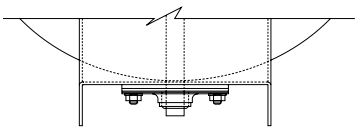


Bolt Holes
Straddle Axle Centerline (S)

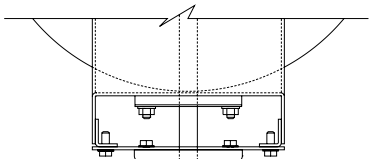


Greenheck Recommended Bolt Hole Pattern (Bolt Holes Parallel to Axle Centerline)					
Diameter Inches (mm)		**Number of Holes**	**Mounting Hole Diameter in. (mm) M**	**Bolt Circle Diameter L**	**Degrees Between Holes**
Above	**Through**				
4 (102)	5 (127)	4	3/8 (9.5)	*	90
5 (127)	8 (203)	6	3/8 (9.5)	*	60
8 (203)	11 (279)	6	7/16 (11)	*	60
11 (279)	18 (457)	8	7/16 (11)	*	45
18 (457)	24 (610)	12	7/16 (11)	*	30
24 (610)	36 (914)	16	7/16 (11)	*	22 1/2
36 (914)	58 (1473)	24	7/16 (11)	*	15
58 (1473)	72 (1829)	32	9/16 (14)	*	11 1/4
* Bolt Circle Diameter = Damper Diameter + Flange Height + 1/4 in. (6mm)					

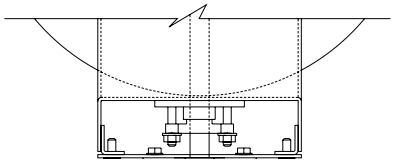
Bearing and Axle Options



External Mounted Bronze Sleeve Bearing with O-Ring (Standard)



O-Ring Axle Seal with Outboard Mounted Bearing (Optional)



Double Gland Stuffing Box with Outboard Mounted Bearing (Optional)

Blade Seal Options

Standard - EPDM Blade Seals (250°F [121°C] max.)
Optional - Silicone Rubber Blade Seals (400°F [204°C] max.)

Specifications

Industrial grade isolation dampers meeting the following specifications shall be furnished and installed where shown on plans and/or as described in schedules.

Dampers shall consist of a round channel frame, single reinforced axle, and single, removable circular blade fabricated from steel with baked polyester urethane enamel finish. Damper axle shall be continuous pivoting in externally mounted bronze sleeve bearings and O-ring axle seals bolted to each side of the damper frame. Dampers shall be equipped with EPDM synthetic rubber blade seals for low leakage performance up to 250°F (121°C) maximum. Leakage shall not exceed 0.029 cfm/ perimeter inch @ 10 in. wg and 70°F (21°C).

Damper manufacturer's printed application and performance data including pressure, velocity, and temperature limitations shall be submitted for approval showing damper suitable for pressures to 20 in. wg (5 kPa), velocities to 6500 fpm, (33 m/s) and temperatures to 400°F (204°C). Testing and ratings to be in accordance with AMCA Standard 500-D.

Specifier may add the following:
Silicone Rubber blade seals and high temperature aluminum paint for 400°F (204°C) maximum temperature.

Basis of design is Greenheck model HCDR-351. Frame gauges, blade gauges, and axle diameters shall be equal to or exceed those of the model which is the basis of design.

GREENHECK
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