**Gravity Operated Fire Damper**

**Guide Specification**

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**Construction**

Fire dampers shall be installed as indicated and to the requirements of the local fire regu­lations. Fire dampers shall be of robust design and constructed of gal­vanized steel/stainless steel SUS 304/ stainless steel SUS 316 *(select one)* plate.

Sleeve - Damper sleeve shall be a full welded assembly constructed of 1.5 to 2.5 mm material as specified above, depending on the damper size. The welded joint shall be cleaned and painted with zinc-rich paint. Tack welding on the sleeve joint is not acceptable.

Retaining angles - shall be constructed of 1.5 to 2.5 mm material as specified above, cold-formed with slotted holes on one leg for minor adjustments to suit wall and floor thickness. The size of retaining angles should be compatible with damper size and required thermal expansion. The retaining angle side that butt against the wall or floor should overlap the expan­sion gap by a minimum of 25 mm.

Damper frame - The fire damper shall have a 100 X 22 X 1.2 mm U channel frame inside the sleeve that house the blades. The frame shall be constructed of material as specified above and spot welded to the sleeve to provide greater damper rigidity.

Blade stack cover - The fire damper shall include a blade stack cover to increase the damper's free area and lower its airflow resistance. The blade stack cover shall enable duct connection below the blade stack and conceals the blade from the airflow. It shall be constructed of 1.2 mm thick material as specified above and spot welded or riveted to the top sleeve.

OR *(Blade stack cover or adaptor, select one)*

Adaptor - An adaptor shall be connected to each side of the damper to conceal the blade stack and the damper frame from the airflow to provide a 100 percent free area. The adaptor shall be constructed of material as specified above and fastened to the sleeve and retaining angles.

Blade - Roll-formed interlocking blades shall be constructed of 1.0 mm thick material as specified above. The blade assembly shall be fastened to the top of the sleeve with steel rivets or spot welding.

Fusible link - UL listed fusible link shall be rated at 74oC and be provided for each module. For galvanized steel damper, the fusible link shall be constructed of steel. For stainless steel damper, SUS 316 stainless steel fusible shall be provided. (look into costing). The fusible link shall be hooked to the hanger bracket and be easily removed for closing testing during maintenance.

Wall and partition-mounted fire dampers shall be gravity operated, and floor-mounted ones shall be spring-operated type. For floor mounted damper, a coil spring mounted on a bearing at each corner of the bottom frame and fastened to each end of the bottom blade to provide the closure force. The coil springs shall have constant torque and be made of SUS 301 stainless steel. These springs' total closure force shall equal to a minimum of 2.5 times the force required to close the damper. Two catches shall be provided to catch the blade, preventing them from the rebound when the damper closes. For all dampers, sufficient gaps shall be allowed on both ends of the blade for reliable closure.

**Performance And Testing**

The fire damper shall be subjected to the performance tests, as indicated in Table 1. Damper performances 1 to 4 shall meet the requirements of the latest Singapore Standard SS 333. Air leakage and pressure loss test shall be carried out according to Air Movement and Control Association Standard AMCA 500D.

Table 1. Specimen testing requirements

|  |  |
| --- | --- |
| Type of test | Damper Specimen Size |
| Closing reliability | Maximum width/maximum height and Minimum width/minimum height |
| Spring force | Maximum width/maximum height for each spring size |
| Air leakage | Maximum width/maximum height and Minimum width/minimum height,  Maximum width/minimum height and Minimum width/maximum height |
| Fire resistance | Single module: Maximum width/maximum height  Multiple-module assembly: 2X2 modules Maximum width/maximum height |
| Pressure loss | Single module: Maximum width/maximum height and Minimum width/minimum height, Maximum width/minimum height and Minimum width/maximum height |

Closing Reliability Test

A fire damper shall be manually closed and latch (if a latch is provided) from the open position during each of 250 operations. Throughout the test, there shall be no evidence of undue wear or damage. All dampers are to be cycled while orientated in the position intended for installation.

Spring force Test

 A spring-operated damper assembly shall employ two springs capable of exerting a force of 2.5times required to close and automatically latch (if a latch is provided) the damper. Three samples of each spring employed for closing and latching shall be tested for the force exerted over the range of extension required for the damper's motion.

Air leakage Test

Fire damper shall be leakage rated at ambient temperature. Air leakage data from a recognized laboratory shall be submitted for approval. Air leakage across the closed damper shall not exceed the values as indi­cated in Table 2.

