



Model HCD-150

The Holyoake HCD-150 is a precisely made volume and pressure control device with extremely low leakage (in the range of 0.003 m³/s at 100 Pa) when closed. It offers great structural strength and very low resistance when open. Suitable for smoke applications up to 200 °C.

Standard Construction

- Frame:** 6063 T5 extruded aluminium with mitred corners, mechanically locked with heavy aluminium gussets.
- Blades:** 6063 T5 three cavity full airfoil extrusion for main blades on 146 mm centres, and half airfoil part blade for intermediate heights.
- Linkage:** Concealed in frame, with cast zinc cranks and aluminium control bars.
- Axles:** Hexagonal Cast Zinc Axles.
- Bearings:** Two piece moulded Acetal, pressed into frame, with the outer sleeve locked by locating ribs. (-8°C to 120 °C)
- Seals:** Blade edge and Jamb: Self inflating extruded vinyl. (0°C to 80°C) Side Seal: Flexible (convex) aluminium.
- Control Shaft:** Optional
 (1) Hex Extension Shaft 95, 125, 300mm complete with Motor Mounting Plate.
 (2) Hex Extension Shaft complete with Quadrant Arm and Plate.
- Blade Rotation:** Opposed (standard) or parallel (specify).
- Finish:** Mill.
- Minimum Size:** Channel Surround 200mm x 225mm high.
 Flange Surround 150mm x 168mm high (Air Stream)
- Maximum Size:** Channel Surround 1525mm x 1831mm high.
 Flange Surround 1400mm x 1774mm high (Air Stream)

Special Construction Options

Low Profile: Part blade and shallow (12.5mm) frame top and bottom members allow for heights below 225mm to 150mm (duct size).

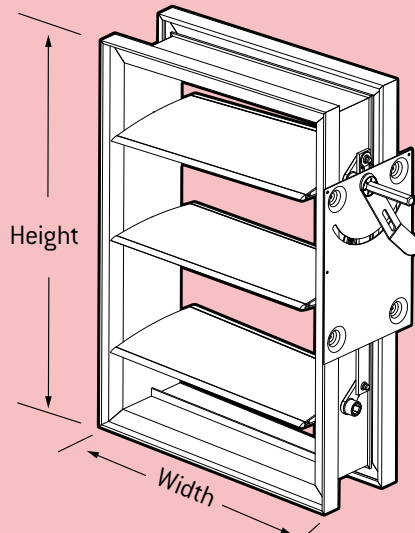
- Bearings:** (1) Ball bearings in press fit race (12.5mm) on axles
 (2) Two piece high temperature bearings, pressed into frame, with the outer sleeve locked by locating ribs (210°C).
- Axles:** Stainless steel
- Seals:** High temperature blade edge seal (225°C).
- Frame:** The HCD-150 can be supplied with an extruded aluminium frame which is designed to match either 25mm or 35mm Ductmate flange.

For other features contact factory.*

Installation

Motorised HCD-150 dampers must not be installed with axles vertical. Dampers must be installed square and free from racking. Where mounted in large accessible plenum chambers actuators can be located within, anchored to floor or ceiling, driving through either a blade bracket and swivel, or on multi section units through a control arm on the jack shaft. Where the actuator is to be located externally, specify either 11mm hex extension or for multi section dampers, extended jack shaft.

For manual control, use shaft extensions and matching locking quadrant. Multi section dampers under manual control are generally best fitted with a shaft extension and quadrant for each section, set independently of one another.

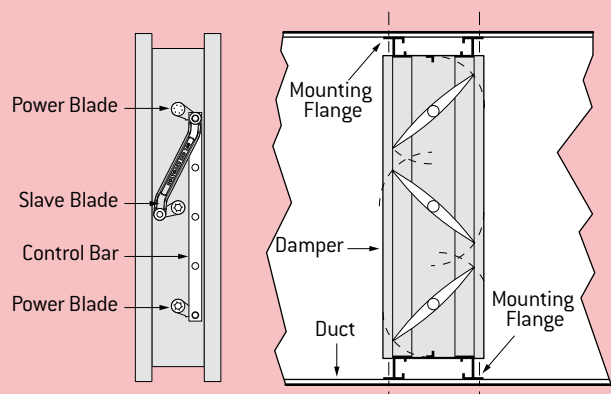


Duct Mounting

Most dampers are duct mounted. The HCD-150 is designed for quick, easy mounting by sliding into a section of duct, with no need for flanges.

