



FIRE DAMPER APPLICATION GUIDE

Use this application guide to help determine what type of fire damper best suits the application.

Below are listed the ten Metal-Fab fire damper model numbers and a brief description of each. A list of options for each model is on the “Submittal Sheet” or in the “Fire Damper Model Selection Guide.”

Model MFD: Metal-Fab Fire Damper; 3-11/16” Wide; 1.5-hour rating; Static Airflow

Model MFD3: Metal-Fab Fire Damper; 3-11/16” Wide; 3-hour rating; Static Airflow

Model MFD3: Metal-Fab Dynamic Fire Damper, 3-11/16” Wide; 1.5-hour rating; Dynamic Airflow.

Model MFD3: Metal-Fab Dynamic Fire Damper; 3-11/16” Wide; 3-hour rating; Dynamic Airflow.

Model MFDS: Metal-Fab Fire Damper; Slim-Frame 2-3/16” wide; 1.5-hour rating; Static Airflow

Model MFDS3: Metal-Fab Fire Damper; Slim-Frame 2-3/16” wide; 3-hour rating; Static Airflow

Model MFD3: Metal-Fab Dynamic Fire Damper; Slim-Frame 2-3/16”; 1.5-hour rating; Dynamic Airflow

Model MFD3: Metal-Fab Dynamic Fire Damper; Slim-Frame 2-3/16”; 3-hour rating; Dynamic Airflow

Model MFDUS: Metal-Fab Fire Damper; Ultra Slim-Frame 1-1/2”; 1.5-hour rating; Static Airflow

Model MFDUS3: Metal-Fab Fire Damper; Ultra Slim-Frame 1-1/2”; 3-hour rating; Static Airflow

Notice that the Metal-Fab fire damper model numbers define three different widths; two different ‘hour ratings’; and the two different airflow applications.

FRAME WIDTH:

The standard frame works well for most installation applications. The Slim-Frame damper works well when the duct terminates at a wall or floor and a grill or register needs to be accommodated. The Ultra Slim-Frame dampers are usually installed where a grille must be accommodated in a very thin barrier. The Ultra Slim-Frame dampers must be used in vertical orientations because the narrow width frame cannot accommodate springs and locking ramps.

1.5 AND 3 HOUR FIRE RATINGS:

The hour ratings for fire dampers must be 75% of the hour rating for the wall, floor or partition. That is why a fire damper rated for 1.5 hours can be used in a fire barrier rated for up to 2 hours and a fire damper rated for 3 hours can be used in a fire barrier rated up to four hours.

STATIC AND DYNAMIC CLOSURE FIRE DAMPERS:

The airflow application, static or dynamic is largely determined by the HVAC system blower operation. Until recently, most building codes required that the HVAC system blower cycle off during a building fire. That is why fire dampers were tested for their ability to endure fire and no consideration was given for a damper to close against the pressure caused by airflow.

With the increased use of dynamic fire control systems, it was discovered that ordinary static type fire dampers would not always close if the HVAC system blower continued to run. If a damper does not close properly, the integrity of the fire barrier is compromised. As of April 1, 1992, all fire dampers used in HVAC systems that might not cycle the blower off during a building fire must be listed and labeled for dynamic closure by Underwriter Laboratories. Metal-Fab’s dynamically rated fire dampers are tested and approved for use up to 4” w.c. (1000 Pa.) at the rated airflow.

To use the chart: Select the damper application, vertical or horizontal. Then select the mounting position, in wall, in duct or in floor. Then select the direction of the airflow, up, down or horizontal. Then select the damper size, and finally determine the maximum rated velocity in feet per minute (fpm) that a specific damper application is rated for.

FIRE DAMPER CONFIGURE TO ORDER (CTO) OPTIONS:

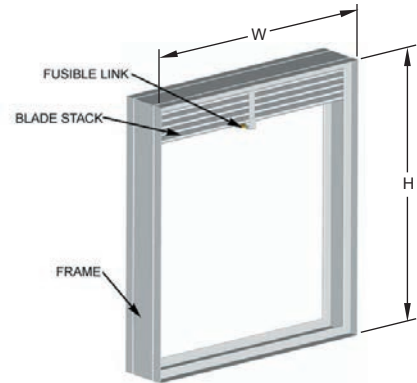
After the model of the fire damper that is required has been determined there will be several configuration options to choose from. The options for each model fire damper are on the 'Specification Sheet' for that model. *All the options listed below are not available for each model fire damper, consult the submittal sheet for the model in question.*

- #1) Type-A, Type-B or Type-C.
- #2.) Fusible link temperature set points of 165°F, 212°F, or 286°F.
- #3.) Vertical or horizontal orientation.
- #4.) Galvanized metal sleeves in lengths of 12", 14" or 16" and metal gauges of 20 ga., 18 ga. and 16 ga.
- #5.) Transition available.
- #6.) Pressure rated low, medium/high or high.
- #7.) Micro-switch.