Table 2 Maximum Allowable Air Leakage

|  |  |  |
| --- | --- | --- |
| Air Pressure Differential (Pa) | Maximum Allowable Leakage For Damper < 0.5 m2 (L/s) | Maximum Allowable Leakage For Damper > 0.5 m2 (L/m2/s) |
| 0.25 | 95 | 190 |
| 0.5 | 125 | 250 |
| 0.75 | 155 | 310 |
| 1.00 | 175 | 350 |
| 1.25 | 195 | 390 |

Fire-resistant Test

The fire damper tested for fire resistance shall be the same damper that was tested for air leakage. Fire damper shall be tested according to the latest Singapore Standard SS333 for 2 or 4 hours fire resistance. The manufacturer shall show proof of a multiple-module damper being tested, and the minimum module size shall not be smaller than 1.44 m2. Single-module damper tested shall not be smaller than 2.0 m2 for better free area and lower pressure loss.

Pressure Loss Test

The pressure loss of the fire damper shall not exceed 30 Pa at a face velocity of 10 m/s. If the proposed fire damper cannot meet the required pressure loss, the manufacturer may submit an alternative design with a higher free area. Pressure loss shall be tested according to sizes, as indicated in Table 1.

**Fire damper inspection**

An authorized testing body shall inspect all fire dampers at the factory and Certificate of Inspection submitted for the record.

**Installation**

All fire dampers shall be supplied with a sleeve and retaining angles complete with fasteners for installation. The installer shall adhere to the installation instructions provided by the damper manufacturer.

The following information shall be submitted for approval before ordering the damper.

1. Manufacturer installation instructions for each type of fire damper.
2. Calculation of thermal expansion gap and damper opening size.
3. Manufacturer certificate of training for the installer.

On Drywall

Fire damper installed on drywall shall be suspended from the building structure *above*it so that its weight is not rested on the drywall. The damper shall be suspended with steel rods so that it can be inspected at any time after installation. At all times, the damper weight shall not rest on the drywall. The damper shall be suspended against the top of the opening and, all vertical expansion gaps shall be allowed beneath the damper.

The subcontractor shall submit details of drywall opening and reinforcement, damper size, accurate damper location and position to the builder and the Resident Engineer for approval. The builder shall provide the drywall damper opening as requested. The site Resident Engineer shall inspect each drywall and damper opening construction to ensure that adequate support is carried out according to the fire damper testing and related assessment report. Ceramic wool shall be used as infill material for the expansion gap to reduce hot gas leakage during a fire. The use of ceramic wool minimizes the temperature rise on the unexposed side of the drywall and preserves the drywall's integrity.

On Masonry Wall

For fire damper installed on the masonry wall, the damper shall sit on the wall, and vertical thermal expansion shall be allowed above the damper. Horizontally, the damper shall be position in the center of the opening and equal thermal expansion gap allow on each side. High-temperature mineral wool shall be used as infill material for the expansion gap. Fire damper exceeding three modules in height shall be supplied with appropriate mullion for assembly between modules to ensure the damper assembly's rigidity and minimize distortion during a fire.

On Masonry Floor

For fire damper installed on the masonry floor, the damper shall be position in the center of the opening and equal expansion gap allow on the opposite side. High-temperature mineral wool may be used as infill material for the expansion gap.

For all installations,

1. The retaining angle shall have a minimum of 25 mm overlap around the wall/floor/partition opening.
2. The retaining angles shall hold the damper firmly to the partition, wall or floor and be free to expand in all directions with the damper during a fire.
3. The duct shall be connected to the damper with S-clip or flange connection with aluminum bolts and nuts. The duct-damper connection shall be such that it can break free if the duct should collapse during a fire, from the fire damper without affecting the fire integrity of the damper and the surrounding wall. Sealant or gasket shall be applied to the joint and sealed with duct tape to prevent air leakage.
4. For ease of duct connection, the connecting duct shall be 600mm in length. Access panel may be installed on the underside of the duct. For a single module fire damper of width larger than 450 mm, an access panel of 450 by 450 mm in size shall be provided for maintenance.
5. For damper smaller than 450 mm in width, a smaller panel shall be provided for inspection. For ease of maintenance, the adjacent duct shall be connected to the damper using a flange connection with aluminum bolts and nuts to remove the duct for maintenance and repair.
6. For multiple module damper assembly, more than one access panel may be necessary. The subcontractor shall submit for approval details for access to different damper module for maintenance and repair.