Procedures

- (1) Identify the axle to be fitted with either locking quadrant or drive shaft. This should be a "power blade" axle, i.e. every second shaft on opposed blade units, or every blade on parallel blade units:-
- (2) Mark the side of the duct where this shaft will occur and cut a 25mm hole with chassis punch or similar.
- (3) Apply 3mm thick sponge seal gasket to both "hat-section" flanges and slide the damper into position. Use sheet metal screws to hold the damper in position. Do not over-tighten, to avoid "dimpling" the duct surface.
- (4) Fit on shaft extension and support bearing for motorised applications or shaft extension and quadrant for manual operation.
- (5) For high pressure units fit sponge seal around shaft, under either locking quadrant or outboard bearing.



Due to a policy of continuous development and improvement the right is reserved to supply products which may differ slightly from those illustrated and described in this publication.



Model HCD-150

Assembly and Dimensional Information

Dampers with channel surrounds are fabricated approximately 7mm less than given duct dimensions.

Dampers larger than maximum single section are an assembly of equal size single section dampers and may be coupled for operation in a variety of ways. Dampers can be coupled using female - male slide connections or a 25mm diameter jackshaft can be used for multi-section coupling as illustrated H3.

Larger Multi-Section Damper Assemblies require an analysis of how the damper is to be operated (how many and what type of operators) before the best method of coupling sections can be determined. Often it is more economical to fit individual actuators to individual sections.

Examples:

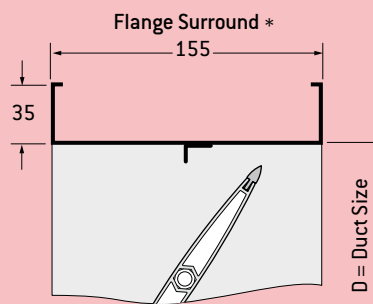
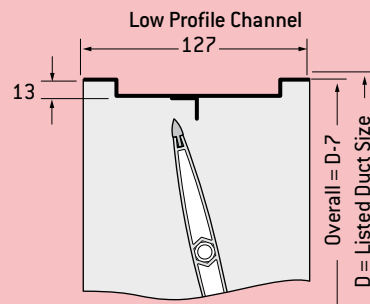
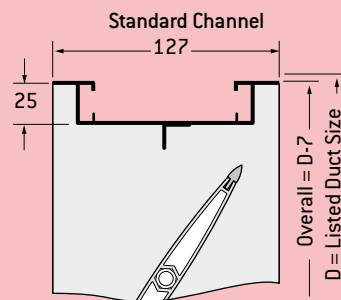
A 1800 x 1500 damper would be an ASSEMBLY consisting of two 900 x 1500 damper sections.

A 3150 x 2500 damper would be an ASSEMBLY consisting of six 1050 x 1250 damper sections.

NOTE: Multi-Section Damper Assemblies three blades high and under do not provide sufficient clearance to allow use of jack shafting. Hex-to-hex connections would then be used between sections.

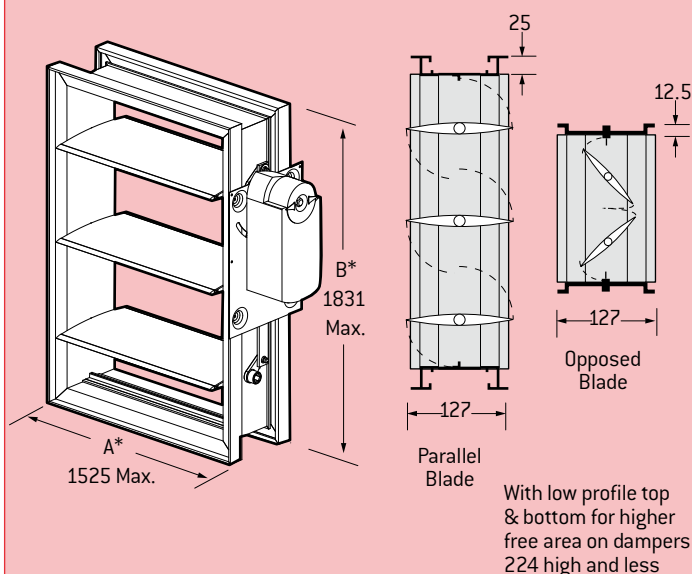
Multi-Section Damper Assemblies are normally shipped completely factory assembled subject to shipping size limitations and other considerations.

