

## Application and Design

Model CFSD-23 is a combination fire smoke damper UL classified to protect corridor ceiling penetrations as required by the Uniform Building Code. This model's operational ratings, of up to 3000 fpm and 8 in. w.g., far exceed the air flows and pressure differences normally encountered when installed above grilles or diffusers in corridor ceilings—providing an extra measure of safety. Model CFSD-23 is rated for air flow and leakage in either direction.

## Ratings

### UL 555 Fire Resistance Rating

Fire Rating: 1 Hour  
 Dynamic Closure Rating—Actual limits are size dependent  
 Maximum Velocity: 2500 fpm  
 Maximum Pressure: 8 in. wg

### UL 555S Leakage Rating

Leakage Class: I  
 Operational Rating—Limits are actuator dependent  
 Maximum Velocity: 2500 fpm  
 Maximum Pressure: 8 in. wg  
 Maximum Temperature: 350°F

## Standard Construction

**Frame:** 5 in. x 1 in. galv. steel hat channel with reinforced corners (meets 13 ga. criteria). A low profile head and sill are used on sizes less than 17 in. high to maximize free area and performance.

**Blades:** 16 ga. galvanized steel, reinforced with 3 longitudinal structurally designed vee's.

**Seals:** Extruded silicone rubber blade seals.  
 Flexible stainless steel jamb seals.

**Linkage:** Concealed in jamb.

**Fusible Link:** UL listed 165°F.

**Axles:** 1/2 in. dia. plated steel.

**Bearings:** Bronze sleeve type.

## Size Limitations (see page 3 for specific limitations)

Minimum Size: Configuration 1: 12 in. W x 12 in. H  
 Configuration 2: 8 in. W x 6 in. H  
 Configuration 3: 8 in. W x 6 in. H

Maximum Size: 24 in. W x 24 in. H

## Optional Features:

- Stainless steel bearings
- OCI (Open Closed Indication switches)
- 212°F fuse links (other temperatures available, consult Greenheck)
- TOR (remote override of 165°F closure. Allows damper to perform smoke management functions during a fire emergency.)
- Electric or pneumatic actuators to accomplish smoke management and system functions.
- RRL (Reusable Resetable Link)
- RRL/OCI

## Installation and Maintenance

Refer to Greenheck Installation Instructions: Part #454822

Dampers and their electric/pneumatic actuator(s) must be maintained, cycled, and tested at intervals not less than every six months but in accordance with:

- The latest editions of NFPA 90A, 92A, and UL 864 unless local codes require more frequent inspections.
- Actuator manufacturer recommendations.

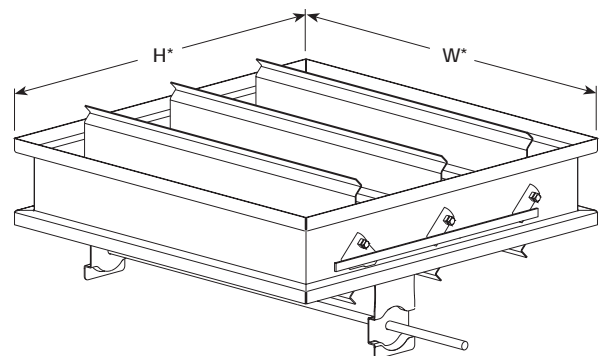
Model CFSD-23 meets the requirements for corridor ceiling dampers, smoke dampers and combination fire/smoke dampers established by:

**National Fire Protection Association**  
 NFPA Standards 90A, 92A, 92B & 101  
**BOCA National Building Codes**  
**ICBO Uniform Building Codes**  
**SBCCI Standard Building Codes**  
**IBC International Building Codes**  
**New York City (MEA Listing #260-91-M Vol. II)**  
**City of Los Angeles**  
**CSFM California State Fire Marshal**  
 Listing #: 3230-0981:105, 3230-0981:106

**"UL CLASSIFIED (see complete marking on product)"**  
**"UL CLASSIFIED to Canadian safety standards (see complete marking on product)"**  
 Standard 555, 555S (Listing #R15439)



Greenheck certifies that the model CFSD-23 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Programs.



