AIR CONTROL DAMPERS

MODEL MD1
PARALLEL BLADE DAMPER

MODEL MD2
OPPOSED BLADE DAMPER

MODEL LD 1
PARALLEL BLADE LEAKAGE RATED DAMPER

OLS CONTROL DAMPERS are constructed of precision-formed parts so that a high standard of quality for the finished product can be achieved. They are designed for trouble-free operation without need for maintenance. The precision-formed blades ensure long-term consistent performance.

Construction

The dampers are constructed of high quality hot-dipped pre-galvanized steel sheet. Damper frames are constructed of 1.20 mm thick cold-formed 'C' channels for single-module dampers and 1.50 mm thick for multiple-module dampers. The channels are mechanically fastened at each corner. The standard depth of frame 'D' is 150 mm and other frame depths are available upon request. The blades are constructed of 1.20 mm thick galvaniz ttted steel specially rolled-formed with three grooves designed for better rigidity. To minimize air leakage for LD dampers, stainless steel compression jamb seals are incorporated on the vertical frames and profile EPDM or PVC seals on the blade edges. The blades with 12.70 mm square plated steel axes at each end pivot on the non-metallic nylon bushes.

Interconnecting blade linkage mechanism consists of galvanized steel brackets fastened to the blade axles outside the air stream are linked together by galvanized steel bar, which is connected to each bracket with a stainless steel pin. For connection to manual operator, electric or pneumatic actuator, dampers are fitted with standard 12.7 mm by 100 mm extended square drive shaft. Manually operated dampers of up to 1200 mm width 1500 mm height are supplied with a factory-installed level operator. Larger size dampers are factory-installed with gear-action operator. The maximum sizes of a single module MD2 dampers are 900 mm width by 1830 mm height and LD1/MD1 dampers are constructed of panels, consisting of multiple modules, up to a maximum factory-assembled size of 2400 mm width by 1200 mm height. For further details on damper sizes, refer to table 2 on page 6. The two tables on page 3 show a summary of the MD and LD dampers standard and optional specifications

Parallel Blade Damper with Pneumatic Actuator

Opposed Blade Damper with Electric Actuator

FEATURES

- Robust construction with high quality material.
- Available with horizontal or vertical blades.
- Modular design for easy assembly on site.
- Gear-action manual operator for large dampers.
- Non-metallic bearings prevent metal to metal contact.
- Square shafts prevent slip between blades & axles, and operator & axle.
- Performance rated.
- Low pressure loss & low leakage.
- No obstruction of blade movements.
- Specially rolled-formed blades guarantee performance of dampers.
- Reliable with stainless steel or non-metallic components for moving parts.

Standard Damper Specifications

Rated Velocity	10.2m/s
Rated Pressure	1000 Pascals
Rated Temperature	70 Degree Celsius
Rated Leakage	Less than 1%, based on design air velocity of 10.2 m/s and pressure differential of 1000 Pa.
Damper Frame	150 mm by 38 mm by 1.2 mm thick, hot-dipped galvanized cold-form steel 'C' channels for single module damper and 1.5 mm thick frame for double or multiple module damper.
Damper Blades	150 mm width by 1.2 mm thick, rolled-formed, hot-dipped pre galvanized steel with 3-grooves profile.
Damper Blade Orientation	Horizontal
Blade Axes	12.7 mm square plated steel
Drive axel	12.77 mm square plated steel with 100 mm extension outside damper.
Bearings	Non-metallic nylon bush and stub
Linkage Mechanism	Hot-dipped galvanized steel linkage bar and brackets with stainless steel pins
Jamb Seals	Stainless steel (applicable to LD models only)
Blade Edge Seals	Profile EPDM or PVC (applicable to LD models only)
Blade Stops	Hot-dipped pre galvanized steel angles
Finish	Mill
Minimum Module Width	150 mm
Minimum Module Height	166 mm (see table 2 on page 11 for standard damper vertical dimensions)
Maximum Module Size	Maximum sizes of a single module MD damper are 120 mm by 1830 mm and 900 mm by 1869 mm for LD damper
Panel Size	Maximum panel size for factory assembled damper is 2400 mm width by 1200 mm height

Optional Damper Specifications

Rated Velocity	15 m/s
Rated Leakage	Less than 0.5% based on design air velocity of 10.2 m/s and pressure differential of 1000Pa
Rated Temperature	150 degree Celsius
Rated Pressure	1500 Pascals, 2000 Pascals
Damper Frames	150 mm by 38 mm by1.2 mm thick stainless steel or aluminum cold-formed channels all round
Damper Blades	150 mm width by1.2 mm thick rolled-formed stainless steel or aluminum with 3-grooves profile
Damper Blade Orientation	Vertical
Blade Axles	12.7 mm square stainless steel or aluminum
Drive axle	12.7 mm square stainless steel or aluminum with 100 mm extension outside damper
Blade Stop	Stainless steel or aluminum angles
Finish	Corrosion or high temperature available upon request

Damper Selection

All OLS damper models may be used for shut-off or on/off and throttling functions. In selecting the type of dampers to be used, the following should be considered:

- On/off or throttling applications
- Leakage rating
- Constant pressure drop
  or varying pressure drop applications

Modulating dampers normally do not require blade or jamb seal and, hence, it is better to use MD dampers for this function as they are supplied without seals and they cost less. LD dampers, on the other hand, are leakage rated and are very often used for shut-off or on/off functions as such applications require a good seal to reduce the flow of air through the damper when closed.

Parallel blade dampers are generally recommended for constant pressure drop applications while opposed blade dampers for varying pressure drop applications. Generally, parallel blade dampers are used so as to take advantage of the more linear inherent characteristics of this type of damper as shown on Figure 2. However, if system resistance is significant, then opposed damper may be preferable as it has a more linear characteristics with system resistance than parallel blade damper as shown on Figure 3. Table 1 shoes a list of applications and recommended damper type for use with each application.

Table 1 : Applications and recommended damper type

Control Applications	Damper Type	Model
1. Mixing Air (see diagram 1)		
Return Air		
• used in flushing operation, D3	Parallel	LD1
• used in normal operation, D1	Opposed	MD2
Exhaust Air, D2	Parallel	LD1
2. Intake Air		
• used in flushing operation, D4	Parallel	LD1
• used in normal operation, D5	Opposed	MD2
3. Multizone	Parallel Action	MD1
4. By-pass:		
• with perforated baffle	Opposed Action	MD2
• without perforated baffle	Parallel Action	MD1
5. Two-Position Applications e.g. flushing operation	Parallel Action, Leakage Rated	LD1
6. Throttling Air Volume	Parallel or Opposed Action	MD1 or MD2