Frame Styles

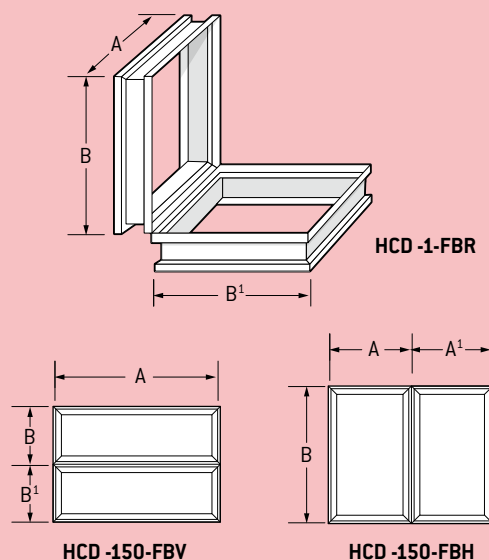


* This flange has been designed to couple with a ductmate system.

Single Section Dampers



Face & Bypass Mixing Dampers





Model HCD-150

Bracing Of Multi Section Damper Assemblies

The HCD-150 is intended to be self supporting only in its largest single section size. Multi-Section Damper Assemblies may require bracing to support the weight of the assembly and to hold against the System pressure. To support the damper horizontally brace at least once for every 2.5m of damper width. Bracing of vertical assemblies and higher system pressures may require more bracing.

The HCD-150 is designed for installation with blades running horizontally. Installation with blades running vertically is not recommended.

Linking Multi Section Damper Assemblies

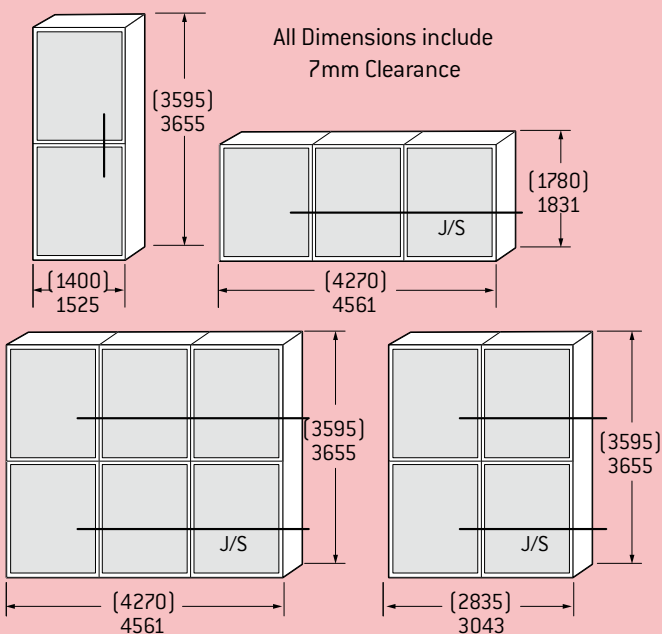
- Option 1. For smaller dampers use female to hex direct linkage.
2. Larger dampers may require special jackshafting arrangements. Discuss with your Holyoake branch.

Multi-section Maximum Dimensions

Nominate Whether Parallel or Opposed Blade For Each Section.

Channel Frame: All dimensions include 7mm clearance

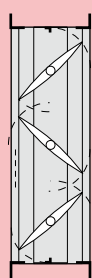
Flanged Frame: (in brackets) all dimensions are duct size