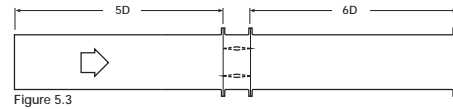
\*W & H dimensions furnished approximately 1/4 in. undersize.  
 (Add sleeve thickness for overall sleeved damper dimension)  
 Right hand drive is shown. Left hand drive is available upon request.

This pressure drop testing was conducted in accordance with AMCA Standard 500 using the three configurations shown. All data has been corrected to represent standard air at a density of .075 lb/ft<sup>3</sup>.

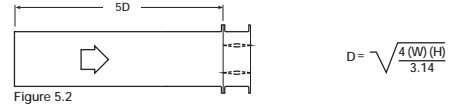
Actual pressure drop found in any HVAC system is a combination of many factors. This pressure drop information along with an analysis of other system influences should be used to estimate actual pressure losses for a damper installed in a given HVAC system.

## AMCA Test Figures

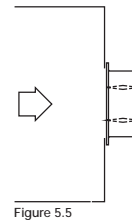
**Figure 5.3** Illustrates a fully ducted damper. This configuration has the lowest pressure drop of the three test configurations because entrance and exit losses are minimized by straight duct runs upstream and downstream of the damper.



**Figure 5.2** Illustrates a ducted damper exhausting air into an open area. This configuration has a lower pressure drop than Figure 5.5 because entrance losses are minimized by a straight duct run upstream of the damper.



**Figure 5.5** Illustrates a plenum mounted damper. This configuration has the highest pressure drop because of extremely high entrance and exit losses due to the sudden changes of area in the system.



## Pressure Drop Calculations

As explained in chapter 32 of the 1997 ASHRAE fundamentals handbook, pressure drop is a function of two variables: pressure velocity and a dimensionless parameter called the pressure loss coefficient ( $C_o$ ).

To calculate the pressure drop across your damper: first select the AMCA test figure shown above that most closely resembles how your damper will be mounted, then substitute the duct face velocity and the appropriate damper pressure loss coefficient ( $C_o$ ) found in the following tables.

**Equation 1:**  $\Delta p = C_o * (V / 4005)^2$

where  $\Delta p$  = pressure drop measured in inches wg  
 $C_o$  = pressure drop coefficient  
 $V$  = Face velocity measured in fpm

## Example

Calculate the pressure drop of a 24 in. x 24 in. damper in a fully ducted configuration (fig 5.3) that sees a face velocity of 1500 fpm.

Using the pressure loss coefficient table corresponding to AMCA fig 5.3 it can be seen that the  $C_o$  value for a 24 in. x 24 in. damper is 0.65. Substituting  $C_o$  and the velocity into equation 1:

$$\Delta p = 0.65 * (1500 / 4005)^2$$

$$\Delta p = 0.091 \text{ in. wg}$$

**Note:** All dimensions shown are in inches.

**Pressure Loss Coefficient ( $C_o$ ) Table for AMCA Test Figure 5.3**

Height	Width				
	8	12	16	20	24
6	11.74	11.74	6.34	6.34	5.14
8	6.34	4.30	4.30	2.41	2.41
12	4.30	2.41	1.69	1.32	1.32
16	2.41	1.32	1.10	0.90	0.90
20	2.41	1.32	1.10	0.90	0.90
24	1.69	1.10	0.90	0.76	0.65

**Pressure Loss Coefficient ( $C_o$ ) Table for AMCA Test Figure 5.2**

Height	Width				
	8	12	16	20	24
6	12.81	12.81	7.23	7.23	6.07
8	7.23	5.25	5.25	3.35	3.35
12	5.25	3.35	2.48	1.96	1.96
16	3.35	1.96	1.62	1.30	1.30
20	3.35	1.96	1.62	1.30	1.30
24	2.48	1.62	1.30	1.07	0.92