Figure 2 : Damper inherent Characteristics

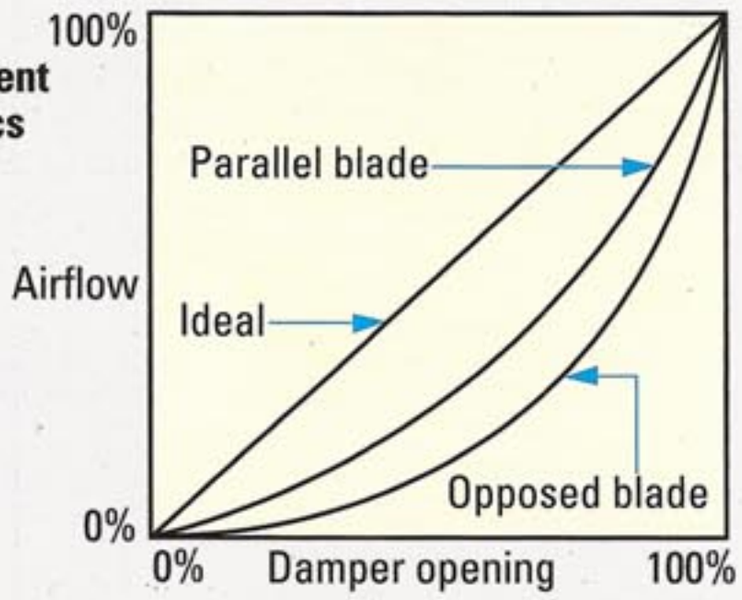


Figure 3 : Damper Characteristics with System Resistance

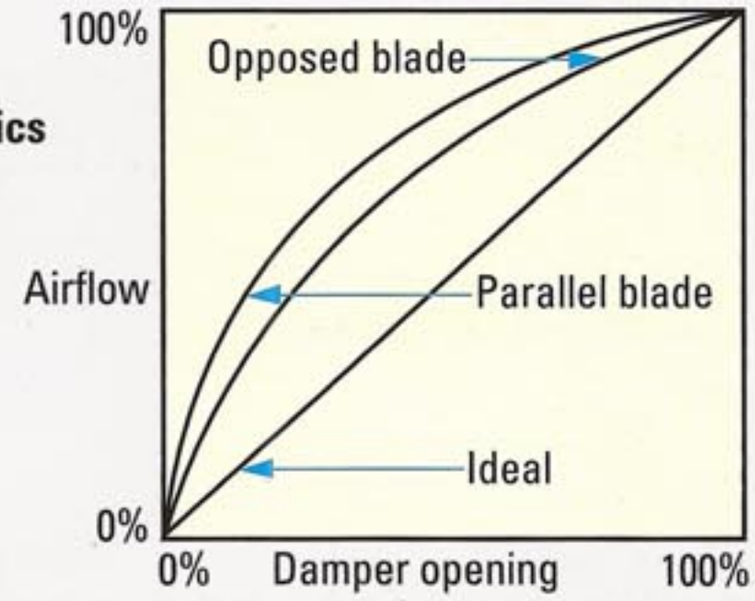
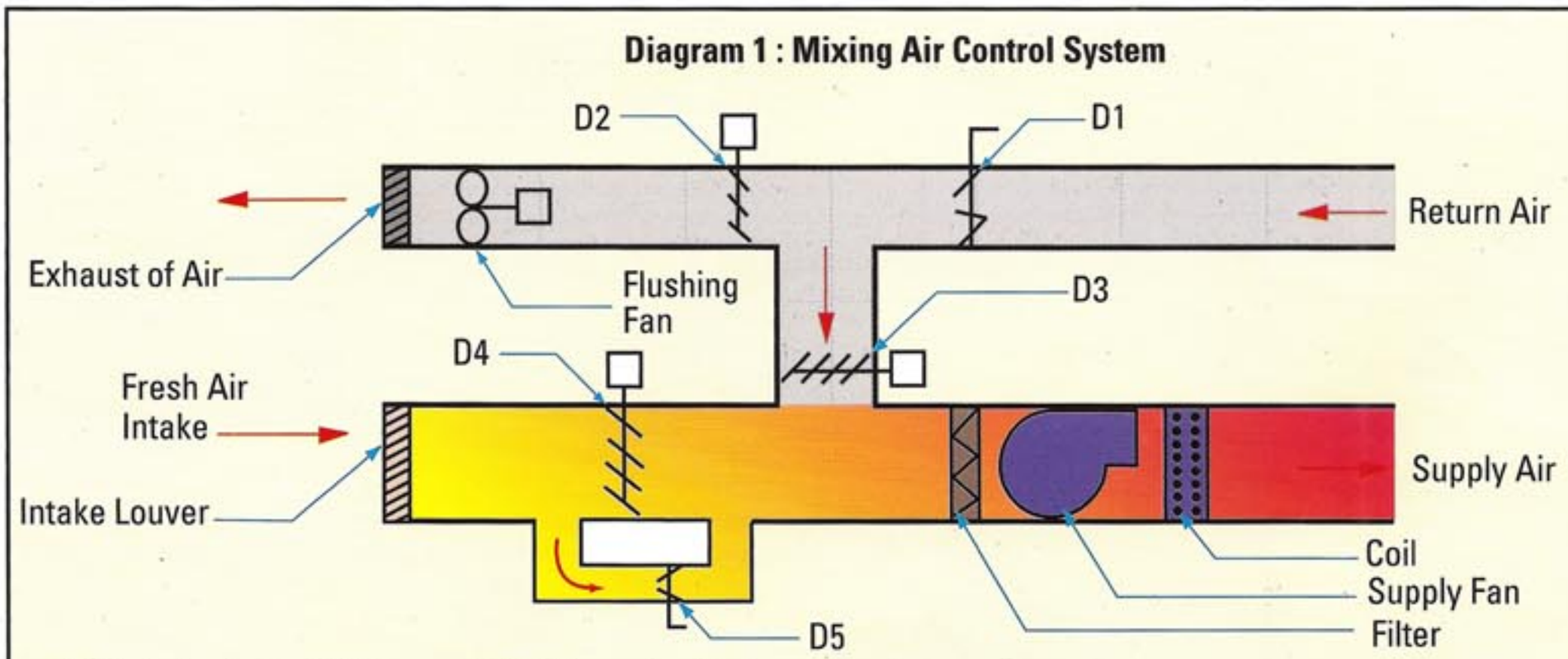