Note: All blades horizontal

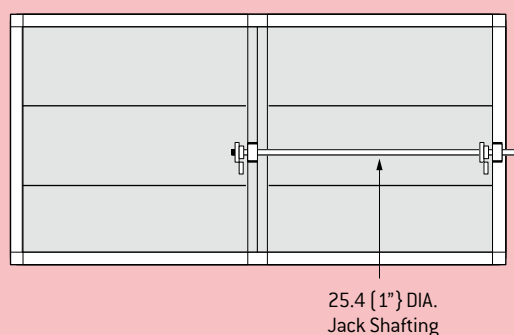
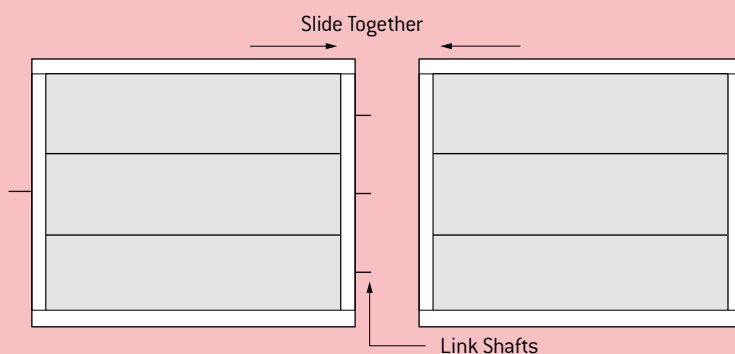
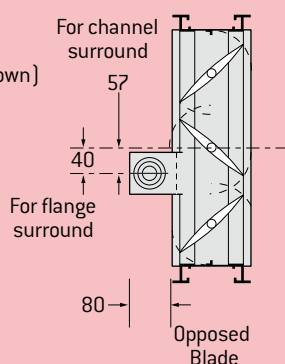
Linking Multi Section Damper Assemblies

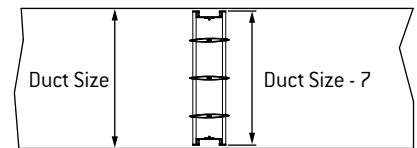
Option 1:
Female to hex
direct linkage
(flange frame shown)



Opposed
Blade

Option 2:
Jackshafting
(channel frame shown)



**Model HCD-150 Pressure Drop Data - Channel Surround****Area Factor Table**

Duct Height (mm)	No. of Blades	Duct Width (mm)																								
		300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500
225	1	34.5	28.6	24.4	21.3	18.9	17.0	15.4	14.1	13.0	12.1	11.3	10.6	9.9	9.4	8.9	8.4	8.0	7.7	7.3	7.0	6.7	6.5	6.2	6.0	5.8
371	2	16.4	13.6	11.6	10.2	9.0	8.1	7.4	6.7	6.2	5.8	5.4	5.0	4.7	4.5	4.2	4.0	3.8	3.7	3.5	3.3	3.2	3.1	3.0	2.9	2.8
517	3	10.8	8.9	7.6	6.7	5.9	5.3	4.8	4.4	4.1	3.8	3.5	3.3	3.1	2.9	2.8	2.6	2.5	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8
663	4	8.0	6.7	5.7	5.0	4.4	4.0	3.6	3.3	3.0	2.8	2.6	2.5	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.5	1.4	1.4
809	5	6.4	5.3	4.5	3.9	3.5	3.1	2.9	2.6	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.2	1.1	1.1
955	6	5.3	4.4	3.8	3.3	2.9	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.1	1.1	1.0	1.0	1.0	0.9	0.9
1101	7	4.5	3.8	3.2	2.8	2.5	2.2	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8
1247	8	4.0	3.3	2.8	2.5	2.2	2.0	1.8	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7
1393	9	3.5	2.9	2.5	2.2	1.9	1.7	1.6	1.4	1.3	1.2	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6
1539	10	3.2	2.6	2.2	2.0	1.7	1.6	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.5
1685	11	2.9	2.4	2.0	1.8	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5
1831	12	2.6	2.2	1.9	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4

[All dimensions include 7mm clearance total between outside of damper frame and inside of duct]