**Pressure Loss Coefficient ( $C_o$ ) Table for AMCA Test Figure 5.5**

Height	Width				
	8	12	16	20	24
6	15.45	15.45	8.35	8.35	7.03
8	8.35	6.15	4.36	4.36	4.36
12	6.15	4.36	3.62	3.16	3.16
16	4.36	3.16	2.83	2.49	2.49
20	4.36	3.16	2.83	2.49	2.49
24	3.62	2.83	2.49	2.21	2.02



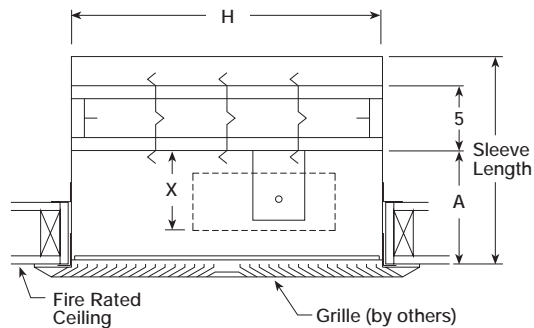
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# CONFIGURATIONS

# SPACE ENVELOPES

CFSD-23 is available in 3 different configurations to accommodate a variety of installation and access requirements. Drawings below illustrate these different configurations and their associated dimensions.

## Configuration #1 – Fire Rated Ceiling Is The Finished Ceiling: Actuator (Internal Only) Accessible Through The Grille



Minimum Size: 12 in. x 12 in.

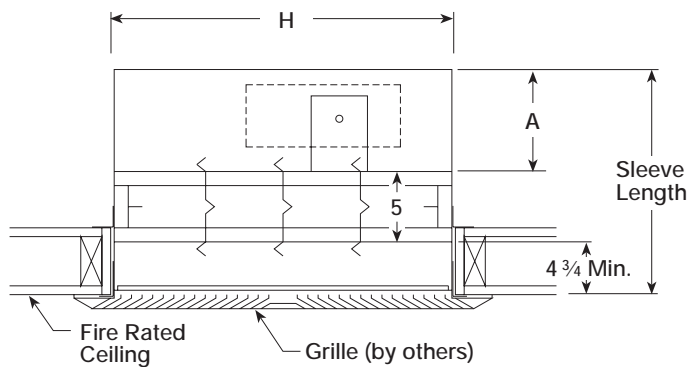
All dimensions shown are in inches.

Actuator Space Envelopes	Honeywell	Siemens
	ML-4115 Series ML-4105 Series	
X Dimension	6.875	7.5
Minimum Width	12	13 (18 w/ options)
Minimum Height	12	18

Sleeve Length = Depth of Grille (or Register)  
 + X (Actuator: see table above)  
 + 5 in. (Damper Width)  
 + 1.25 in. (for duct connection)  
 (round up to nearest length: 14 in., 16 in., 18 in., or 21 in.)

Sleeve Gauge = 16 Ga. or 20 Ga.

## Configuration #2 – Fire Rated Ceiling Is The Finished Ceiling: Actuator (Internal or External) Accessible Above Finished Ceiling

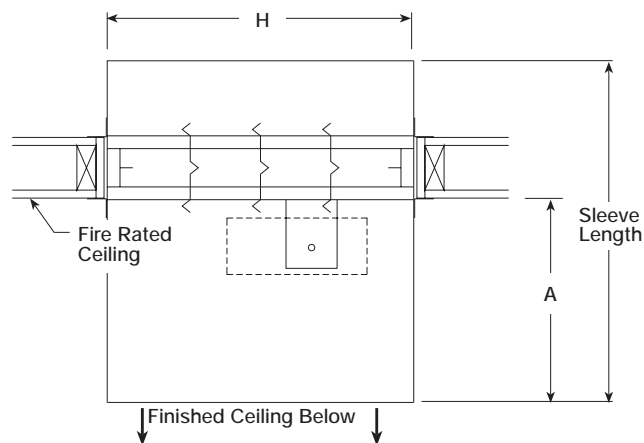


Configuration #2 is for applications where the fire rated ceiling is the finished ceiling but where access to the damper actuator is available from above the finished ceiling. Actuators can be mounted internally or externally. Clearance must be maintained between damper and grille for proper operation.