Option #1) Type-A, Type-B or Type-C:

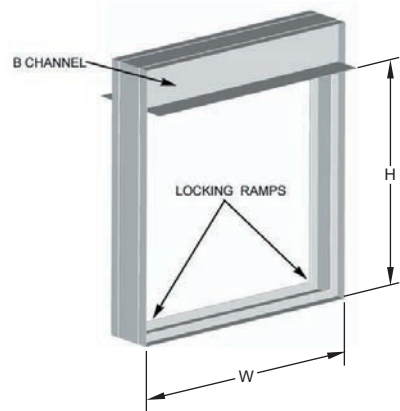
TYPE-A FIRE DAMPER:

The Type-A fire damper is generally used in applications where the blade stack intrusion in the air stream is not a consideration. Typical installations are in a low pressure (less than 3" w.c.) system.



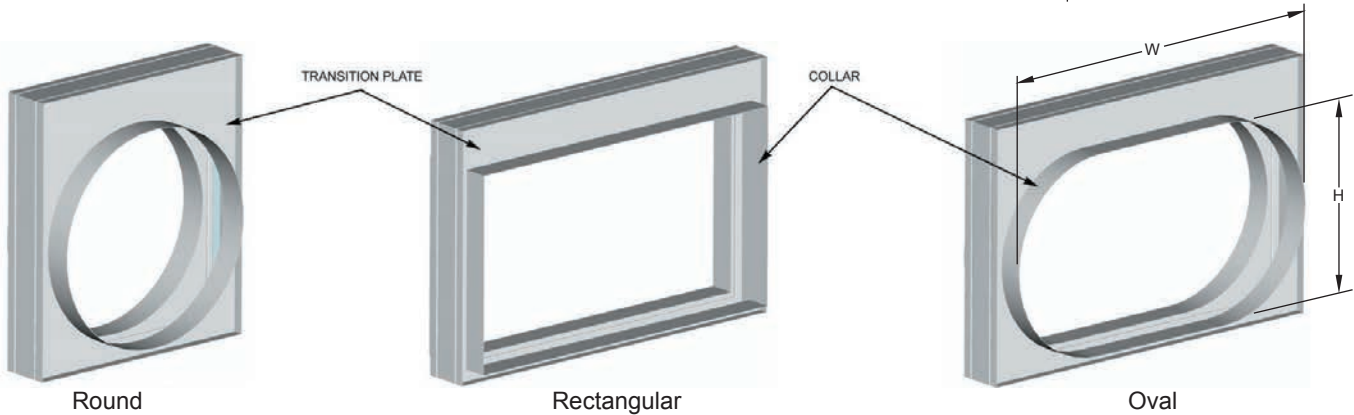
TYPE-B FIRE DAMPER:

The Type-B fire damper is generally used where the duct height is 12" or less and/or where air speed velocities are fast enough. It will be beneficial to have the blade stack out of the air stream. Having the blade stack out of the air stream maximizes free area and reduces the pressure drop.



TYPE-C FIRE DAMPER:

The Type-C fire damper is generally used where velocities are medium to high and free area is a consideration. Type-C dampers can be ordered with low pressure (less than 3" w.c.) medium/high pressure (from 3" w.c. up to 10" w.c.) or high pressure (10" w.c.) pressure ratings. The Type-C fire damper has a collar (or transition collar) the installer can attach the duct to. The collar is available in three configurations, round, square/rectangular or oval.



NOTE: Always specify duct Width first and Height second when ordering.

Option #2.) Fusible link temperature set points of 165°F, 212°F, or 286°F.:

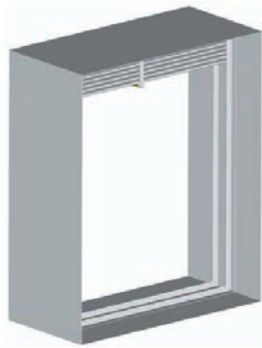
The fusible link is the mechanism that holds the damper blades in the open position. If the fuse link reaches the temperature set point the fuse link will open. When the fuse link opens, the damper blades close and prevent the spread of fire for a set amount of time. The standard fusible link for Metal-Fab fire dampers is 165° F. Two other fusible links with different temperature set points are available, 212° F and 286° F.

Option #3.) Vertical or horizontal orientation.:

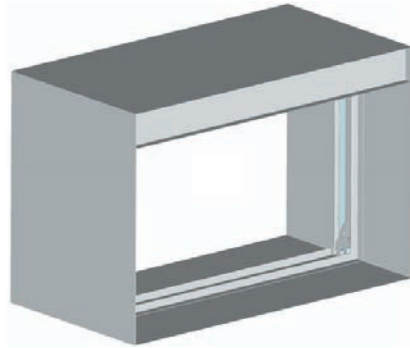
Fire dampers are typically installed in fire rated walls, floors or partitions. If a fire damper is installed in a wall it will be in a vertical position. Vertical dampers for static airflow systems do not have springs. If a fire damper is installed in a floor it will be in a horizontal position. All horizontal dampers have springs to insure proper closure. ***It is important to know what orientation the damper will be in after installation and ordered accordingly.***

Option #4.) Galvanized metal sleeves in lengths of 12", 14" or 16" and metal gauges of 20 ga., 18 ga. and 16 ga.:

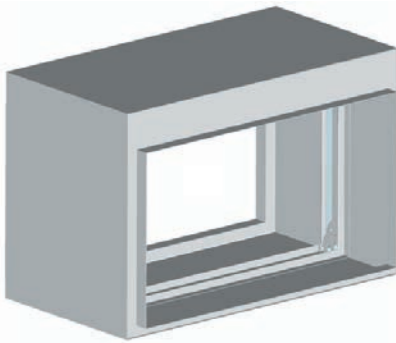
Fire damper sleeves are made of galvanized steel. Standard lengths for sleeves are 12", 14" and 16". Standard metal gauge sizes are 20 ga., 18 ga. and 16 ga. Sleeves shall be approximately 3" on either side of wall or floor to facilitate the joining of the sleeve to the duct. For sleeves of different lengths than listed above or for sleeves made from 12 ga. or 14 ga., contact the factory for special pricing and delivery times.



Type-A Sleeve



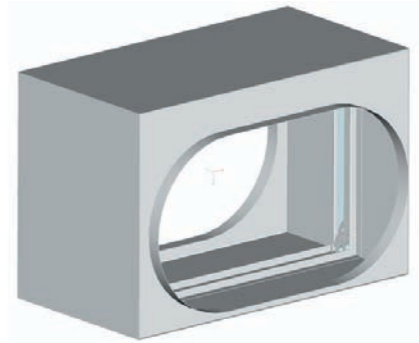
Type-B Sleeve



Type-C Sleeves: Rectangular Collar



Round Collar



Oval Collar

Option #5.) Transition available:

The transition plate is used on Type-C dampers and Type-C sleeves. This option is automatic during the order entry process. If an Type-A or Type-B damper or sleeve is ordered, the only option available for a transition is 'None' and if a Type-C damper or sleeve is ordered, the only option available is 20 gauge galvanized steel.

Option #6.) Pressure rated low, medium/high or high:

The Metal Fab fire damper pressure rating as it relates to manufacturing the damper:

NOTE: Type-C dampers and Type-C sleeved dampers are the only dampers that can be built as medium/high or high pressure.

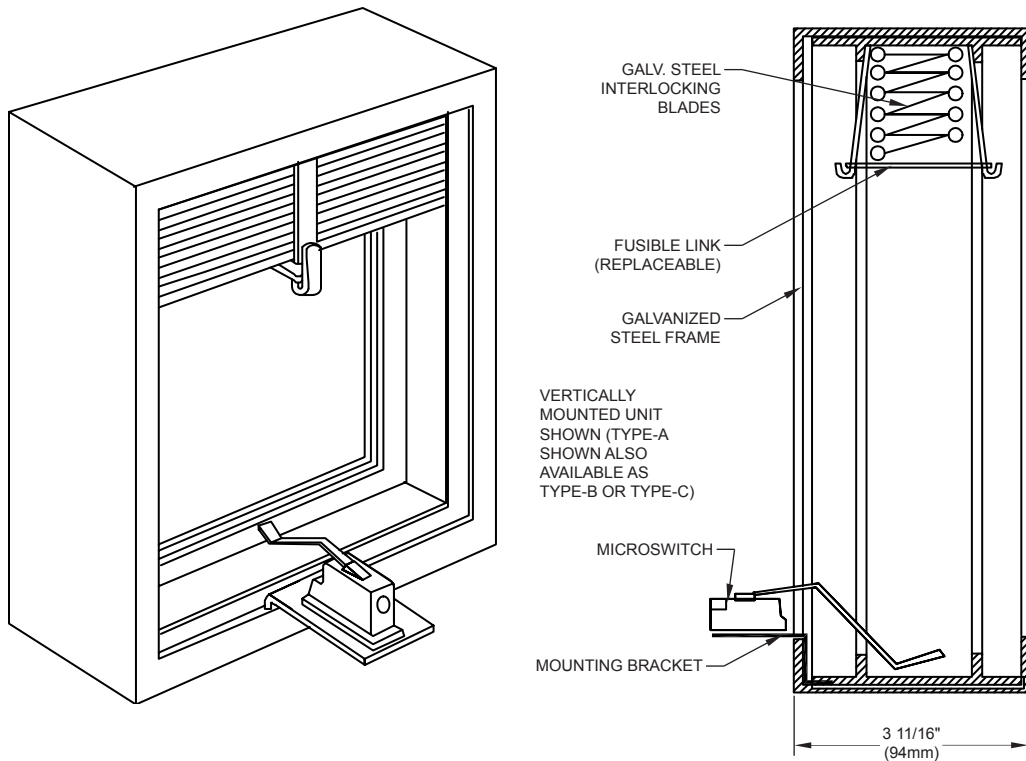
Low pressure (less than 3" w.c.): Standard fire damper, no additional construction is required.

Medium/High pressure (from 3" w.c. up to 10" w.c.): The damper frame is wrapped with a 5" wide piece of metal. Think of it as a narrow sleeve. The transition plate is spot welded to the damper frame or narrow sleeve depending on the application. Then the transition plate is sealed with caulk around the perimeter. The sleeved damper does not require the 5" wide metal wrap.