For pressure drop through an open HCD-150 use the following procedure:-

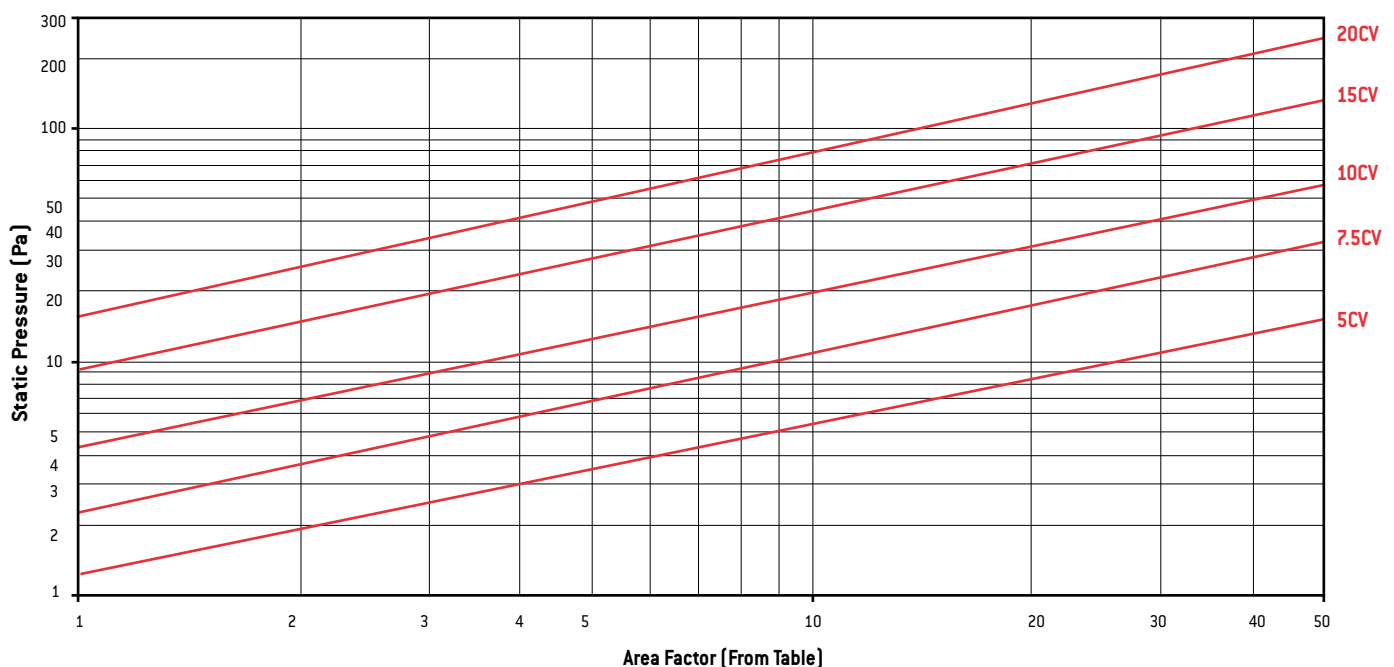
1. Find the Area Factor from the above table – enter duct height and width.
2. Determine Conversion Velocity (CV) by multiplying Area Factor by flow in m³/s [CV = Area Factor x m³/s]
3. Enter pressure drop chart with Area Factor and establish intersection with Conversion Velocity (CV) line just determined. Read pressure drop on left hand side of the chart.

Note: Interpolations while not precise, are adequate for most calculations.

Example:

Find the pressure drop across a 350 wide x 517 high model HCD-150 with a flange surround, passing 0.84 m³/s.

1. From the table using interpolation, the Area Factor is 8.9
2. CV = 0.84 x 8.9 = 7.5
3. From pressure drop chart, pressure drop is 10 Pa

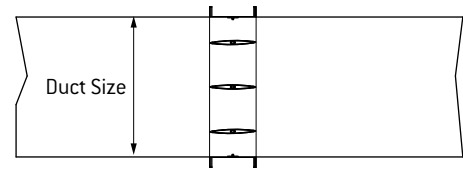
**Notes**

1. Static Pressure and Conversion Velocities are correct for 1.2 kg/m³ air density.
2. Pressure drops are for dampers mounted in duct (up and downstream). Adjust (increase) for zero velocity entering and / or leaving where damper is in a plenum wall, or ducted on one side only.
3. Data is for the specific sizes listed in the area factor table. For sizes in between those shown, the pressure drop should be calculated by

- using the area factor for the next smallest size listed in the above table. An adjustment (increase) should then be made to account for the additional change in free area as the air goes through the damper.
4. For Area Factors less than 1 use an Area Factor of 1 when reading the pressure drop off the above chart.