All dimensions shown are in inches.

	'A' Dimension Standard	Minimum Sleeve Length
With OCI, RRL, or TOR, H dimension less than 10 in.	10 1/4	21
All other dampers	6 1/4	16

## Configuration #3 – Fire Rated Ceiling Is Above The Finished Ceiling: Actuator (Internal or External) Accessible Through Finished Ceiling



Configuration #3 is for applications where the fire rated ceiling is above the finished ceiling. Actuators can be mounted internally or externally.

All dimensions shown are in inches.

	'A' Dimension Standard	Minimum Sleeve Length
With OCI, RRL, or TOR, H dimension less than 10 in.	10 1/4	21
All other dampers	6 1/4	16

Corridor Ceiling Fire Smoke Dampers meeting the following specifications shall be furnished and installed where shown on plans and/or as described in schedules. Dampers shall meet the requirements of the latest edition of NFPA 90A, 92A and 92B.

Dampers shall be tested, rated and labeled in accordance with the latest edition of UL Standards 555 and 555S. Dampers shall be classified by UL under the "Corridor Damper" listing with a UL 555 fire rating of 1 hour. Each damper shall be equipped with a heat responsive device which has been tested and approved for use with the damper assembly in accordance with UL 555. The heat responsive device shall have a temperature rating of (specifier select one of the following) 165°F or 212°F. Dampers shall be UL labeled for use in dynamic systems. The damper shall have a dynamic closure airflow rating equal to or greater than the airflow at the damper's installed location and a dynamic closure pressure rating of 8 in. wg.

Dampers shall have a UL 555S Leakage rating of Class I and a temperature rating of 350°F. Dampers shall have a UL 555S operational airflow rating equal to or greater than the airflow at its installed location and an operational pressure rating of 8 in. wg. Damper actuators shall be factory mounted and qualified for use with the damper in accordance with UL 555S. Damper actuators shall be (specifier select one of the following) electric type for 120 (or 24) volt operation *or* pneumatic type for 20 psi minimum operation. Manufacturers submittal data shall indicate actuator space requirements around the damper.

All UL 555 and 555S Dynamic Closure Ratings, Operational Ratings and Leakage Ratings shall be qualified for airflow and

pressure in either direction through the damper. UL ratings shall allow for mounting damper vertically (with blades running horizontal) or horizontally.

The Damper Manufacturers submittal data shall certify all air performance pressure drop data is licensed in accordance with the AMCA Certified Ratings Program for Test Figures 5.2, 5.3 and 5.5. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D. Dampers shall be labeled with the AMCA Air Performance Seal.

Dampers shall be listed by the California State Fire Marshal. Dampers shall be listed by the New York City Department of Buildings Material and Equipment Acceptance (MEA).

Damper blades shall be 16 ga. galvanized steel 3 Vee type with three longitudinal grooves for reinforcement. Blades shall be completely symmetrical relative to their axle pivot point, presenting identical resistance to airflow and operation in either direction through the damper (blades that are non-symmetrical relative to their axle pivot point or utilize blade stops larger than 1/2 in. are unacceptable).

Damper frames shall be galvanized steel formed into a structural hat channel shape with reinforced corners. Bearings shall be sintered bronze sleeve type rotating in extruded holes in the damper frame. Blade edge seals shall be silicone rubber designed to inflate and provide a tight seal against leakage as pressure on either side of the damper increases. Jamb seals shall be stainless steel compression type.

Basis of design is Greenheck Model CFSD-23.