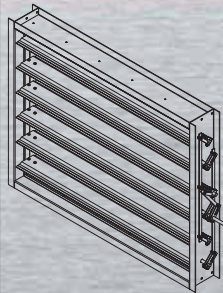
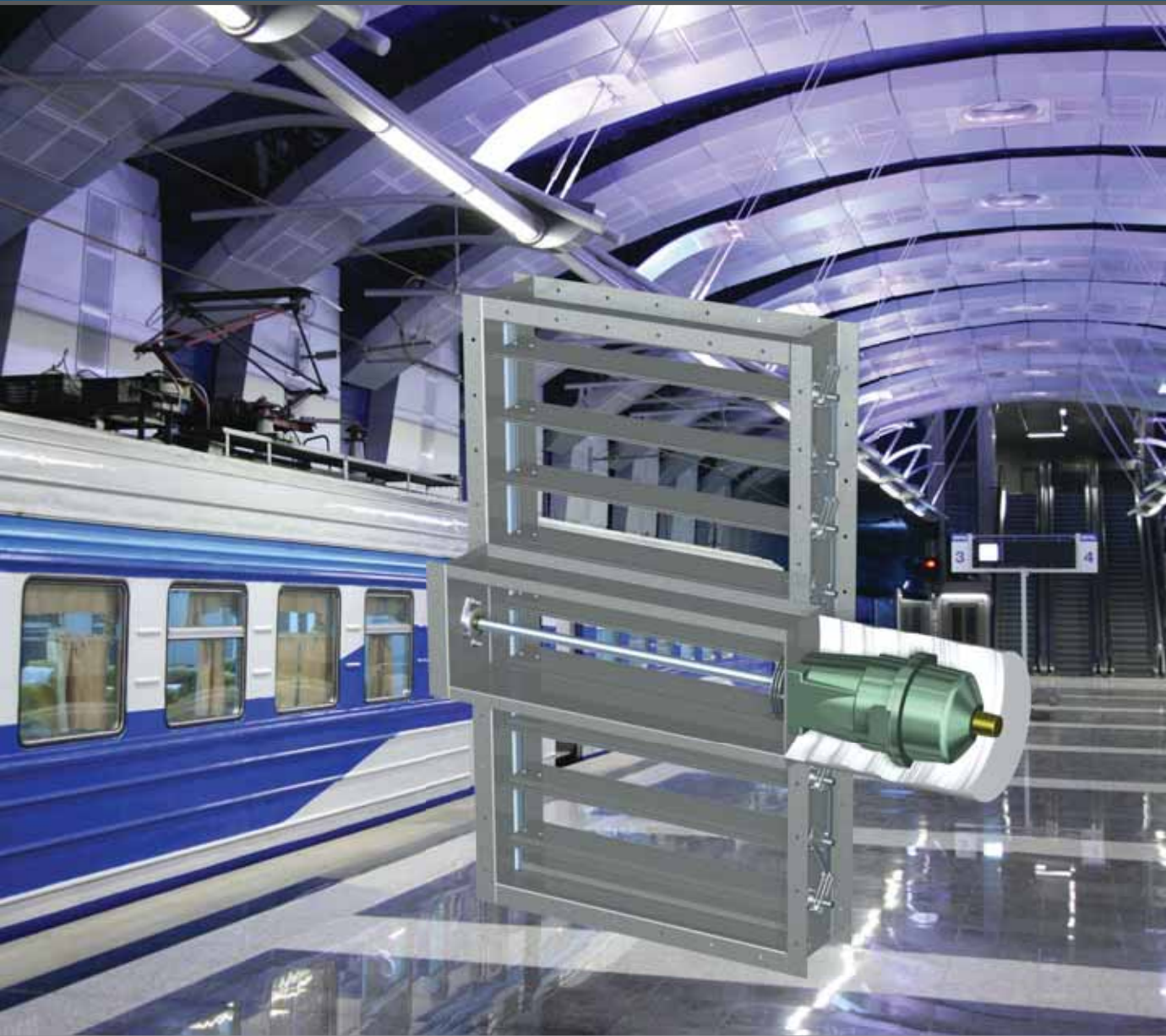


Tunnel Transit Dampers

- Heavy Duty Tunnel Transit
- Life Safety



 **GREENHECK**
Building Value in Air.

November
2017

Applications

Dampers in subway tunnels and transit systems serve three primary functions, depending on design of the ventilation system.



Pressure Equalization

Dampers mounted in the side of the tunnel vent pressurized air in front of a train and reintroduce air as it passes. In single trackways, this air movement can be substantial.