High pressure (10" w.c.): The damper frame is wrapped with a 5" wide piece of metal, think of it as a narrow sleeve. The transition plate is welded around the entire perimeter to the damper frame. If the damper is constructed with a sleeve, then the narrow sleeve is not required. High pressure dampers are special order items and are not included in the next day shipping part of our fire damper product line. When ordering high pressure dampers or sleeves call the factory for delivery times.

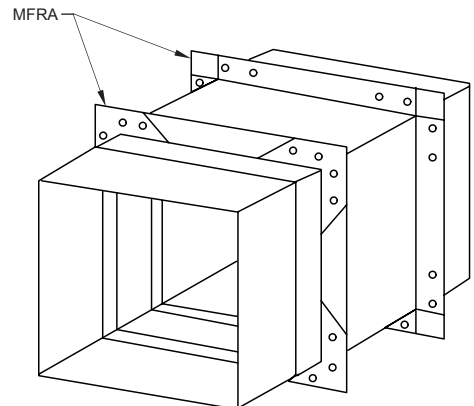
OPTION #7.) Micro-switch:

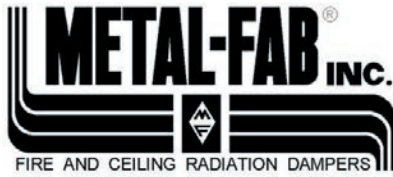
The micro-switch is mounted on a fire damper and is typically used for one or both of the following purposes. If a damper closes it will trip the micro-switch and initiate an audio or visual alarm in a control room and/or cycle off the HVAC blower motor. This is a single pole, double throw switch rated for 15 amps. One set of contacts are normally open and one set of contacts are normally closed.



Model MFRA Framed Retaining Angles:

All fire dampers installed in a fire rated wall, floor or partition must be attached to a sleeve that is held in place by framed retaining angles. See the installation Instructions and a Specification Sheet for additional information. Metal-Fab offers sets of framed retaining angles as an option to any sleeved dampers that are ordered.





FIRE DAMPER/ENGINEERING AND PERFORMANCE DATA

INTRODUCTION:

Although the primary purpose of a fire damper is to maintain the fire resistance of a fire separation, its inclusion in the HVAC system of a building necessarily affects the air handling characteristics of the system during the normal operating mode. Fire dampers impose some resistance to air flow and therefore must be considered by the designer in determining the required flow rate (cfm) to each space. The main design considerations are: Free Area, Flow and Leakage.

Free Area: The total minimum area of the openings in the air outlet or inlet through which air can pass. Free Area is expressed in square feet. **NOTE:** Type-C damper has 100% free area, equal to duct size.

TYPE-A DAMPER

| | | DUCT WIDTH (IN.) | | | | | | | | | | | | | | |
|-------------------|----|------------------|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|
| | | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 |
| DUCT HEIGHT (IN.) | 4 | .05 | .11 | .15 | .2 | .2 | .3 | .4 | .5 | .5 | .6 | .6 | .7 | .7 | .8 | .9 |
| | 8 | .11 | .33 | .45 | .7 | .8 | 1.0 | 1.2 | 1.6 | 1.7 | 1.8 | 2.0 | 2.1 | 2.2 | 2.4 | 2.5 |
| | 12 | .15 | .55 | .76 | .95 | 1.3 | 1.7 | 2.0 | 2.2 | 2.6 | 2.9 | 3.1 | 3.3 | 3.6 | 3.8 | 3.9 |
| | 16 | .2 | .7 | 1.1 | 1.4 | 1.8 | 2.1 | 2.5 | 2.9 | 3.2 | 3.6 | 4.0 | 4.3 | 4.7 | 5.1 | 5.4 |
| | 20 | .2 | .8 | 1.3 | 1.8 | 2.3 | 2.8 | 3.3 | 3.7 | 4.2 | 4.7 | 5.2 | 5.6 | 6.1 | 6.6 | 7.0 |
| | 24 | .3 | 1.1 | 1.6 | 2.2 | 2.8 | 3.4 | 3.9 | 4.5 | 4.9 | 5.6 | 6.2 | 6.8 | 7.3 | 7.9 | 8.5 |
| | 28 | .4 | 1.2 | 1.9 | 2.6 | 3.2 | 3.9 | 4.8 | 5.4 | 5.9 | 6.7 | 7.3 | 8.1 | 8.8 | 9.4 | 10.0 |
| | 32 | .5 | 1.4 | 2.2 | 2.9 | 3.7 | 4.5 | 5.8 | 6.6 | 7.3 | 8.1 | 8.8 | 9.8 | 10.4 | 11.1 | 11.5 |
| | 36 | .5 | 1.5 | 2.4 | 3.3 | 4.4 | 5.3 | 6.4 | 7.2 | 7.8 | 8.8 | 9.7 | 10.8 | 11.8 | 12.6 | 13.1 |
| | 40 | .6 | 1.7 | 2.7 | 3.8 | 4.8 | 5.9 | 6.9 | 8.0 | 8.8 | 9.7 | 10.7 | 11.8 | 12.7 | 13.8 | 14.6 |
| | 44 | .6 | 1.9 | 2.9 | 4.1 | 5.1 | 6.3 | 7.3 | 8.4 | 9.6 | 10.8 | 11.9 | 12.9 | 13.9 | 15.3 | 16.2 |
| | 48 | .7 | 2.0 | 3.2 | 4.4 | 5.6 | 6.9 | 8.0 | 9.3 | 10.5 | 11.9 | 13.3 | 14.1 | 15.6 | 16.6 | 17.7 |
| | 52 | .7 | 2.2 | 3.6 | 4.8 | 6.1 | 7.5 | 8.8 | 10.2 | 11.6 | 12.7 | 13.9 | 15.2 | 16.7 | 17.9 | 19.2 |
| | 56 | .8 | 2.3 | 3.8 | 5.3 | 6.6 | 8.0 | 9.5 | 10.9 | 12.3 | 13.6 | 15.2 | 16.6 | 17.9 | 19.3 | 20.8 |
| 60 | .9 | 2.5 | 4.0 | 5.5 | 7.1 | 8.6 | 10.1 | 11.6 | 13.2 | 14.7 | 16.3 | 17.8 | 19.3 | 20.9 | 22.5 | |

