

OLS Tunnel Ventilation Dampers



OLS Tunnel Ventilation Dampers

With OLS's expertise and many years of dedication to research and product development, the OLS tunnel ventilation damper

is one of the products that developed for

Designed to handle hot gases, high pressure and low leakage applications.

many quality OLS has the industry.

Designed to

suit exact

applications, client's specifications and statutory regulations, OLS tunnel ventilation dampers are developed for use in subways for underground tunnel ventilation systems, that require heavy duty dampers.

99.99% Air Tight Closure is Possible !

OLS tunnel ventilation dampers are supplied as standard or purpose-made to your projects by professional OLS design engineers who will ensure close collaboration at all stages of design development.

With our wealth of experience in servicing international contract,

OLS is confident of providing the highest quality products and best services to our customers wherever they are !





Construction

OLS tunnel ventilation dampers (TVD) are constructed using high quality galvanized steel with stainless steel moving parts. The bush is made of phosphor bronze material while the damper frames constructed of 2.5mm thick hot-dipped, galvanized steel, 200mm by 50mm cold-formed channels with full-welded corners. The 1.5mm thick double-skinned airfoil blades with special edge seals ensure low air leakage through the closed damper and handle hot gases. To minimize air leakage, stainless steel jamb seals are incorporated on the vertical frames of the dampers. SD 60 blade axles are made of 25mm diameter stainless steel shafts and pivot on phosphor bronze bushes. SD 20 blade axles are made of 12.7mm by 12.7mm zinc-plated steel shafts and pivot on phosphor bronze/teflon bushes. The blade linkage mechanism consists of steel linkage brackets fastened to the blade axles outside the airstream. The blade brackets are attached to a steel linkage bar with stainless steel pins. Sleeves may be used if the dampers are installed within the wall and connected to the adjoining ductwork. The sleeve and retaining angles may be supplied in galvanized steel. The dampers may be powered externally by electric or pneumatic actuators each of which may be protected in an optional steel enclosure which is constructed of

galvanized steel. Upon customers' requests, OLS tunnel ventilation dampers can be ordered in full stainless steel construction.

Features

- **Tough & Enduring**

OLS TVD dampers with their heavy gauge material construction and fully-welded corners, provide strength and tolerance to endure rough site handling. The specially-designed blades enable the dampers to withstand high pressure fluctuations.

- **Reliable & Superior in Quality**

The high quality galvanized steel used for OLS TVD dampers with stainless steel moving parts, not only prevent seizures but also enable the dampers to withstand adverse environmental conditions.

- **Low Leakage**

OLS TVD dampers are designed to effectively seal openings when closed. This is an essential feature of smoke control and isolation dampers that are used in subway tunnels to control the movement of airflow and toxic smoke. Such safety design is important to prevent loss of lives during a fire.

- **Low Airflow Resistance**

The aerodynamic design of the

OLS TVD dampers with their airfoil blades present very low resistance to airflow.

- **Performance Tested**

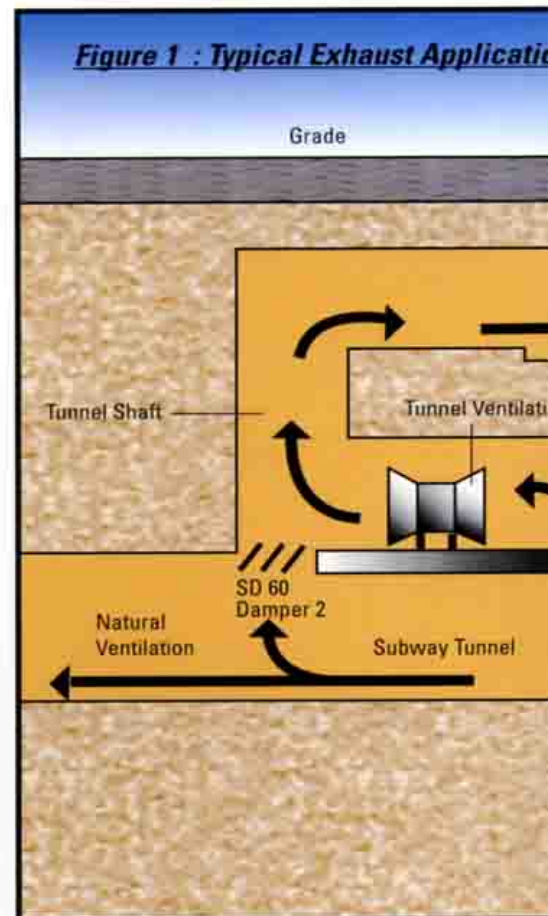
OLS TVD dampers and their actuators have been rigorously tested according to *UL555S: Leakage Rated Dampers For Use In Smoke Control System* for its reliability, temperature resistance, air tightness and ability to operate under dynamic conditions.