Portal Intake and Exhaust

Dampers at tunnel ends control air intake and emergency smoke exhaust in long tunnels without intermediate air supplies.

Emergency Fire/Smoke Control

Dampers are spaced along the tunnel and can be remotely controlled to (a) pressurize a tunnel section to allow safe egress of train/automobile passengers to an escape tunnel, while blowing fire and smoke from this area, and (b) create negative pressure in the area of the fire to vent smoke and gases.

Tunnel Ventilation Dampers

Underground road and metro tunnels are some of the most difficult environments in the world. High humidity, dust-laden air, and limited access can make the installation and operation of ventilation systems problematic. However, these issues become insignificant in the event of an emergency — the dampers and fans that make up the ventilation system simply must operate when lives are on the line. Greenheck's tunnel specific dampers, the HTD series, were designed to meet these challenges.



Construction

Greenheck's HTD series dampers begin with the same flange mount and channel style frame as the HCD line of products. Three blade profiles are offered: the HTD-630 is a fabricated airfoil blade, the HTD-636 is a fire rated fabricated airfoil blade, and the HTD-640 uses an extruded aluminum blade. Several materials can be used to meet the requirements of each environment, including galvanized steel, 304 or 316 stainless steel, or aluminum.

Reliability

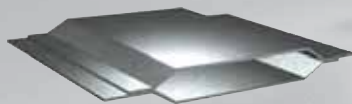
In compliance with NFPA 130 and 502, HTD models are tested in Greenheck's test facility for operation up to two hours at 482°F (250°C). HTD-636 has been tested to 752°F (400°C) and in accordance to British Standard 476 for 2 hours at Warringtonfire, UK. Our engineering staff has the experience to perform additional tests as required including the cyclic pressure test, mimicking the piston effect caused by passing trains.

Maintainability

HTD dampers are designed to keep maintenance procedures simple and low in frequency. The bearings on a HTD damper are 316 stainless sleeve type, requiring no lubrication or maintenance throughout its useful life. Linkages are designed for L/360 deflection and each axle is bolted to the damper blade allowing for easy removal if repair is needed.

Blades

Airfoil blades are constructed of double-skin galvanized or heavy gauge aluminum. The airfoil blade design has a higher strength when compared to a 3V blade. HTD-630 features fabricated airfoil blades. HTD-640 features extruded airfoil blades. HTD-636 features fire rated fabricated airfoil blades.



Fabricated Airfoil



Extruded Airfoil



Fire Rated Fabricated Airfoil

Blade Seals

Greenheck recommends silicone blade seals for low leakage performance.



Bearings

316 stainless steel sleeve bearings are standard on Greenheck's HTD series dampers. Options include a self-aligning bronze sleeve with galvanized steel housing, an external relubricatable ball bearing, or a carbon sleeve bearing.



316 stainless steel sleeve



Self-aligning bronze sleeve



Relubricatable ball bearing



Carbon Sleeve

Bearing Placement



External Bearing

An external bearing placement mounts the bearing directly to the damper's frame and is recommended for continuous operating temperatures of 400°F (204°C) or less. In applications with

elevated airstream temperatures, the heat conducts through the damper frame and into the bearing. If the maximum rated temperature of the bearing is exceeded, the lubricants inside the bearing can leak and the bearing can seize.



Outboard Bearing

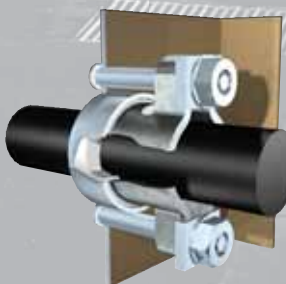
For temperatures above 400°F (204°C), outboard bearing placement locates the bearings away from the hot damper frame.

Jamb Seals

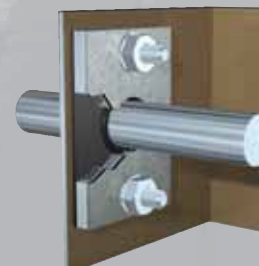
Type 304 or 316 stainless steel jamb seals are used to prevent air from leaking between the ends of each blade and frame.

Axle Seals

To ensure that the medium in the duct stays there, two axle seal options are available. An o-ring seal is ideal for clean air applications. A double-gland stuffing box uses a packing gland impregnated with Teflon® or carbon/graphite for a superior seal. The double-gland stuffing box is recommended for clean air, contaminated air, and high temperatures.