TYPE-B DAMPER

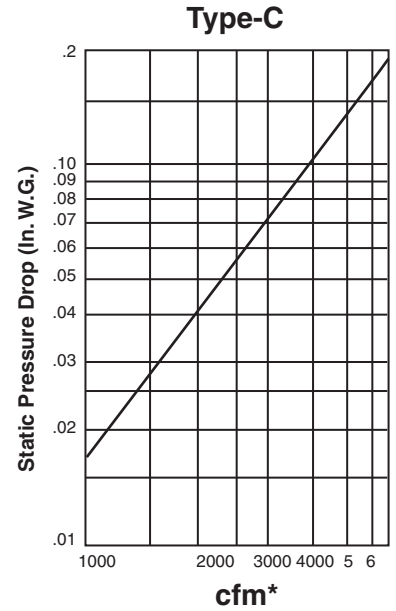
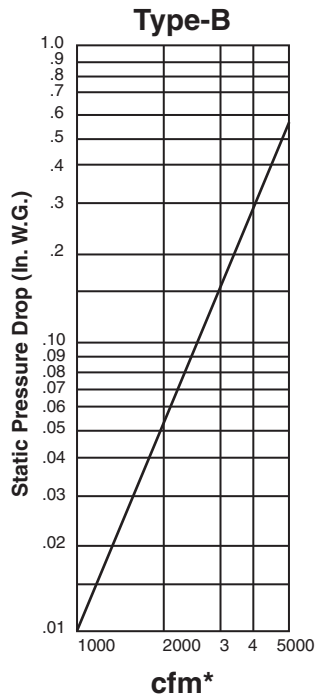
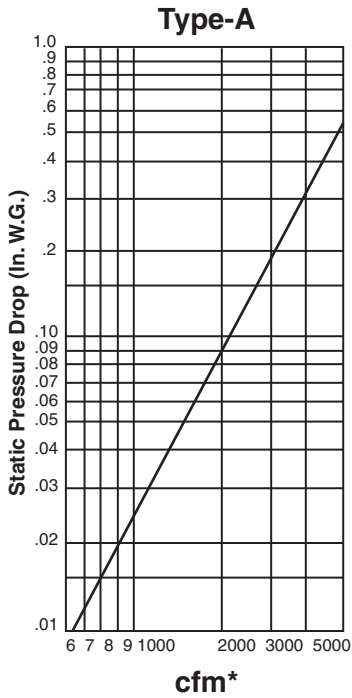
| | | DUCT WIDTH (IN.) | | | | | | | | | | | | | | |
|-------------------|-----|------------------|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|
| | | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 |
| DUCT HEIGHT (IN.) | 4 | .06 | .15 | .2 | .3 | .4 | .4 | .5 | .6 | .7 | .8 | .9 | 1.0 | 1.1 | 1.2 | 1.3 |
| | 8 | .15 | .45 | .6 | .8 | 1.0 | 1.3 | 1.5 | 1.5 | 1.8 | 1.8 | 2.2 | 2.4 | 2.6 | 2.8 | 3.0 |
| | 12 | .2 | .7 | .88 | 1.2 | 1.5 | 2.0 | 2.2 | 2.4 | 2.8 | 3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.6 |
| | 16 | .3 | .8 | 1.1 | 1.6 | 2.1 | 2.5 | 2.9 | 3.2 | 3.6 | 4.2 | 4.6 | 5.0 | 5.4 | 5.9 | 6.3 |
| | 20 | .4 | .9 | 1.4 | 2.0 | 2.7 | 3.3 | 3.6 | 4.1 | 4.7 | 5.2 | 5.7 | 6.3 | 6.8 | 7.4 | 7.9 |
| | 24 | .4 | 1.1 | 1.7 | 2.3 | 3.1 | 3.8 | 4.3 | 5.2 | 5.7 | 6.3 | 6.9 | 7.6 | 8.2 | 9.0 | 9.6 |
| | 28 | .5 | 1.3 | 2.2 | 2.9 | 3.6 | 4.4 | 5.3 | 5.8 | 6.6 | 7.2 | 8.1 | 8.8 | 9.6 | 10.3 | 11.0 |
| | 32 | .6 | 1.4 | 2.3 | 3.1 | 4.2 | 5.3 | 5.9 | 6.9 | 7.6 | 8.5 | 9.4 | 10.1 | 11.0 | 11.8 | 12.8 |
| | 36 | .7 | 1.5 | 2.6 | 3.5 | 4.7 | 5.7 | 6.6 | 7.7 | 8.6 | 9.6 | 10.6 | 11.5 | 12.3 | 13.3 | 14.3 |
| | 40 | .7 | 1.9 | 3.0 | 3.9 | 5.2 | 6.4 | 7.4 | 8.6 | 9.5 | 10.8 | 11.2 | 12.9 | 13.9 | 14.9 | 16.1 |
| | 44 | .7 | 1.9 | 3.1 | 4.3 | 5.7 | 6.9 | 8.2 | 9.5 | 10.5 | 11.7 | 13.0 | 14.1 | 15.3 | 16.5 | 17.7 |
| | 48 | .8 | 2.1 | 3.4 | 4.8 | 6.2 | 7.6 | 8.8 | 10.2 | 11.4 | 12.7 | 14.1 | 15.5 | 16.7 | 18.0 | 19.4 |
| | 52 | .9 | 2.3 | 3.7 | 5.2 | 6.7 | 8.2 | 9.5 | 11.1 | 12.6 | 13.9 | 15.3 | 16.8 | 18.4 | 19.7 | 21.0 |
| | 56 | 1.0 | 2.4 | 4.0 | 5.6 | 7.2 | 8.8 | 10.3 | 11.9 | 13.5 | 15.1 | 16.6 | 18.2 | 19.5 | 21.3 | 22.6 |
| 60 | 1.2 | 2.6 | 4.3 | 6.0 | 7.8 | 9.5 | 11.1 | 12.7 | 14.5 | 16.0 | 17.6 | 19.4 | 21.0 | 22.8 | 24.4 | |