- **Pressure Resistance**

The dampers have been designed to withstand high pressure or applications with constant fluctuating pressures. The SD60 damper has been tested to the pressure of 6000 pascals.

- **Temperature Resistance**

OLS TVD dampers and their actuators are also designed to handle hot gases of temperatures ranging from 150°C to 250°C, for duration of up to 2 hours. This is possible only because of the special insulation components used and the ability of the dampers to absorb the thermal expansion in the presence of hot gases.



Ease of maintenance & Installation

The damper frames may have pre-punched holes on them for easy installation. To install the dampers within building walls, sleeves may be used and they are provided with retaining angles for ease of installation. Due to the high quality material used for the dampers and its moving parts, the dampers are virtually maintenance-free. OLS TVD dampers come in modular designs which can be easily assembled into larger dampers on site (see drawings under installation on pages 2 & 3).

Though OLS TVD dampers are designed to be maintenance-free, the dampers may be tested regularly to ensure proper functioning of the pneumatic or electric system, and that there are no obstructions to the blade movements. Tests can be carried out remotely if the dampers are installed with suitable limit switches.

Application

OLS TVD dampers are designed for enclosed vehicular and service tunnels,

particularly, for subways with long tunnels where mechanical ventilation becomes essential in order to supplement the natural ventilation from the piston effect of moving trains within tunnel. This is to ensure that environmental pollutant levels within subway tunnels and stations are maintained at acceptable levels. In addition, the dampers play a vital role in controlling the direction of airflow and migration of smoke within the tunnels during an emergency ventilation activation as a result of fire within tunnel. The emergency ventilation allows rapid removal of smoke and heat within the tunnel to permit safe evacuation of the train occupants and the entry of fire fighting personnels to the scene of fire.

Figure 1 shows a typical application of the SD60 dampers in a subway tunnel with combined natural and forced ventilation. During normal operation, damper 1 may be closed and damper 2 is opened to allow the escape of contaminated air through the ventilated shafts. If necessary, damper 1 may be opened to allow for additional ventilation by the reversible flow fan.