Double-gland stuffing box



O-ring axle seal

Actuators

Greenheck has a variety of actuators available for the HTD series. The common models are:

RCS Sure Series

- 120V or 230V, 50/60 Hz
- NEMA-4, 4X and 7
- Spring return, modulating or power open/close

RCS MAR Series

- 24V, 120V, or 230V, 50/60 Hz
- NEMA-4, 4X and 7
- Modulating or power open/close

Siemens 331-2856

- Pneumatic
- Two position, modulating
- Maximum 25 psi supply

Hytork XL681SRHT

- Pneumatic
- Two position, modulating
- Minimum 80 psi supply

Bray S70 Series

- 120V or 230V, 50/60 Hz
- Manual handwheel override
- Heater, Thermostat, Auxiliary Switches
- NEMA-4 or 4X



RCS Sure 100



RCS MAR 90



Siemens
331-2856



Hytork XL681SRHT



Bray S70 Series

Proximity Switch

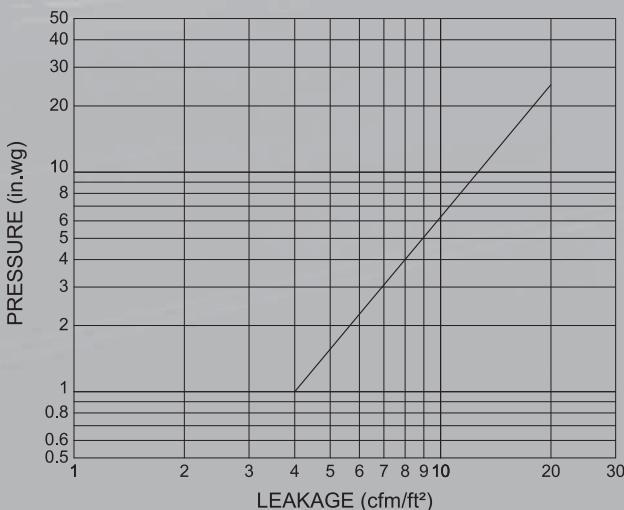
A proximity brand switch is mounted to the damper axle to indicate blade position on the damper. O-rings are used to seal the switch compartment for hazard, corrosion, and leakage protection. This proximity switch is NEMA-4, 4X, and 7 rated and has been tested to a temperature of 250°C for 2 hours of operation.



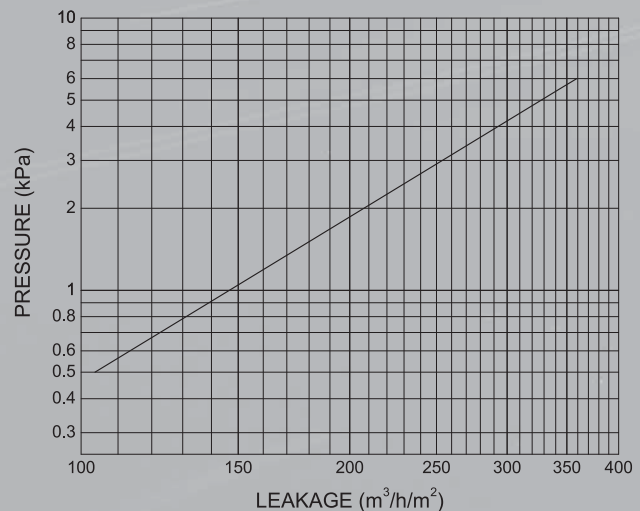
Leakage Data

Damper leakage (with blades fully closed) varies based on the type of low leakage seals applied. Leakage testing was conducted in accordance with AMCA Standard 500-D and is expressed as CFM per sq. ft. of damper face area. All data has been corrected to represent standard air at a density of .075 lb./ft³ (1.2 kg/m³).