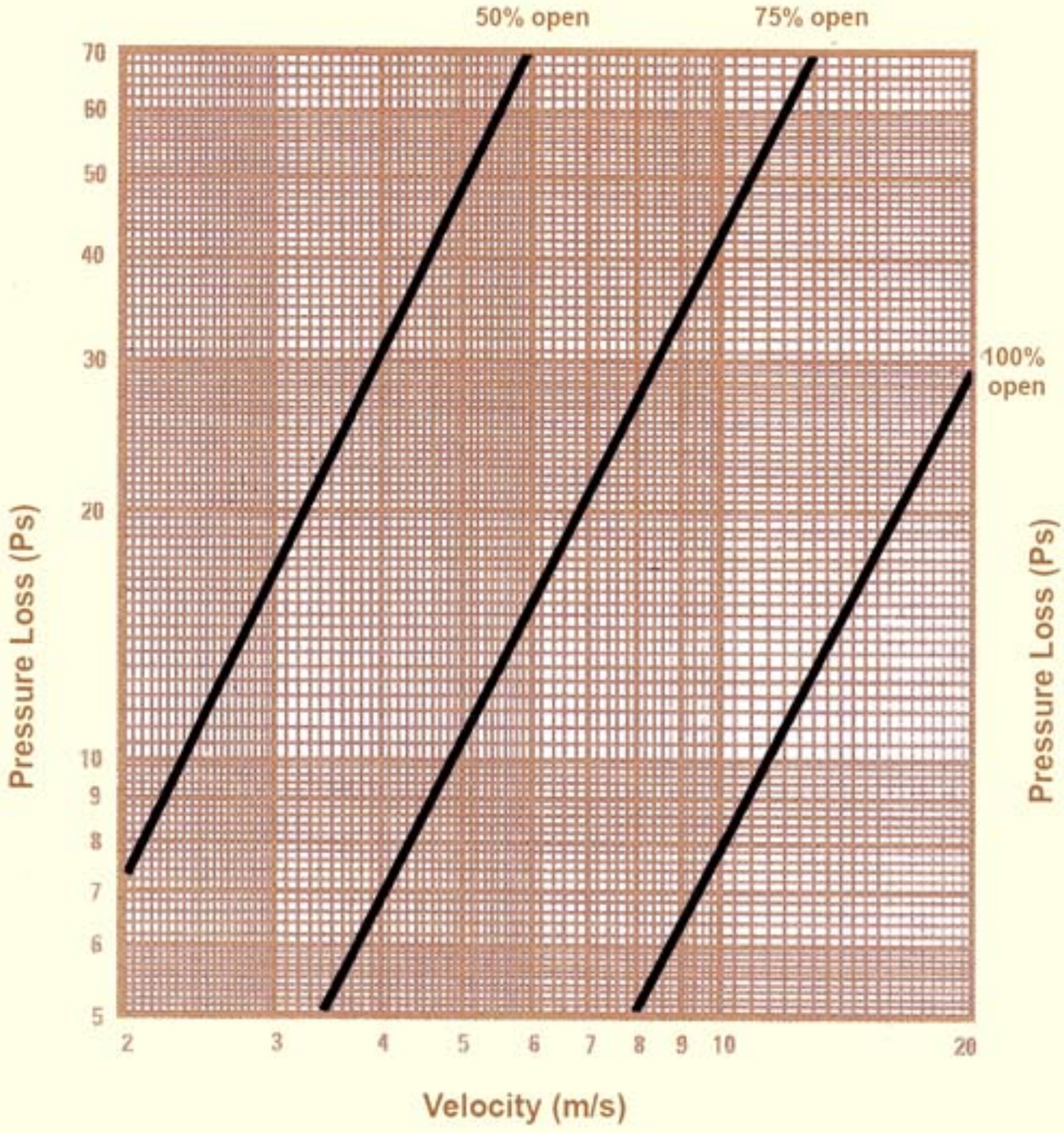
Diagram 1 : Mixing Air Control System



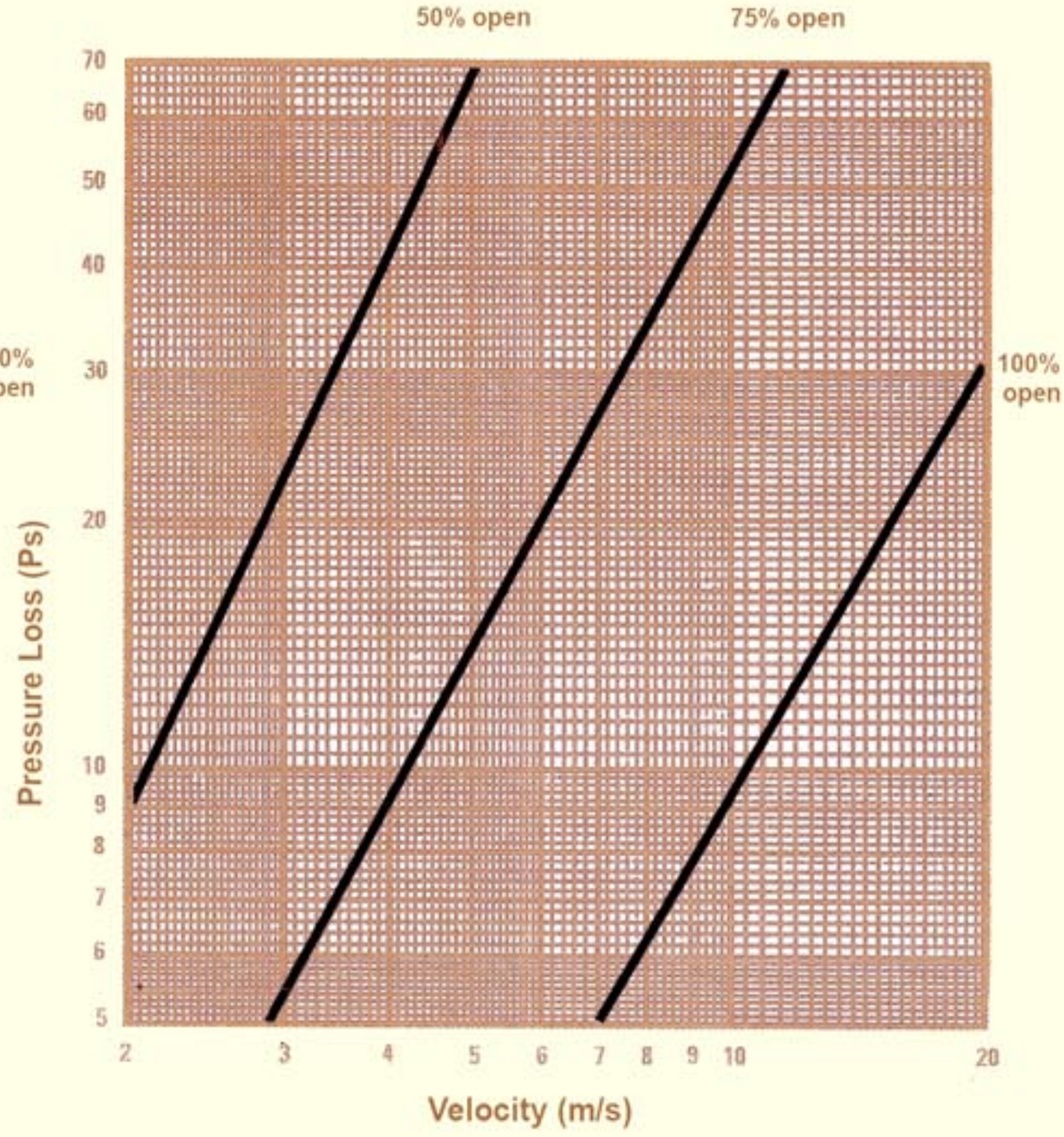
D1: Manual return air opposed blade damper, model MD 2 (for normal operation).
D2: Motorized exhaust air parallel blade leakage- rated on/off damper, model LD1 (for flushing operation).
D3: Motorized return air parallel blade leakage- rated on/off damper, model LD1 (for flushing operation).
D4: Motorized fresh air intake parallel blade leakage- rated on/off damper, model LD1 (for flushing operation).
D5: Manual fresh air intake opposed blade damper, model MD 2 (for normal operation).