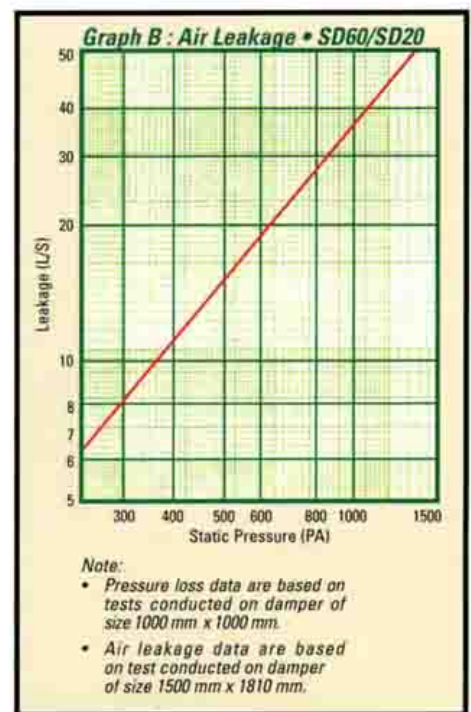
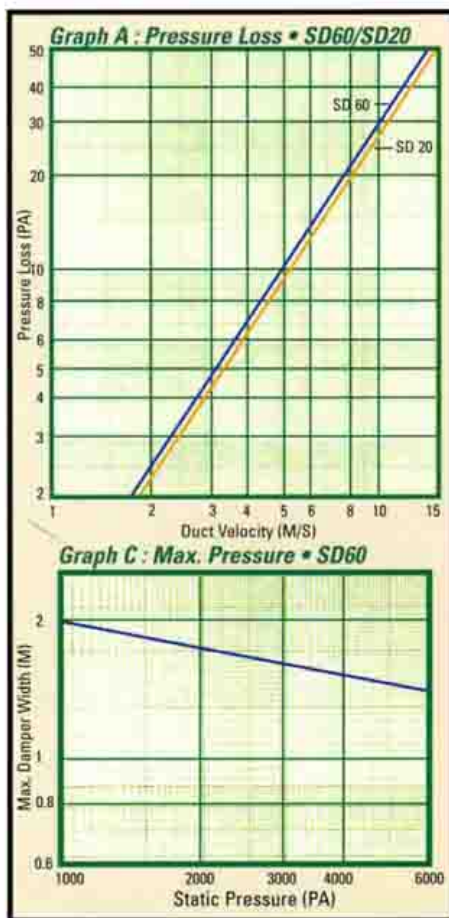
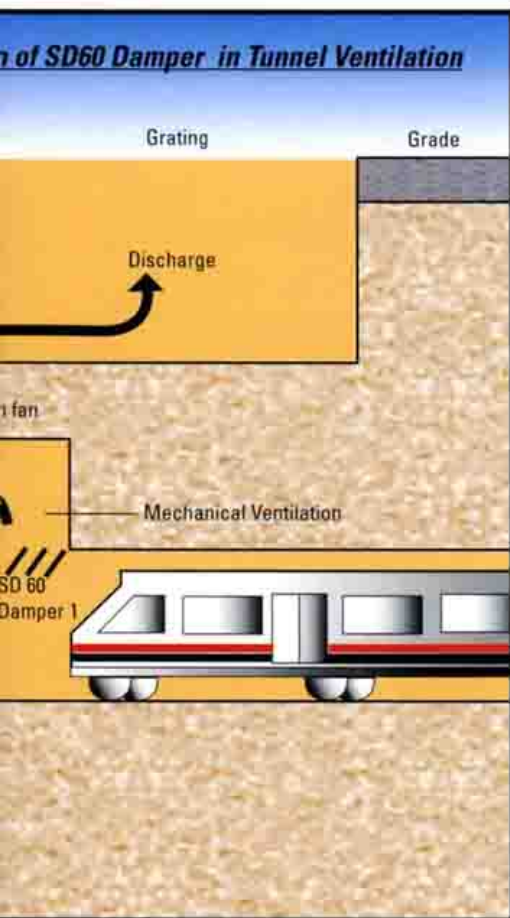
During emergency, when forced ventilation is required, damper 2 will be closed and