HTD-630
Leakage (English version)
42 in. x 42 in. (1067mm x 1067mm) damper



HTD-630
Leakage (Metric version)
1067mm x 1067mm (42 in. x 42 in.) damper



Quick Reference Chart

| | | HTD-630 | HTD-636 | HTD-640 |
|------------------------|--------------------|---|---|--|
| Pressure in. wg (kPa) | Maximum | 24 (6) | 24 (6) | 12 (3) |
| Velocity ft/min. (m/s) | Maximum | 4000 (20.3) | 4000 (20.3) | 4000 (20.3) |
| Leakage | | 8 cfm/sq. ft. @ 4 in. wg (128cmh/sq. m @ 1 kPa) | 8 cfm/sq. ft. @ 4 in. wg (128cmh/sq. m @ 1 kPa) | 8 cfm/sq. ft. @ 4 in. wg (128cmh/sq. m @ 1 kPa) |
| Blade Deflection | Standard | L/180 | L/180 | L/180 |
| | Optional | L/360 | L/360 | L/360 |
| Frame | Galvanized Steel | ● | ● | ● |
| | 304SS | ○ | ○ | ○ |
| | 316SS | ○ | ○ | ○ |
| Frame Gauge | 14 ga. (2mm) | ○ | ○ | ○ |
| | 12 ga. (2.7mm) | ● | ● | ● |
| | 10 ga. (3.5mm) | ○ | ○ | ○ |
| | 1/4 in. (6mm) | ○ | ○ | ○ |
| Frame Depth | 8 in. (203mm) | ○ | - | ○ |
| | 10 in. (254mm) | ○ | - | ○ |
| | 12 in. (305mm) | ● | ● | ● |
| Blade Profile | Fabricated Airfoil | ● | - | - |
| | Extruded Airfoil | - | - | ● |
| | Fire Rated Airfoil | - | ● | - |
| Blade Material | Galvanized Steel | ● | ● | - |
| | Aluminum | - | - | ● |
| | 304SS | ○ | ○ | - |
| | 316SS | ○ | ○ | - |
| Blade Thickness | 16 ga. (1.5mm) | ○ | ● | - |
| | 0.080 (2mm) | - | - | ● |
| | 14 ga. (2mm) | ○ | ○ | - |
| | 12 ga. (2.7mm) | ● | ○ | - |
| | 10 ga. (3.5mm) | ○ | ○ | - |
| Blade Seals | Silicone | ● | ● | ● |
| | Stainless Steel | ○ | - | - |
| Jamb Seals | Stainless Steel | ● | ● | ● |
| Certifications | Operation | 250°F (121°C) Continuous; 482°F (250°C) for 2 hours | 752°F (400°C) for 2 hours | 250°F (121°C) Continuous; 482°F (250°C) for 1 hour |
| | Standards | NFPA 130, 502; UL 555S | NFPA 130, 502; UL 555S; BS476 | NFPA 130, 502; UL 555S |
| | Fatigue Cycles | 8 million reverse cycles at 24 in. wg (6 kPa) | | - |

● = Standard ○ = Optional

NFPA 130

NFPA 130 is the National Fire Protection Agency standard for fixed guideway transit and passenger rail systems. This standard covers fire protection requirements for underground, surface, and elevated fixed guideway transit and passenger rail systems, including trainways, vehicles, and vehicle maintenance and storage areas including areas regarding life safety. Greenheck's tunnel transit dampers are designed to meet the rigorous requirements of NFPA 130 on the dampers and actuators.



NFPA 502

NFPA 502 is the National Fire Protection Agency standard for fire protection and fire life safety requirements for limited access highways, road tunnels, bridges, elevated highways, depressed highways, and roadways that are located beneath air-right structures. This standard establishes minimum requirements for each of the identified facilities. Greenheck's tunnel transit dampers are designed to meet the rigorous requirements of NFPA 502 on the dampers and actuators.

BS476 Part 20

British Standard, BS476 Part 20, is a fire test method for building materials and structures that has been historically used throughout the world to evaluate the fire resistance performance of a damper in the event of a fire. The damper is mounted to a fire test chamber and burned up to 2 or 4 hours of operation. The test report, provided by a testing authority such as Warringtonfire, signifies that the damper can resist a fire up to the hours indicated.



New York City Transit Authority (NYCTA)

Greenheck also has a damper design that has been approved for the stringent specification requirements of the New York City Transit Authority. Over the years, NYCTA has developed very robust and stringent specification requirements for their dampers. These specifications include for all stainless steel construction, including 3/16 inch thick damper frames. It also requires special actuator requirements, factory supplied junction boxes and wiring, debris screens and special independent monitoring limit switches. Dampers are maintenance free in many respects, but very maintenance friendly where needed.

UL 555

UL 555 is the standard that governs fire dampers which are intended for use where air ducts penetrate or terminate at openings in walls or partitions, in air transfer openings in partitions, and where air ducts extend through floors as specified in the Standard for Installation of Air-Conditioning and Ventilating Systems, NFPA 90A. In a fire emergency the fire damper is designed to close and prevent the spread of fire from one side of the wall or partition to the other. Testing includes cycling, salt spray, dust loading, dynamic closure, fire endurance, and hose stream.



UL 555S

UL 555S is the standard that governs smoke dampers which are intended to prevent the spread of smoke when HVAC systems shutdown during a fire emergency and those which control the movement of smoke within a building when the HVAC system functions in a smoke control mode. Leakage rated dampers are intended for installation in accordance to NFPA 90A. Testing includes salt spray, dust loading, cycling, temperature degradation, operation while under heated airflow, and elevated temperature leakage.

AMCA

The AMCA Certified Rating Program seal assures you that a product line has been tested to the appropriate AMCA standards in accordance with a legal license agreement and that the manufacturer's catalogued certified ratings have been submitted to AMCA International for approval prior to publication.