TYPE C DAMPER:
100% Free Area
EQUAL TO DUCT SIZE

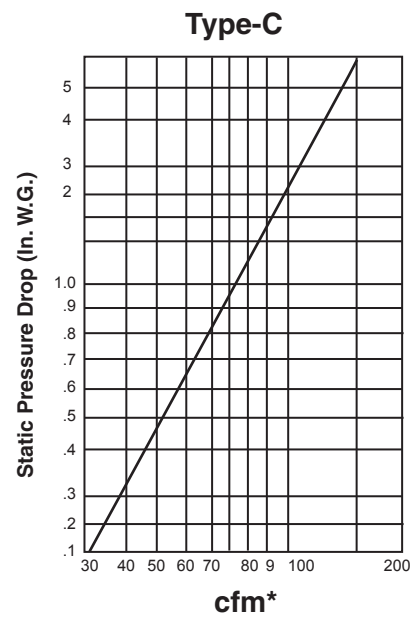
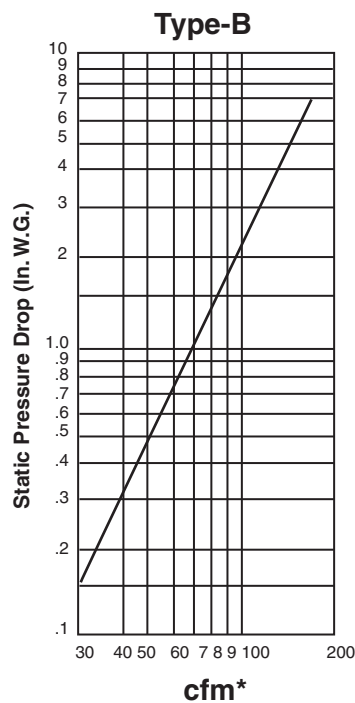
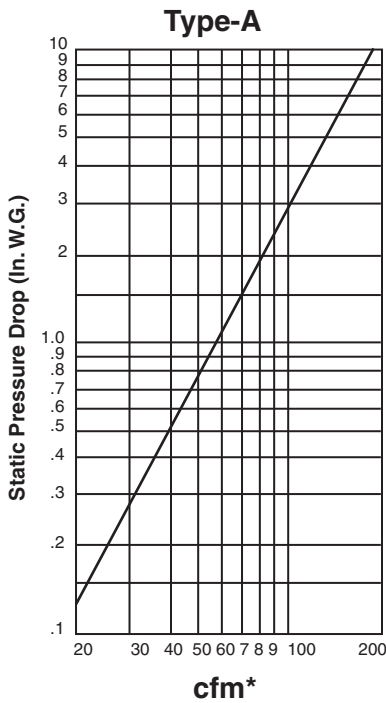
PERFORMANCE CHARACTERISTICS:

Flow: A dynamic loss of static pressure as a result of damper obstructions. This is expressed as a measure of the Free Area X Free Area Velocity versus Static Pressure Drop (inches w.g.).

*cfm = Free Area (sq. ft) x Free Area Velocity (fpm or cfm/sq. ft.)



Leakage: Duct leakage is a significant factor in controlling the performance of the HVAC system. If leakage is uncontrolled, energy will be wasted and the system may fail to perform as specified. Leakage is expressed as the drop in static pressure.