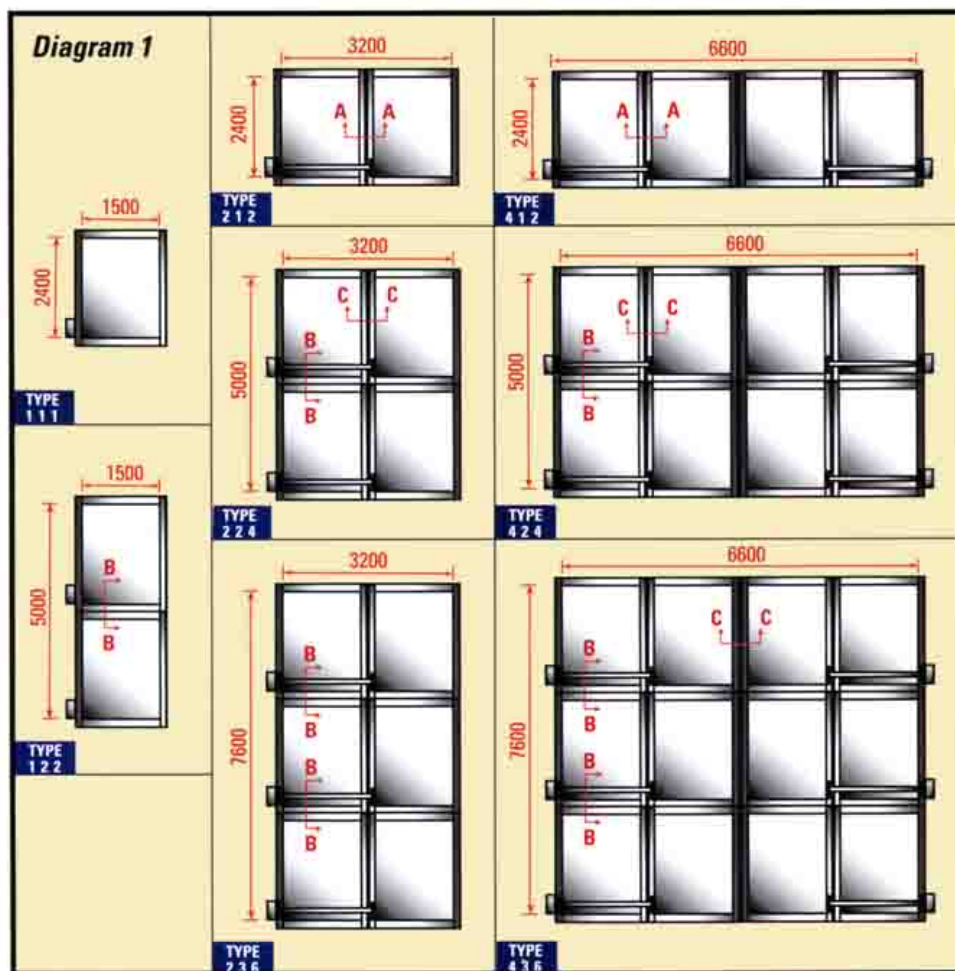
damper 1 will be opened to allow for the removal of smoke and heat, or the supply of fresh air to the tunnel, depending on the locations of the stalled train and fire. The dampers on the ventilation shaft nearest to the stalled train will be opened for the supply of fresh air and those on the ventilation shafts on the opposite end of the stalled train will be opened for smoke removal.

When interlocked with the tunnel ventilation system and integrated into the automation system for central control and monitoring, OLS TVD dampers with externally-powered electric or pneumatic actuators serve as live support system for the subway tunnels. As all the tunnel ventilation dampers may serve the smoke extract function, the dampers and their actuators must be able to operate at elevated temperatures and have a safety feature that allow them to assume the fail-safe position during power interruption.

Standard OLS TVD dampers are able to provide air tightness of 99.86% (i.e. a leakage rate of $14 \times 10^{-3} \text{ m}^3/\text{s/m}^2$), based on duct design velocity of 10.2 m/s at 1000 pascals pressure differential across the closed damper or 99.99% (i.e. a leakage rate of $8 \times 10^{-4} \text{ m}^3/\text{s/m}^2$), based on duct design velocity of 10.2 m/s at 100 pascals pressure differential across the closed damper.

Please consult our factory or your nearest OLS representative for more information.





Performance Tested

OLS TVD dampers and their actuators were subject to a series of tests according to *UL555S* for their reliability, temperature resistance and air-sealing capability.

During the tests, the dampers were first subject to a pre-conditioning cycling test. They were then tested for their temperature resistance of 250°C for a total duration of 2 hours. Air leakage test that was carried out on the dampers immediately after the degradation tests indicated a leakage factor of less than 0.5%, based on a duct velocity of 10.2 metre per second at a pressure differential of 1000 pascals. The dampers and its actuators were finally tested for proper functioning under operating conditions of 10.2 metres per second airflow and pressure differential of 2000 pascals. In addition, the SD60 dampers were pressure tested to 6000 pascals and for pressure loss. Results of the tests are shown on Graphs 1 to 3.

After the 2-hour temperature degradation tests, the dampers and actuators were able to open and close tightly while at 250°C. The operation of the dampers and their actuators were satisfactory under a

velocity of 10.2 m/s and pressure differentials of 2000 and 2650 pascals, for SD20 and SD60 respectively, where the dampers were able to open and close fully under dynamic conditions.