Model HCD-150 Pressure Drop Data - Flange Surround



Area Factor Table

Duct Height (mm)	No. of Blades	DUCT WIDTH (mm)																											
		250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550	1600
168	1	33.5	28.0	24.0	21.0	18.6	16.8	15.2	14.0	12.9	12.0	11.2	10.5	9.9	9.3	8.8	8.4	8.0	7.6	7.3	7.0	6.7	6.5	6.2	6.0				
314	2	16.0	13.3	11.4	10.0	8.9	8.0	7.3	6.7	6.1	5.7	5.3	5.0	4.7	4.4	4.2	4.0	3.8	3.6	3.5	3.3	3.2	3.1	3.0	2.9				
460	3	10.5	8.7	7.5	6.5	5.8	5.2	4.8	4.4	4.0	3.7	3.5	3.3	3.1	2.9	2.8	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.9				
606	4	7.8	6.5	5.6	4.9	4.3	3.9	3.5	3.2	3.0	2.8	2.6	2.4	2.3	2.2	2.1	1.9	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.4				
752	5	6.2	5.2	4.4	3.9	3.4	3.1	2.8	2.6	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1				
898	6	5.2	4.3	3.7	3.2	2.9	2.6	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.1	1.1	1.0	1.0	1.0	0.9	0.9			
1044	7	4.4	3.7	3.2	2.8	2.5	2.2	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.8				
1190	8	3.9	3.2	2.8	2.4	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7				
1336	9	3.4	2.9	2.4	2.1	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6				
1482	10	3.1	2.6	2.2	1.9	1.7	1.5	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5			
1628	11	2.8	2.3	2.0	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5				
1774	12	2.6	2.1	1.8	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5				

[All dimensions include 7mm clearance total between outside of damper frame and inside of duct]

For pressure drop through an open HCD-150 use the following procedure:-

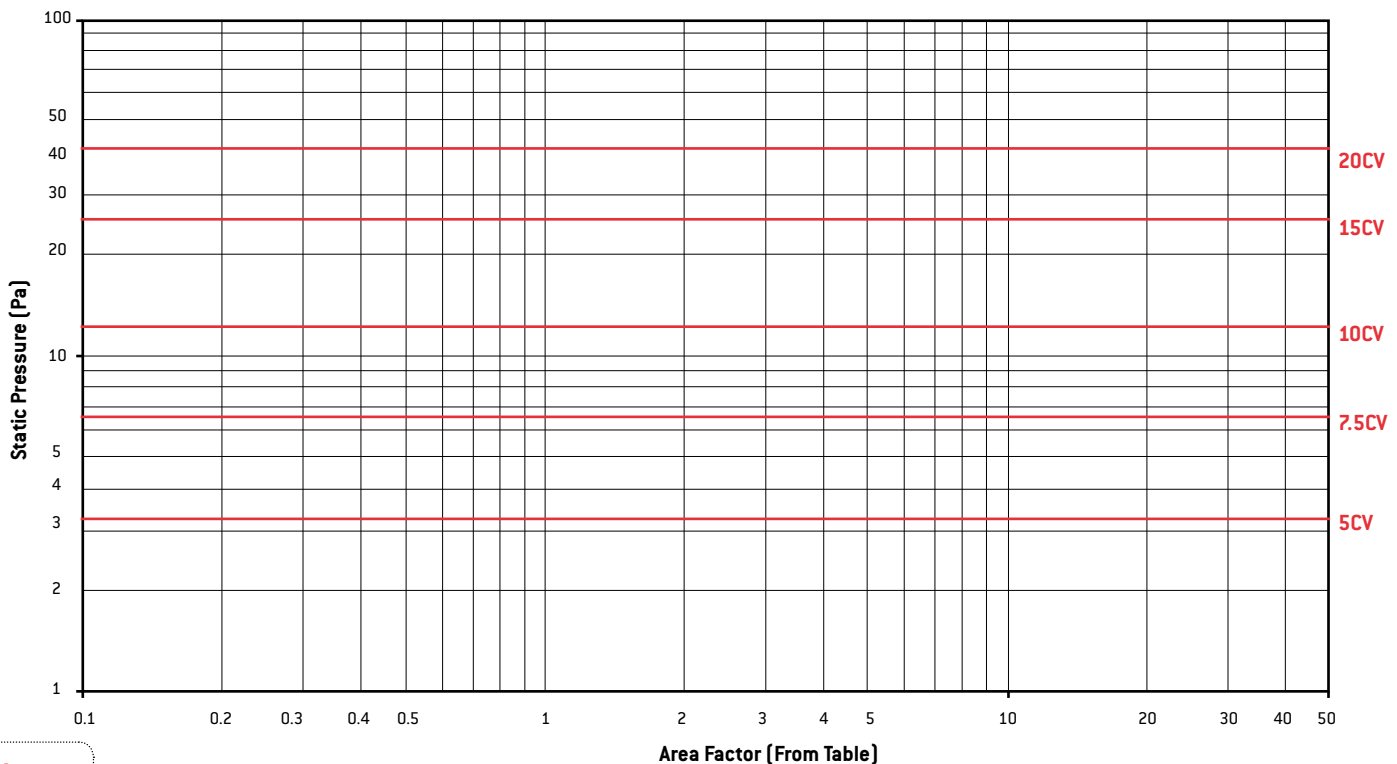
1. Find the Area Factor from the above table – enter duct height and width.
2. Determine Conversion Velocity (CV) by multiplying Area Factor by flow in m³/s (CV = Area Factor x m³/s)
3. Enter pressure drop chart with Area Factor and establish intersection with Conversion Velocity (CV) line just determined. Read pressure drop on left hand side of the chart.