Performance Data

Parallel Blade Damper
LD 1 / MD 1 - Pressure Loss

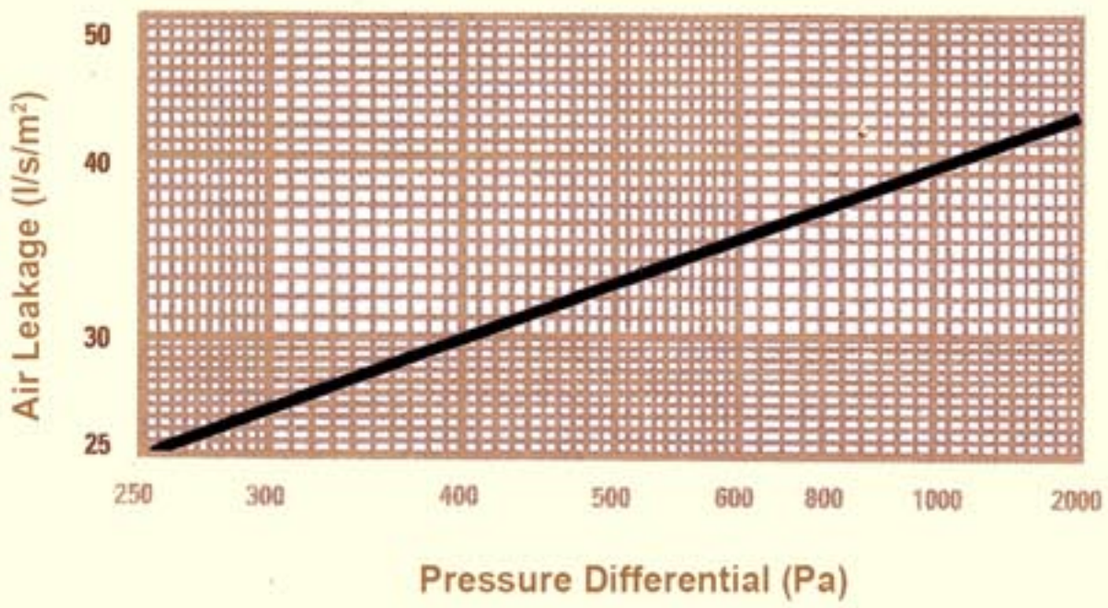


Opposed Blade Damper
MD2 - Pressure Loss

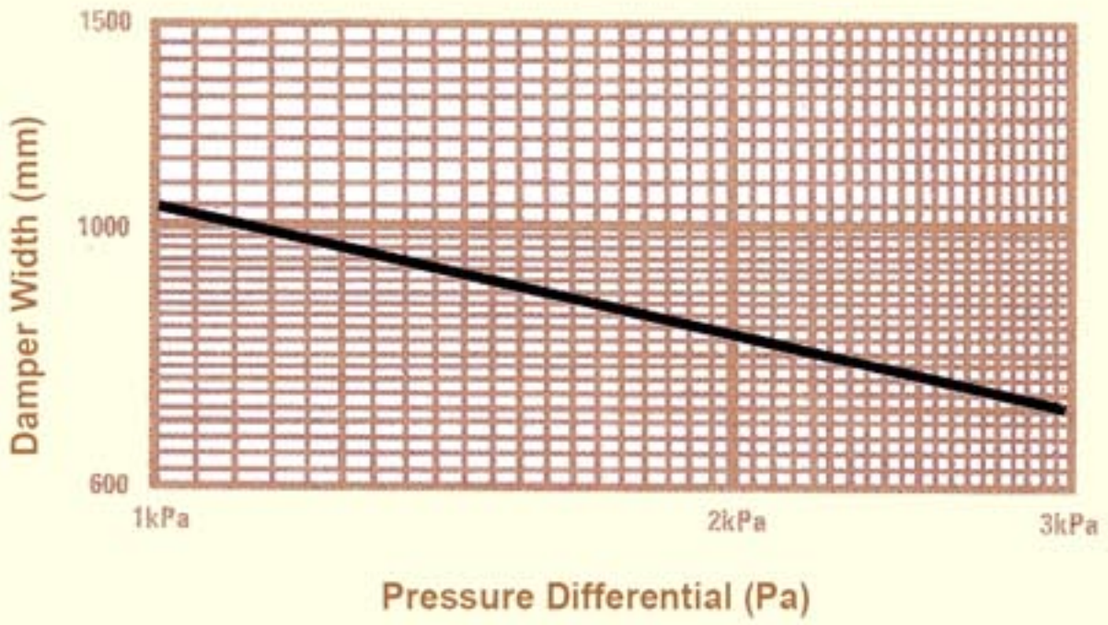


Note: Pressure loss data are based on tests carried out on dampers of size 600 mm x 600 mm

Leakage Rated Damper
LD 1 - Air Leakage



MD / LD - Pressure Resistance



Note: Air leakage data is obtained based on test on 1940 mm x 1200 mm damper

Standard Dimensions / Physical Weight

OLS dampers are constructed of precision rolled-formed blades of standard width of 150 mm and the blades are spaced at a standard centre-to-centre distance of 128 mm for opposed blade dampers and 131 mm for parallel blade dampers. Production of damper blades with precision roll-forming and straightening process is necessary to ensure blade straightness and prevent blade twisting. A high standard of quality for the finished product can be achieved. If damper blades are constructed of poor quality, leakage rating and control capability of the damper may be severely affected. To achieve good performance, OLS damper are constructed of standard vertical dimensions starting with a minimum nominal height of 166 mm with an increase of 128 mm or 131 mm for each additional blade. Table 2 lists the standard vertical and physical net weights. TO achieve maximum free area, it is advisable to follow the standard vertical dimensions recommended on table 2. Other vertical dimensions are possible but they will result in a decrease in the free area of the damper. Width, however, may differ from the standard dimension on Table 2 without affecting the free area of the damper.

Table 2 Standard Dimensions And Physical Weight (kg) (excluding the weight of actuator)

Nominal Height (mm)		Width (mm)				
MD 2	MD1 & LD1	No. of Blades	300	600	900	1200
166	166	1	3.0	4.9	8.3	10.6
294	297	2	4.2	6.6	10.7	13.6
422	428	3	5.1	8.1	12.8	16.1
550	559	4	6.5	10.0	15.5	19.5
678	690	5	9.0	13.5	18.0	22.4
806	821	6	10.3	15.3	20.4	25.4
934	952	7	11.6	17.2	22.8	28.3
1062	1083	8	12.9	19.0	25.2	31.3
1190	1214	9	14.2	20.9	27.6	34.2
1318	1345	10	15.6	22.8	30.0	37.2
1446	1476	11	16.9	24.6	32.4	40.1
1574	1607	12	18.2	26.5	34.8	43.1
1702	1738	13	19.5	28.3	37.2	46.0
1830	1869	14	20.8	30.2	39.6	49.0

Types of Operators

The damper may be supplied without operator in which case each damper will be shipped with an extended 12.7 mm square drive shaft as standard. However, it is advisable that the actuator be supplied and installed by us so that we are able to ensure the actuator is fully compatible with the damper. OLS damper may be supplied with the following operators:

PNEUMATIC OPERATION

- Double-acting commercial actuator for leakage drive with 1.4 bars supply pressure
- Single-acting commercial actuator for linkage drive with 1.4 bars supply pressure
- Double-acting industrial actuator for direct drive with 6 bars supply pressure
- Single-acting industrial actuator for direct drive with 6 bars supply pressure

MANUAL OPERATION

- Level operator for dampers up to 1200 mm X 1500 mm in size
- Gear-action operator with hand wheel for larger size damper; gear-action operator offers easier and more precise adjustments of the damper-smaller dampers may also be supplied with this operator as an option with additional costs.

ELECTRIC OPERATION

- 24 VAC/ 230 VAC/ 110 VAC modulating actuator
- 24 VAC/ 230 VAC/ 110 VAC on/off actuator
- 24 VAC/ 230 VAC/ on/off actuator with spring return

Torque Requirements

Operating and sealing torque for MD and LD dampers are shown on Table 3 which refers to the largest torque that is required to close or open the damper during actual operation. When selecting the actuator for the damper, three factors must be considered: the face velocity; pressure differential across the damper which determines the sealing torque of the damper. Table 3 gives dynamic torque value which is applicable to the LD dampers only. The sealing torque of the LD dampers is the torque require to close against the blade edge seal to provide complete closure. For other face velocity the torque values may be determined with the multipliers given on Table 4.

TABLE 3

	Dynamic Torque (NM)				Sealing Torque (NM)		
Ht (mm)	300	600	900	1200	300	600	900
300	0.8	1.6	2.4	3.2	1.2	2.5	3.7
600	1.6	3.2	4.9	6.5	2.5	5.0	7.5
900	2.4	4.9	7.3	9.7	3.7	7.5	11.2
1200	3.2	6.5	9.7	13.0	5.0	9.9	14.9
1500	4.1	8.1	12.2	16.2	6.2	12.4	18.6
1800	4.9	9.7	14.6	19.4	7.5	14.9	22.4

Note for tables 3 & 4:

1. Dynamic torque is the torque due to face velocities and pressure differential across the damper whichever is the greater.

2. Sealing torque is the torque required to close the damper against the pressure of blade and jamb seals.

3. The tabulated dynamic torque is based on a face velocity of 10m/s and maximum pressure differential of 1000Pa.

4. For other face velocities and pressure differentials, multiply the tabulated torque values with the appropriate multiplier shown on table 4.

5. Sealing torque values on table 3 apply to leakage rated dampers only.

6. For multiple-module dampers, use the unit torque on table 3 to determine the torque required for each actuator.

TABLE 4

Face Velocity (m/s)	Multiplier	Press Diff (Pa)	Multiplier
2.5	0.0625	250	0.25
5.0	0.25	500	0.5
7.5	0.5625	750	0.75
10.0	1.0	1000	1.0
12.5	1.5625	1250	1.25
15.0	2.25	1500	1.5

Control Options

With externally powered electric or pneumatic actuators, the damper will open and close in response to a signal from a controller. On/off actuator provide normally opened or normally closed damper operation. In a normally opened or normally closed damper operation, the damper closes when either no control signal is applied (dampers with on/off actuators) or power to the actuator is lost (dampers with spring-return type on/off pneumatic actuator). On the other hand, in the normally opened application, the damper will remain open when there is no control signal or power to the actuator. Selection of the mode of operation is based on the desired damper blade position when power or compressed air is removed from the actuator. Limit switches may be provided on the damper upon request to allow for remote indication of damper position and for the purpose of testing the damper position and for the purpose of testing the damper as part of regular maintenance. Dampers operated by externally powered actuator may be equipped with position-sensing feedback controls as an option with additional cost. Hysteresis which is inherent in the actuator is minimized.