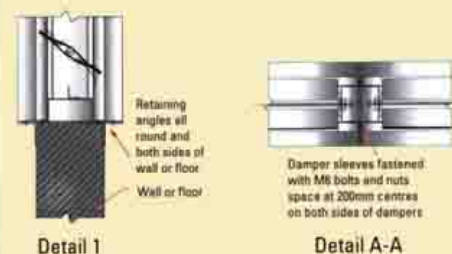
Multiple Module Assembly

While planning for the design of damper assemblies and installation method for large dampers, the pressure and the temperature under which the dampers will be exposed to must be taken into consideration. Diagram 1 shows a typical multiple-modules arrangement. For other arrangements, please contact our factory or your nearest OLS representative for more details.

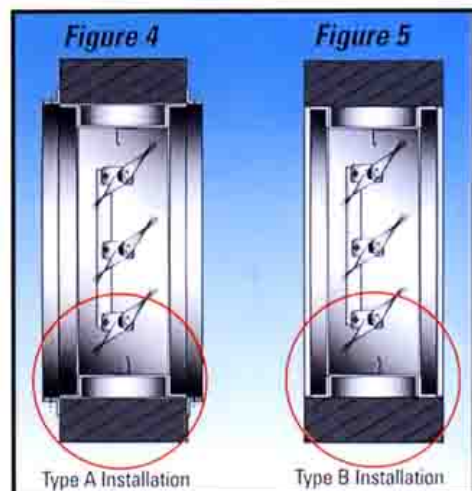
Installation

The SD60 dampers may be duct mounted or installed on masonry wall or floor. For connection to duct, both sides of the damper frames are pre-punched with slotted holes for the purpose of fastening, using M6 bolts and nuts. Direct drive with externally powered actuator is possible with installation method of this nature. When installed within

Type A Installation



Type B Installation

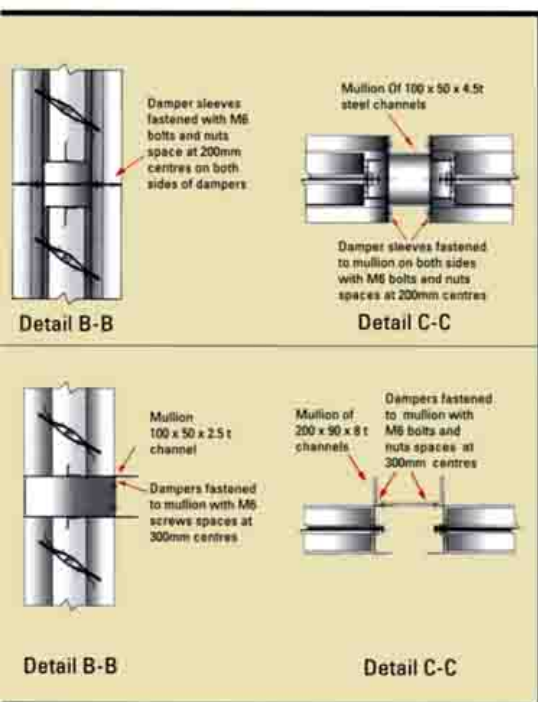


masonry wall or floor, steel sleeve may be used as shown on Figure 4. The sleeve allows for ease of connection to steel ductwork. An alternative masonry installation is shown on Figure 5 with the damper mounted between installation frames. For installation within masonry wall or floor, direct drive is not possible and the damper has to be driven through linkage mechanism.

Control Option

Pneumatic

Single acting pneumatic actuator provides a fail-safe feature in which it will return the damper to the safety position during power interruption. The pneumatic option consists of double-acting actuator or single actuator with spring return. Double-acting pneumatic actuator may be used, but this option does



Specifications for Subway Tunnel Ventilation Dampers

Damper Type

All dampers shall be rectangular with multiple blades. They shall be suitable for vertical and horizontal installations, but shall always be installed with blades horizontally.