The Controversy: By offering two frame styles, A and B, to accommodate low and medium velocity duct systems, respectively, the fire damper industry has attempted to serve the needs of the HVAC designer. However, this accommodation has inadvertently caused some conflict of interest. To explain, most contractors prefer to use Type-A fire dampers whenever possible because of their low cost and ease of installation (a further cost savings versus Type-B).

Engineers, on the other hand, prefer the more expensive Type-B fire dampers because of their superior air handling characteristics.

Rule of Thumb: As a natural result of these different interests, an industry “Rule of Thumb” developed:

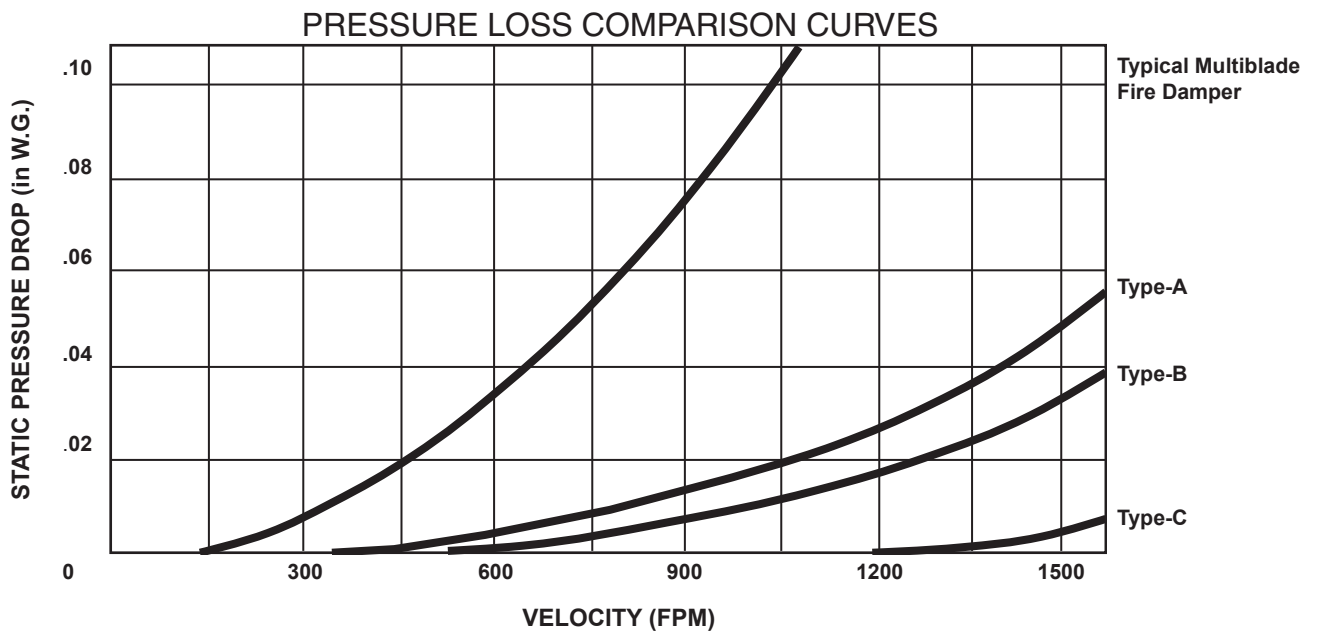
For low and medium velocity duct up to 12” height, use Type-B.

For low and medium velocity ducts over 12” height, use Type-A.

For high velocity duct systems, use Type-C.

Metal-Fab fire damper permits improvement in this guideline. By virtue of our narrow blade profile, we are able to offer greater free area than ordinary Type-A’s. We are also able to offer a less costly fire damper than the wide blade A’s which use more material. In summary, our fire dampers offer the least costly fire damper with the greatest free area.

See chart below



| Size | % Free Area | | Static Pressure Drop at 150 fpm (inches W.G.) | |
|---------|-------------|-----|---|------|
| | A | B | A | B |
| 12 x 12 | 78% | 88% | .048 | .033 |
| 20 x 20 | 83% | 92% | .046 | .030 |
| 30 x 30 | 86% | 95% | .044 | .028 |
| 40 x 40 | 88% | 96% | .041 | .026 |

STANDARD TO METRIC CONVERSIONS:

To convert cubic feet per minute (cfm) to cubic meters per second (m/s) multiply by 0.000 471 947.

To convert feet per minute (fpm) to meters per second (m/s) multiply by 0.005 080.

To convert inches of water to pascals (Pa) or newtons per square meter (N/m²), multiply by 249.082.

To convert square inches to square meters, multiply by 0.000 645 16.

To convert inches to meters, multiply by 0.0254.