Modular Arrangement

OLS MD and LD dampers are constructed of panels that can be easily assembled on site into large-sized dampers. Each panel may consists of one, two or multiple dampers. However, the maximum panel size that can be factory assembled for both MD and LD damper is limited to 2400 mm x 1200 mm. Please contact our factory or your nearest OLS representatives if smaller or larger panel sizes are required. Smaller panel size may be required due to the entrance restriction at the site. For MD dampers, the maximum module width will be limited to 1200 mm and LD dampers, 900 mm. For large damper assembly, jackshafts may be provided, allowing each actuator to drive adjacent modules with evenly distributed force. Jackshafts provide adjustability and uniform synchronized section to section operation.

How to Order

Model — **Module & Operator Qty** — **Operator Type** — **Blade**

MD 1 : Parallel blade
MD 2 : Opposed blade
LD 1 : Parallel blade leakage rated damper

Three digits
First digit : No. of module horizontally
Second digit : No. of module vertically
Third digit : No. of operators
For example : 111 refers to single module with one operator, 210 refers to 2 x 1 modules and no operator.

0 : Without operator
ML : Manual level operator
MG : Manual gear-action operator
E1 : 24 / 230 VAC electric modulating actuator
E2 : 24 VAC , 50 / 60 HZ modulating with spring return
E3 : 24 / 230 VAC electric On/off actuator
E4 : 24 VAC / 230 VAC electric on / off actuator with spring return
P1 : Double-acting pneumatic actuator
P2 : Single-acting pneumatic actuator

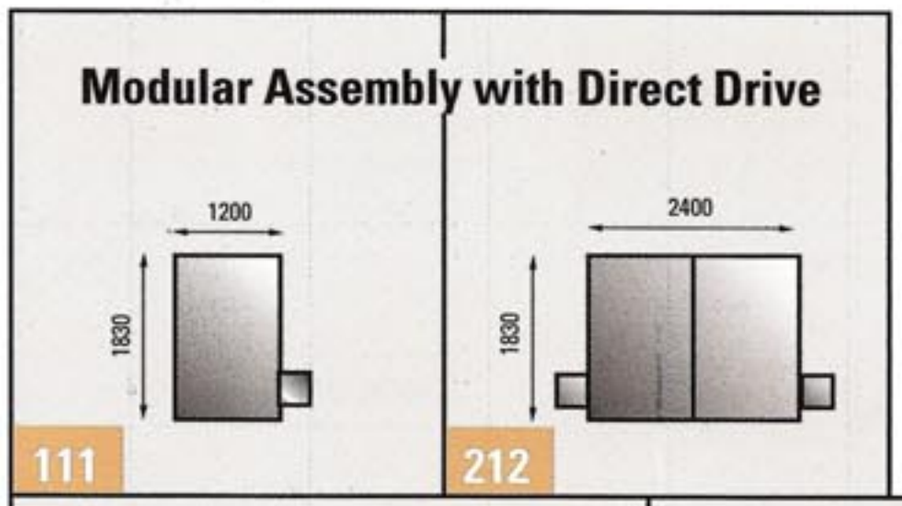
H : Horizontal
V : Vertical

Example

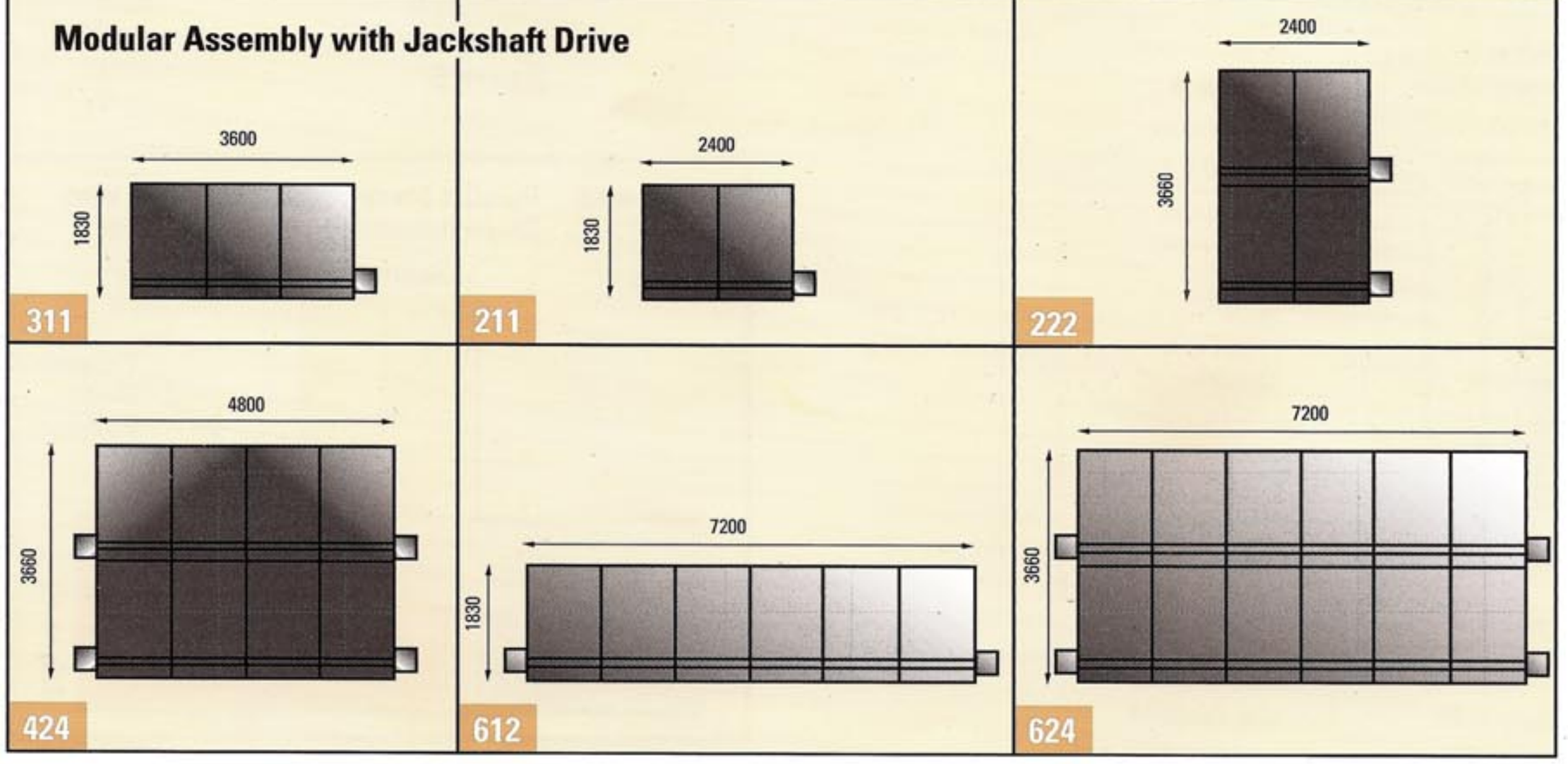
MD2–111– MG–H *refers to a single module, horizontal blade, modulating opposed blade damper with one gear-action manual operator.*

When ordering, or requesting for quotation, please specify the nominal width first , followed by the nominal height and depth of frame (if non-standard frame is required). The damper will be made 6 mm smaller than the specified nominal dimensions. If no frame depth has been specified, the damper will be made with standard frame depth of 150 mm. If damper is to be installed within the wall, please specify if sleeve is required when requesting for quotation.