Damper Modules

Each damper shall be constructed of one or more modules. Each module shall not be greater than 2400 mm in any dimensions, and shall be a complete factory-assembled unit contained in a steel channel frame. Each damper of more than one module shall be assembled on site by bolting each module onto a steel framework. It shall be possible to remove and install any module without having to remove other adjacent modules.

Damper Frame

The frame of modular damper shall be constructed of minimum 2.5 mm thick hot-dipped galvanized steel cold-formed channel sections, full-welded at each corner. The depth of channel shall be such that the blades will not protrude outside the frame when they are fully-opened.

Lifting lugs shall be provided on the frame of each module.

Damper Blades

Damper blades shall be of double-skinned airfoil cross-section, fastened to stainless steel axles with high tensile nuts and bolts. The width in the direction of airflow shall not exceed 200 mm. The length shall not exceed 1500mm. Blades shall not extend beyond the damper frame when in the open position.

Blade axles shall pivot on self-lubrication bronze bearings fixed to the vertical module frames. The gaps between the ends of the blades and the module frame shall be sealed by spring stainless steel jamb seals.

Dampers Actuators

Damper actuators shall be *pneumatically (or *electrically) operated, and mounted on the outside of the module frame.

Electric actuators shall be driven by motor designed for *110/220 VAC, *50/60 Hz supply. Pneumatic actuator shall operate with 6 bar clean supply air. The motor IP rating shall be suited to the environment where it is installed.

Actuators shall have a spring return mechanism to allow fail-safe operation to the desired blade position on loss of power.

Actuator shall be designed with sufficient margin of torque to operate under all the specified conditions.

Electric actuator shall be mounted within a purpose-designed heat-resistant enclosure to protect it against the heat generated from the smoke.

Performance Rating

When fully opened, the pressure loss through the damper shall not exceed 50 pascals at the air velocity of 10.2 m/s.

When fully closed, the leakage through any damper shall not exceed 0.05m³/s per m² of face area at 1kPa differential pressure in either direction.

When fully closed, the dampers shall withstand a maximum differential pressure of 6kPa in either direction without any permanent deformation or damage. Maximum blade deflection at this pressure shall not exceed 1/180 of blade span.

Damper Operation

The dampers shall be controlled to move to either fully-closed or fully-opened positions. Intermediate positions are not required. The time taken to move to the fail-safe positions shall not exceed 10 seconds.

Temperature Resistance

Each damper, shall be able to withstand a maximum temperature of _____°C for up to _____ hour(s) without permanent distortion or buckling, and without damage to bearings or seals.

Support Steelworks

Supporting steel framework shall be supplied by the contractor and shall be designed to support the damper modules :

- to provide sealing against leakage
- to accommodate irregularities in the structural opening in which the damper is fitted
- to provide temperature resistance to the same standard as that of the overall damper

Testing

Testings shall be conducted on each type of damper according to UL 555S for:

- Air tightness when closed
- Temperature resistance
- Operation under maximum airflow conditions. In addition the largest module size shall also be subject to pressure resistance test to determine for blade deflection. Test reports shall be submitted for approval .

*select according to your requirements

not provide the fail-safe feature during power interruption.

For elevated operating temperature, non-standard actuators with high temperature components have to be used. Production of such non-standard actuators require more lead time. Typically, 6 to 8 bar supply air is required for both types of pneumatic actuators. Damper may be supplied with purpose-designed heat-resistant actuator enclosure, depending on the operating temperature and time duration. If operating temperature of more than 250°C is required, kindly consult our factory or your nearest OLS representative for more details.

Electric

• 100/120 VAC or 220/240 VAC, 50/60Hz On/Off type with spring return. This actuator provides fail-safe feature during power interruption.

• 100/120 VAC or 220/240 VAC, 50/60Hz On/Off type. This actuator does not provide fail-safe feature during power interruption.

• 100/120 VAC or 220/240 VAC, 50/60Hz modulating type with spring return. This actuator provides fail-safe feature during power interruption.

• All dampers will be supplied with purpose-designed heat-resistant actuator enclosures. If operating temperature of more than 250°C is required, please consult our factory or your nearest OLS representative for more details.