Note: Interpolations while not precise, are adequate for most calculations.

Example:

Find the pressure drop across a 500 wide x 606 high (Airstream Size) model HCD-150 with a flange surround, passing 2.8 m³/s.

1. From the table using interpolation, the Area Factor is 3.9
2. CV = 2.8 x 3.9 = 10.9
3. From pressure drop chart, pressure drop is 13 Pa

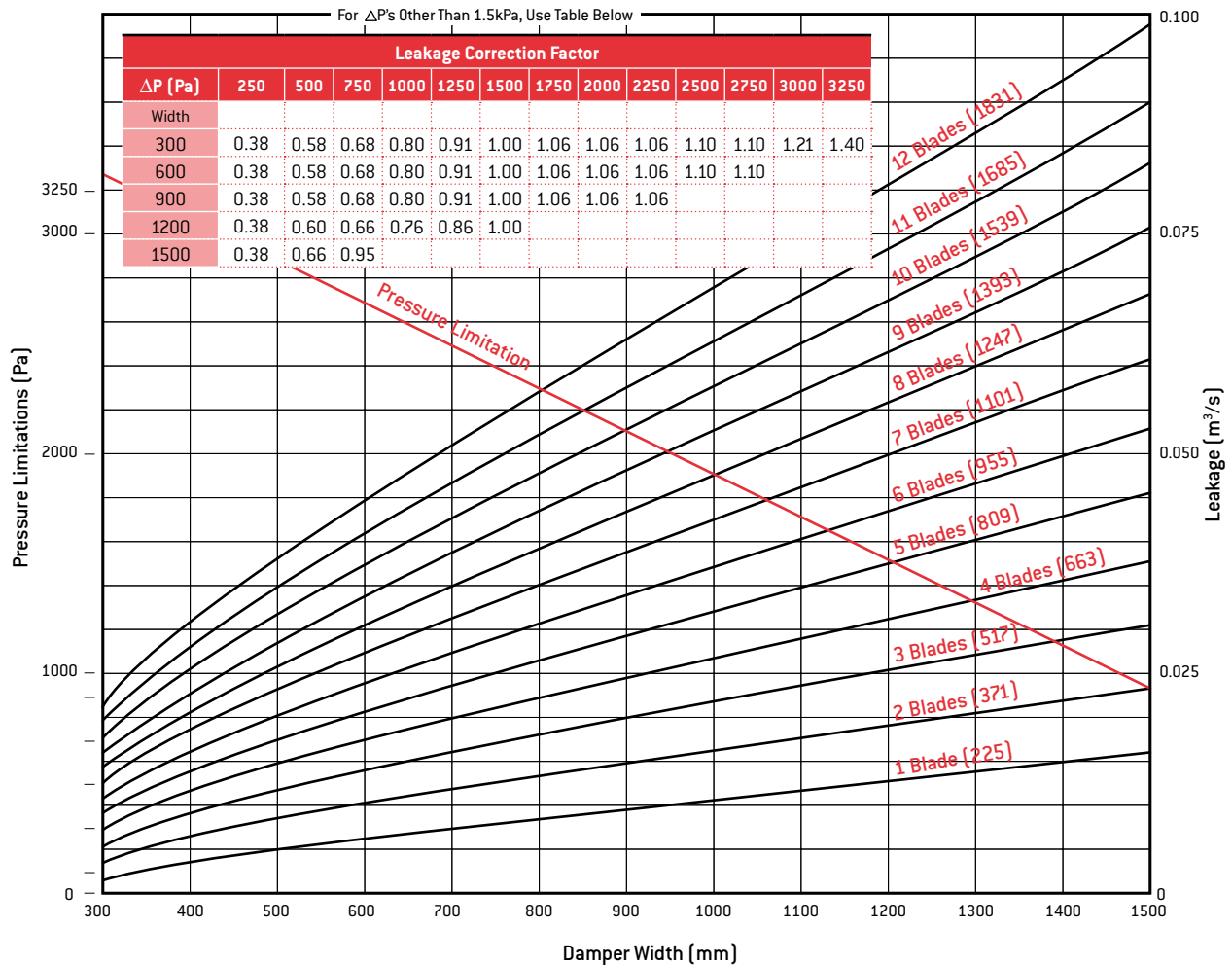


Notes

1. Static Pressure and Conversion Velocities are correct for 1.2 kg/m³ air density.
2. Pressure drops are for dampers mounted in duct (up and downstream). Adjust (increase) for zero velocity entering and / or leaving where damper is in a plenum wall, or ducted on one side only.
3. Data is for the specific sizes listed in the area factor table. For sizes in between those shown, the pressure drop should be calculated by using the area factor for the next smallest size listed in the above table. An adjustment (increase) should then be made to account for the additional change in free area as the air goes through the damper.



Model HCD-150 Leakage Data



Leakage Through Closed HCD-150

Example:

Find leakage through 1200 wide x 1101 high (7 blades) damper at 500 Pa ΔP .

- Enter graph at 1200 mm width and read intersection at 7 blade line. Read right hand side of chart at 0.050 m³/s.
- Read leakage correction factor for 1200 width and 500 Pa = 0.6
- Calculate leakage as 0.05 x 0.6 = 0.030 m³/s.

Notes:

- Leakage is frequently specified as a percentage of maximum design flow. Typically, full flow velocity on the above example would be 5 m/s, which would require volumetric flow of $5 \times 1.2 \times 1.101 = 6.606$ m³/s. Leakage would, in this case, be $(0.03 \times 100) / 6.606 = 0.45\%$
- Above leakage figures are based on a closing torque of 13.16 Nm per m² of damper area, with a minimum of 24.46 Nm.
- Pressure limitations established by the above graph are intended to limit deflection on the longest blade (1500) to 8.3mm. Deflections for 1200mm or shorter blades at higher pressure differentials will be substantially less.

Example:

Establish pressure differential limitation for a damper with 1 metre long blades.

- Enter graph at 1000mm damper width.
- Read intersection with pressure limitation line at left hand side as 1900 Pa.

HCD-150 – Sound Rating

Damper Size	Damper Full Open		Damper 75% Open		Damper 50% Open		Damper 25% Open	
	m ³ /s	NC	m ³ /s	NC	m ³ /s	NC	m ³ /s	NC
300 x 300	0.943	17	0.708	11	0.472	11	0.236	*
	1.415	28	1.062	22	0.708	19	0.354	*
	1.887	35	1.415	29	0.943	24	0.472	*
450 x 450	1.062	17	0.797	10	0.531	21	0.266	*
	2.124	33	1.593	26	1.062	32	0.531	*
	3.185	43	2.389	37	1.593	40	0.797	15
600 x 600	1.887	11	1.415	10	0.943	26	0.472	*
	3.775	32	2.831	30	1.887	38	0.944	21
	5.663	43	4.247	42	2.831	46	1.415	31

NC = Noise Criteria in Decibels is based on 10 dB room attenuation.

* Less than 10 NC.

Note: Above are indicative examples of measured values.