Modular Assembly with Direct Drive



Modular Assembly with Jackshaft Drive



Installation and Flange Details

As a standard, operator and actuator are located on the right side of the damper, except for large damper where more operators or actuators are used and they may be located on both sides of the damper. Where parallel blade dampers are used, it is important to check the preferred positions of the operators or actuators before ordering as there may be a preference for the direction of air flow through blade as in case of mixing dampers shown on Diagram 3.Proper orientation helps avoid cold areas in the mixed air stream which could freeze coils. With opposed blade damper, prior knowledge of the position of the operators or actuators is not necessary as the damper is symmetrical, with respect to its blades and the damper may be installed in any direction.

The damper frames are constructed to allow for direct flange connection to ductwork on both sides of he damper as shown on figure 4. As a standard, the damper are constructed of 150 mm depth frame to prevent the blade from protruding outside the frame when it is fully-opened position. This is to prevent obstruction of blade movements by the connected duct.

For connection to duct flanges (as shown on figure 40), the damper frames are pre-punched in the factory with 20 mm x 8 mm slot holes located a four corners of the damper flange (as shown on figure 6). Damper may be installed within the walls whereby the sleeve may be required for proper installation as shown on Figure 5. For such installation, the actuator may be installed within or outside the wall. For more information, please contact our OLS factory for more details.