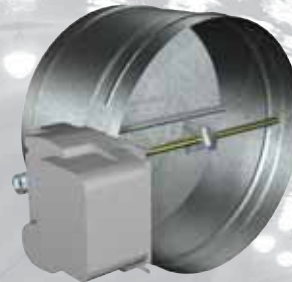
Combination Fire Smoke Dampers

A combination fire smoke damper performs the function of both a fire damper and a smoke damper. Combination fire smoke dampers must be qualified under UL Standard 555 as a fire damper and UL Standard 555S as a smoke damper. The combination fire smoke damper is qualified to 4000 ft/min. (20.3 m/s) and 6 in. wg (1.5 kPa) for operation and dynamic closure in emergency fire smoke situations.

Model FSD-211 has been tested in accordance with BS476 to 4 hours at Warringtonfire, UK, and are approved for fire partitions of 4 hours or less where British Standards are required.

Standard Construction Features

- Galvanized steel
- Fabricated to your size requirements
- UL 555 and UL 555S Classified
- BS476 approved
- 165°F (74°C) RRL
- Horizontal or vertical mount
- Factory furnished sleeves
- Blade styles
 - 3V
 - Airfoil
 - Round



Dynamic Fire Dampers

Dynamic fire dampers are approved for use in walls, floors and partitions. The dampers must be qualified under UL Standard 555 as a fire damper. Dynamic fire dampers, DFD series, are qualified up to 4000 ft/min. (20.3 m/s) and up to 10 in. wg (2.4 kPa) for operation and dynamic closure in emergency fire situations.

DFD-150 and DFD-210 have been tested in accordance with BS476 to 4 hours at Warringtonfire, UK, and are approved for fire partitions of 4 hours or less where British Standards are required.

Standard Construction Features

- Galvanized steel
- Fabricated to your size requirements
- UL 555
- Horizontal or vertical mount
- Blade styles
 - Curtain style blade
 - 3V
 - Round



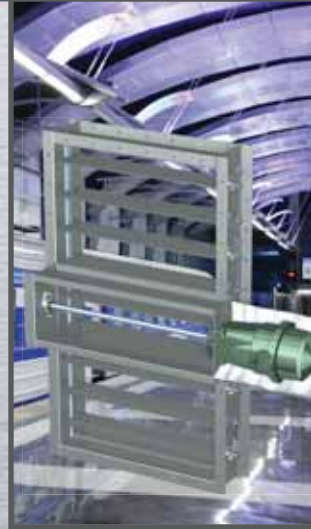
Greenheck Fan Corporation certifies that the models CFSD-211, 212; DFD-210; DFDAF-310; SEDFD-210; FSD-211, 212, 213, 311, 311M, 312, 312M, 331; SSFSD-211; SEFSD-211; OFSD-211, 212, 311, 312; SMD-201, 202, 203, 301, 302, 301M, 302M; SESMD-201 and SSSMD-201 shown herein are licensed to bear the AMCA Seal. 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. The AMCA Certified Ratings Seal applies to air performance only.

The Greenheck Difference

Greenheck dampers bring the same quality engineering and manufacturing that has earned Greenheck its position as an industry leader. Aggressive research and development keeps Greenheck a major player in the damper and louver industry. Greenheck has the most UL Classified dampers and largest selection of AMCA Licensed dampers and louvers in the industry.

In-House Testing

State-of-the-art laboratory and testing facilities have always been important to Greenheck's continuing business success. A laboratory facility devoted exclusively to development and testing of damper and louver related products for testing to the latest versions of AMCA, ANSI, ASHRAE, UL, Miami-Dade County, and other industry standards of performance.



Enjoy Greenheck's extraordinary service, before, during and after the sale.

Greenheck offers added value to our wide selection of top performing, energy-efficient products by providing several unique Greenheck service programs.



- Our **Quick Delivery** Program ensures shipment of our in-stock products within 24 hours of placing your order. Our **Quick Build** made-to-order products can be produced in 1-3-5-10-15 or 25-day production cycles, depending upon their complexity.
- Greenheck's free **Computer Aided Product Selection** program (CAPS), rated by many as the best in the industry, helps you conveniently and efficiently select the right products for the challenge at hand.
- Greenheck has been **Green** for a long time! Our energy-saving products and ongoing corporate commitment to sustainability can help you qualify for LEED credits.
- Our **3D service** allows you to download at no charge lightweight, easy-to-use AutoDesk® Revit® 3D drawings for many of our ventilation products.

Find out more about these special Greenheck services at greenheck.com

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.



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