FIRE DAMPER SIZING CHART

| Duct Height | | Type-B Damper Height | | Type-C Damper Height | | NOTES |
|-------------|------|----------------------|------|----------------------|------|---|
| Inches | MM | Inches | MM | Inches | MM | |
| 3 | 76 | 5 | 127 | 6 | 152 | #1: Standard dampers are 1/4" smaller than duct size on both height and width. |
| 4 | 102 | 6 | 152 | 7 | 178 | |
| 5 | 127 | 7 | 178 | 8 | 203 | #2: For exact opening sizes see Section 4 of the installation instructions. |
| 6 | 152 | 8 | 205 | 9 | 229 | |
| 7 | 178 | 9 | 229 | 10 | 254 | #3: Maximum single section for Dynamic Dampers - 36"W x 36"H. |
| 8 | 203 | 10 | 254 | 11 | 279 | |
| 9 | 229 | 11 | 279 | 12 | 305 | #4: Type-C damper width equals the width of the duct + 1". |
| 10 | 254 | 12 | 305 | 13 | 33 | |
| 11 | 279 | 13 | 330 | 14 | 356 | #5: Type-C round collars = nominal - 1/4" |
| 12 | 305 | 14 | 356 | 15 | 381 | |
| 13 | 330 | 15 | 381 | 16 | 406 | #6: If UL size restrictions dictate use of multisection dampers, size chart may be affected by various blade cap height change 2" to 3" or 3" to 4" caps - see example. |
| 14 | 356 | 16 | 406 | 17 | 432 | |
| 15 | 381 | 17 | 432 | 18 | 457 | Model MFD, Type-B, Vertical: 40"W x 70"H duct 39-3/4"W x 73-3/4"H multisection damper. One Type-A damper, 39-3/4"W x 35"H on the bottom. One Type-B damper 39-3/4"W x 38-3/4"H on the top. 74"W x 40"H sleeve 70-7/8"W x 40-1/2 H opening. |
| 16 | 406 | 18 | 457 | 19 | 483 | |
| 17 | 432 | 19 | 483 | 20 | 508 | Type-A Example: Duct 40"W x 36"H Damper 39-3/4"W x 35-3/4"H Sleeve 40"W x 36"H Opening 40-1/2"W x 36-1/2"H |
| 18 | 457 | 20 | 508 | 21 | 533 | |
| 19 | 483 | 21 | 533 | 22 | 559 | Type-B Example: Duct 40"W x 36"H Damper 39-3/4"W x 39-3/4"H Sleeve 40"W x 40"H Opening 40-1/2"W x 40-1/2"H |
| 20 | 508 | 22 | 559 | 23 | 584 | |
| 21 | 533 | 24 | 610 | 25 | 635 | Type-C Examples: Duct 40"W x 36"H Damper 40-3/4"W x 40-3/4"H Sleeve 41"W x 41"H Opening 41-1/2"W x 41-1/2"H Collar 39-3/4"W x 35-3/4"H |
| 22 | 559 | 25 | 635 | 26 | 660 | |
| 23 | 584 | 26 | 660 | 27 | 686 | Duct 40" Dia. Damper 40-3/4"W x 44-3/4"H Sleeve 41"W x 45"H Opening 41-1/2"W x 45-1/2"H Collar 39-3/4" Dia. |
| 24 | 610 | 27 | 686 | 28 | 711 | |
| 25 | 635 | 28 | 711 | 29 | 737 | |
| 26 | 660 | 29 | 737 | 30 | 762 | |
| 27 | 686 | 30 | 762 | 31 | 787 | |
| 28 | 711 | 31 | 787 | 32 | 813 | |
| 29 | 737 | 32 | 813 | 33 | 838 | |
| 30 | 762 | 33 | 838 | 34 | 864 | |
| 31 | 787 | 34 | 864 | 35 | 889 | |
| 32 | 813 | 35 | 889 | 36 | 914 | |
| 33 | 838 | 37 | 940 | 38 | 965 | |
| 34 | 864 | 38 | 965 | 39 | 991 | |
| 35 | 889 | 39 | 991 | 40 | 1016 | |
| 36 | 914 | 40 | 1016 | 41 | 1041 | |
| 37 | 940 | 41 | 1041 | 42 | 1067 | |
| 38 | 965 | 42 | 1067 | 43 | 1092 | |
| 39 | 991 | 43 | 1092 | 44 | 1118 | |
| 40 | 1016 | 44 | 1118 | 45 | 1143 | |
| 41 | 1041 | 45 | 1143 | 46 | 1168 | |
| 42 | 1067 | 46 | 1168 | 47 | 1194 | |
| 43 | 1092 | 48 | 1219 | 49 | 1245 | |
| 44 | 1118 | 49 | 1245 | 50 | 1270 | |
| 45 | 1143 | 50 | 1270 | 51 | 1295 | |
| 46 | 1168 | 51 | 1295 | 52 | 1321 | |
| 47 | 1194 | 52 | 1321 | 53 | 1346 | |
| 48 | 1219 | 53 | 1346 | 54 | 1372 | |
| 49 | 1245 | 54 | 1372 | 55 | 1397 | |
| 50 | 1270 | 55 | 1397 | 56 | 1422 | |
| 51 | 1295 | 56 | 1422 | 57 | 1448 | |
| 52 | 1321 | 57 | 1448 | 58 | 1473 | |
| 53 | 1346 | 58 | 1473 | 59 | 1499 | |
| 54 | 1372 | 59 | 1499 | 60 | 1524 | |