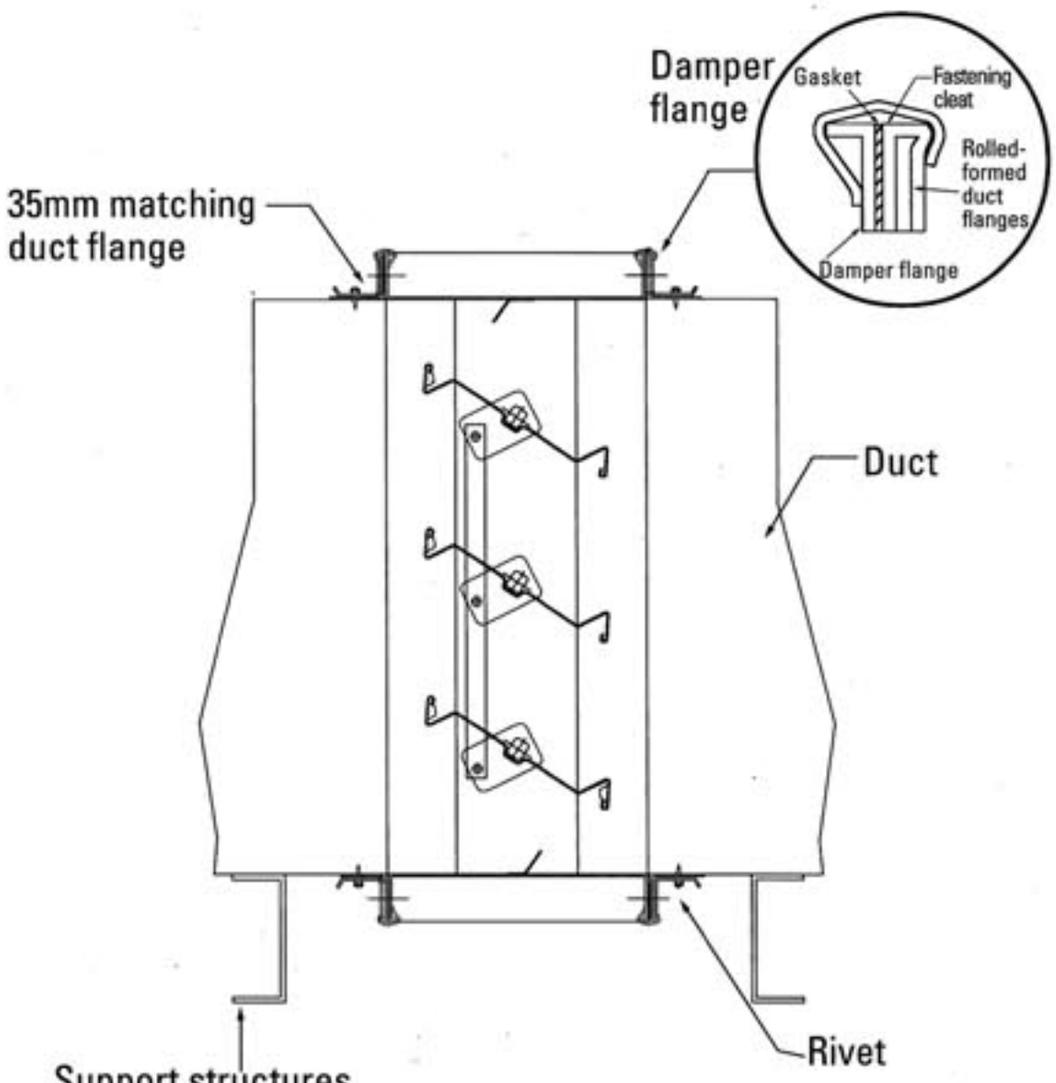


Figure 4

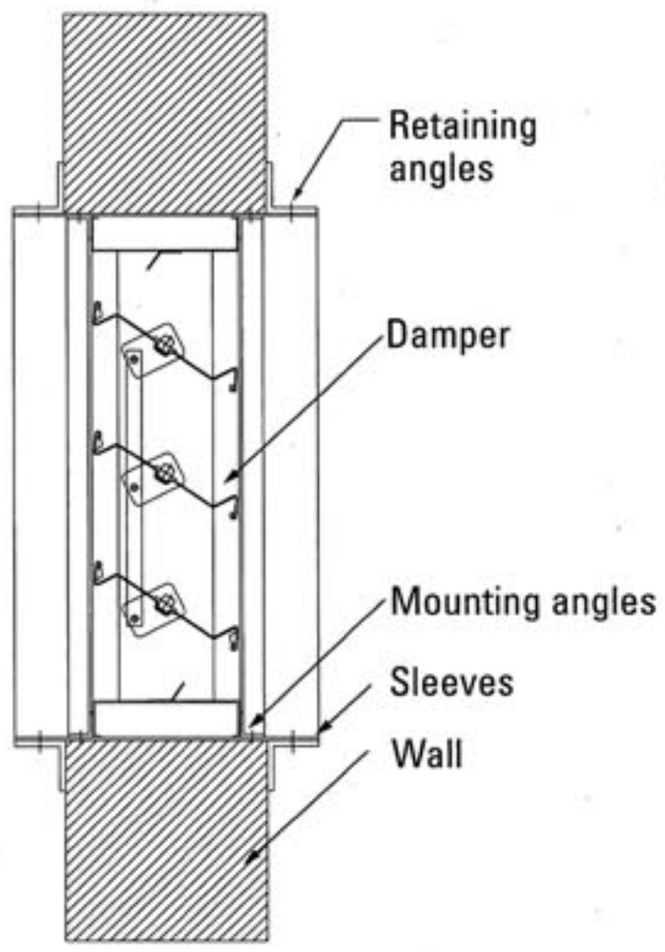


Figure 5

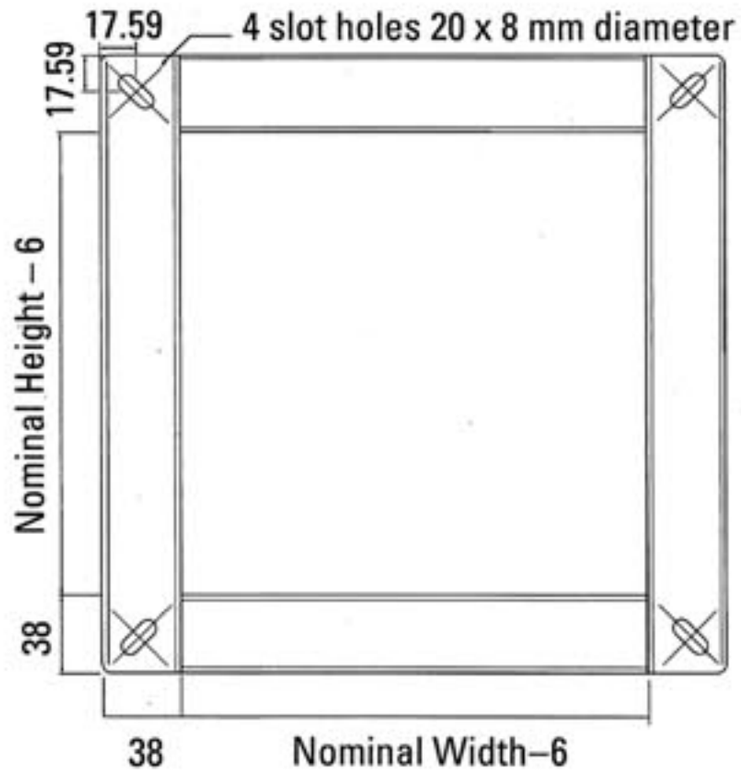
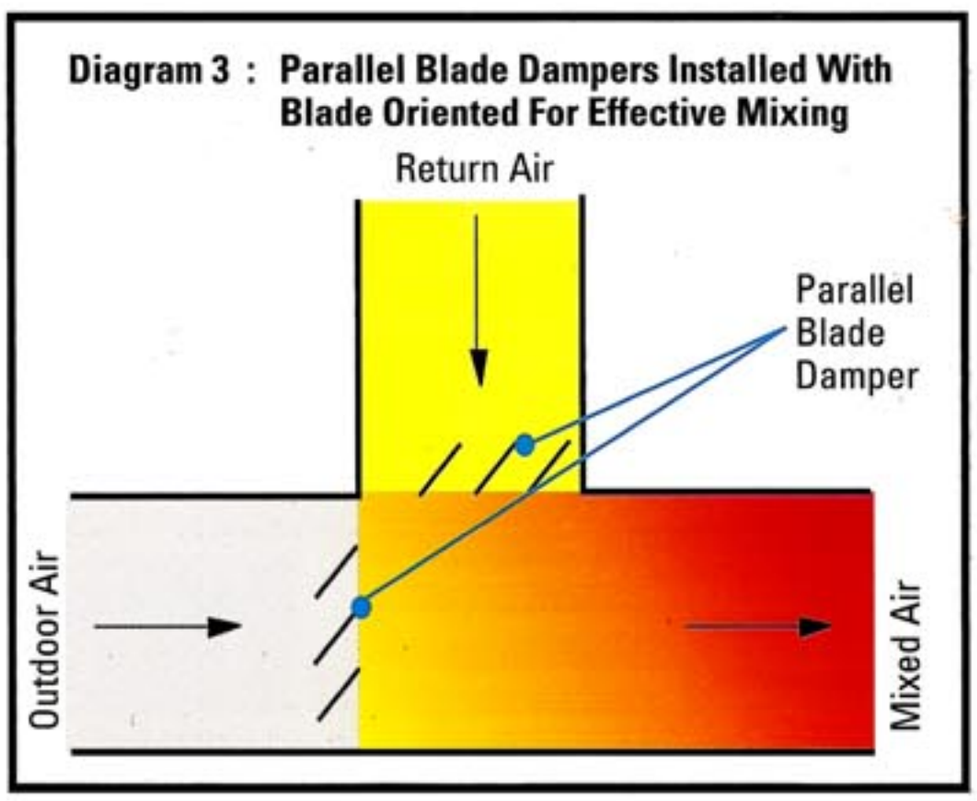


Figure 6



Application Considerations

In selecting dampers, the application consideration outlined on this page must be carefully examined to ensure job requirements are met. If special features such as blade reinforcements, heavy duty linkages, bearings axles & frames, special seals & finishes and construction of corrosion resistant materials are required, they can be incorporated a additional costs. Please consult our factory for advice.

VELOCITY

As air velocity increases, dampers in system encounter higher forces, resulting in an increase in the deflection of blades. Due to higher air velocity, the blades are also subject to twisting as they move. As a result, it may be necessary to reinforce the blades.

TEMPERATURE

Typically, operating temperature in HVAC system is limited to about 70 degree Celsius. Some applications may require much higher temperature which may necessitate the use of high temperature resistant material o construction and special actuator.

CORROSION

Damper in conventional HVAC system typically use hot-dipped galvanized steel sheet which provides sufficient protection against corrosion. However, in many applications, more protection may be necessary, hence, an all aluminum stainless steel construction are used. Alternatively, protective coating may be used. Some examples of such applications include:

- dampers in exhaust duct, carrying corrosive fumes
- dampers used for outdoor air intake in building in the vicinity of coastal areas
- face dampers near cooling coils
- dampers near spray humidifiers

TURBULENCE

Excessive turbulence and pulsation of air may cause bending and twisting of damper blades and stress on bearings and linkages, resulting in accelerated wear on these parts. This can occur when dampers are located near large fans, abrupt duct transition or near elbow without turning vane. Dampers located near to fan discharge must be reinforced, due to severe turbulence that can easily cause fatigue failure in the dampers. In addition, more or larger actuators may be needed, due to the additional torque which may have resulted from the turbulence.

After installation, it is recommended that the dampers be inspected during actual operation over a full range of positions (from fully opened o fully closed positions) to ensure that the damper blades are not subject to severe vibrations. Such vibrations can be due to damper blades being in resonance with the frequency generated by the fan blades.

If severe vibrations still occur, stiffening of the blades, additional linkages and actuator may e essential to prevent failure of the dampers. If possible, dampers should b located as far away from the fan discharge as possible.

NUCLEAR/ SEISMIC

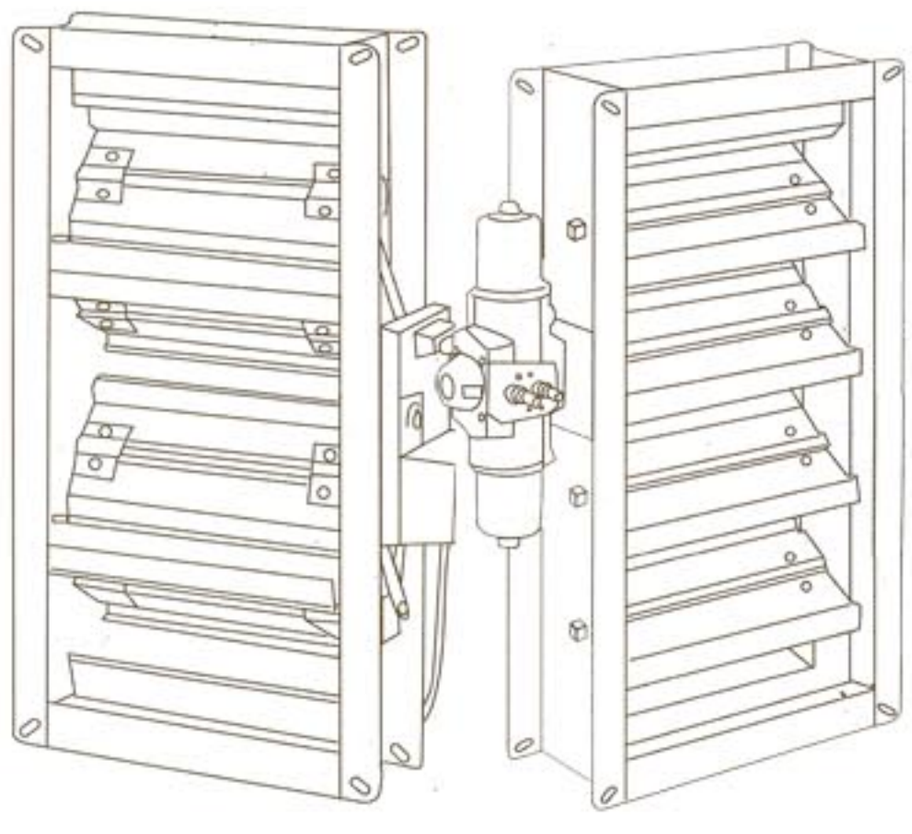
Damper used in nuclear power plants and other similar facilities may be required to operate during and after an earthquake. Such dampers are required to meet stringent applicable regulations and testing to ensure that they can meet specified levels of vibration. Dampers for such application must be designed o withstand low frequency, high amplitude multi-axis vibration.

AIR LEAKAGE

Some applications may have very stringent air leakage requirements such as ventilations system of civil defense shelters. It may be difficult for normal damper to achieve very low air leakage and special seals or construction may be necessary.

STATIC PRESSURE

Dampers are subject to maximum pressure differential when they are fully closed. As they open, airflow increases and a portion of static pressure is converted to velocity pressure and the forces on the damper become more dynamic than static. It is important to determine the maximum possible static pressure in normal operation when selecting damper.



Recommended Specifications

The **Air Control Damper** shall be supplied and installed as shown on the drawings and shall be single acting (parallel blades) or counter acting (opposed blades) as manufactured by OLS Manufacturing Co. Pte Ltd.

All damper components, except moving parts, bearings and damper seals, shall be constructed of high quality hot-dipped galvanized steel sheet. Damper frame shall be constructed of minimum 150 mm depth so that its blades when in fully-opened position will not protrude outside the frame and shall have flange of 38 mm factory pre-punched with 20 mm x 8 mm slot holes at each corner.

The damper frame shall be constructed of minimum 1.2 mm thick material. The blade shall be constructed of 1.2 mm thick material profile so that it is straight and it shall not twist. The blade shall be of standard width of 150 mm and formed with three grooves to provide strength and rigidity. Maximum length of blades shall not exceed 1200 mm. However, for leakage rated damper, the maximum length of blade shall not exceed 900 mm. Blade axles and drive shaft of a damper shall be constructed of 12.7 mm square solid plated steel shafts that pivot on non-metallic nylon bearings. Round drive shaft shall not be permitted. Blade axles and drive shaft shall be fastened to the damper blades so that they do not distort the blades.

Manual operators or externally-powered actuators shall be supplied and installed by damper manufacturer to ensure proper selection and interfacing of the actuators or operators to the dampers. The damper manufacturer shall be responsible for the proper functioning of the damper and actuator. For manually operated damper of up to 1200 mm width by 1500 mm height, lever operator may be used, but for larger sizes, gear-action operator shall be used to enable easy and fine adjustment of the damper blades.

The maximum module size of a damper shall not exceed 1200 mm width by 1869 mm height. For damper up to 2400 mm width by 1200 mm height, multiple damper modules shall be factory assembled and installed with selected operator or actuator. Contractor shall ensure that large dampers can be brought to the designated location at the building site.

Contractor shall ensure that the dampers are properly sized and the type of damper selected are suitable for its control functions and the environmental conditions, to prevent corrosion. The damper selection shall generally be based on the selection criteria shown on the table below. As far as possible, all dampers shall be located away from the duct elbow, duct transition and fan. If this is not possible, contractor shall ensure that the dampers are upgraded to handle the turbulent air and pressure associated with such system components.

Damper Selection Criteria

Control Functions	Damper Type	Make/Model
(1) Mixing Air Return Air Out air intake and exhaust: • if used with weather louver and insect screen • if used with bird screen only	 Opposed Action Opposed Action Parallel Action	 OLS/MD2 OLS/MD2 OLS/MD1
(2) Multi-zone	Parallel Action	OLS/MD1
(3) Coil Face	Opposed Action	OLS/MD2
(4) By-pass: • with perforated baffle • without perforated baffle	 Opposed Action Parallel Action	 OLS/MD2 OLS/MD1
(5) Two-Position Applications e.g. Flushing operation	Parallel Action, Leakage Rated	OLS/LD1
(6) Throttling Air Volume	Parallel or Opposed Action	OLS/MD1 or OLS/MD2

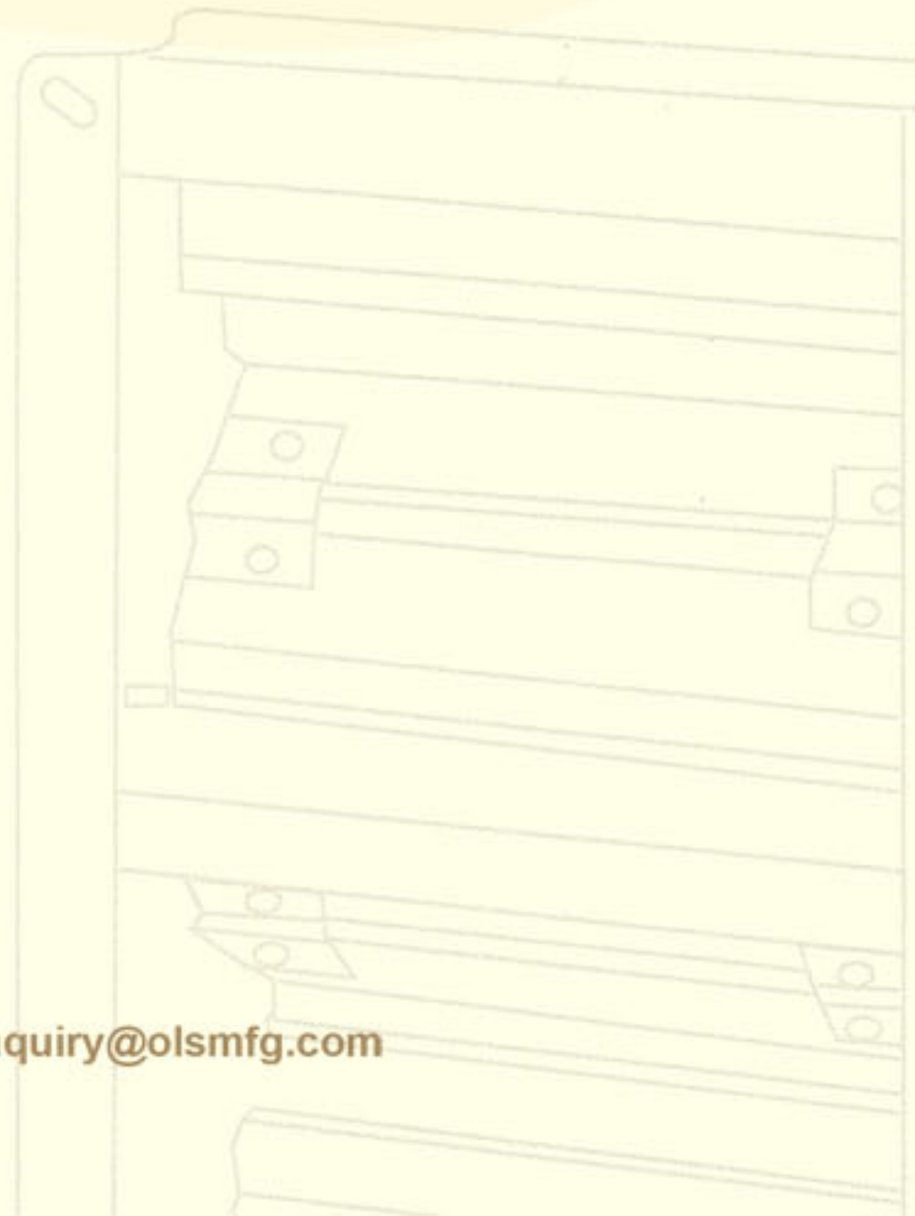
For non-standard dampers, please refer to factory for sample specifications.

AIR CONTROL DAMPERS

MODEL MD1
PARALLEL BLADE DAMPER

MODEL MD2
OPPOSED BLADE DAMPER

MODEL LD 1
PARALLEL BLADE LEAKAGE RATED DAMPER



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