RUSKIN®

Specified by Many — Equaled by None

FIRE & SMOKE DAMPERS

Selection and Application Manual

Introduction

Ruskin believes it is important to understand the needs of our customers and to provide them with answers to their fire, smoke and combination fire/smoke damper questions. The purpose of this publication is to answer some of those questions. The information provided herein serves as a guide to understanding the application of fire, smoke and combination fire/smoke dampers. This manual includes general information, in addition to important points to consider when designing a system or writing a specification.

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Definitions

Actuator – An electric or pneumatic device which drives the damper open or closed. It is often referred to as a damper operator or damper motor and is integral to the proper operation of the damper. Actuators used with fire/smoke dampers are spring return type which spring return to their normal position when power is removed.

Blade Axle – A shaft that supports the blade and extends through the frame.

Blade Edge Seal – A strip of material applied to the edge of the blade to minimize air leakage between blades. Blade edge seals are typically made of flexible silicone.

Blade Stop – A metal strip attached to the top and bottom parts of the frame that provides a surface for the blades to stop against in the closed position. They also minimize air leakage at the top and bottom of the frame.

Ceiling Damper – A device used to protect HVAC openings in fire rated horizontal ceiling assemblies. A ceiling damper closes automatically to restrict the passage of flame and heat.

Combination Fire/Smoke Damper – A device that functions as both a fire damper and a smoke damper.

Corridor Damper – A fire/smoke damper intended for use where air ducts penetrate or terminate at horizontal openings in the ceilings of interior (tunnel) corridors.

Drive Blade – The blade which is connected to the jackshaft and is the source of actuation for the other blades. Actuation force is transmitted through the jackshaft to the drive blade and through the linkage to the other blades.

Electric Fuse Link (EFL) – An electric, resettable, quick release device which allows the damper to close upon a rise in temperature. The EFL replaces “old fashioned” fusible rods and is used in conjunction with an electric actuator.

EP (Electro-pneumatic) Switch – A device which allows electricity to control a pneumatic actuator. EP’s are required when utilizing pneumatic actuators with TS150’s or ELF’s.

Fire Damper – A device used to restrict the passage of flame through the ductwork of an air system. A fire damper is installed in a fire rated wall or floor and closes automatically to maintain the integrity of that partition.

Jackshaft – A ½" solid steel rod or 1" hollow steel tube used to connect the actuator to the drive blade on fire/smoke dampers. A jackshaft is also used to connect multiple section dampers together so they work as a single unit.

Jamb Seal – A strip of material applied to the gap between the damper frame and the end of the blade which minimizes air leakage through that area. Jamb seals are normally compressible stainless steel.

Linkage – Steel bars or rods and axles used to interconnect all the blades of a damper. The linkage is either concealed within the damper frame or exposed to the airstream.

Mullion – A device used to subdivide openings in fire walls when the opening is larger than the maximum size of the damper. Mullions are application specific and can only be used as approved.

Pneumatic Fuse Link (PFL) – A pneumatic, quick release device which allows the damper to close upon a rise in temperature. The PFL is used in conjunction with a pneumatic actuator.

Position Indication Switch – A device that provides the ability to check the damper blade position from a remote location.

Sleeve – A steel box, open on both ends, which encloses a fire damper. Fire and fire/smoke dampers require sleeves in order to be installed properly.

Smoke Damper – A device used:

1. to restrict the spread of smoke in HVAC systems which shut down in the event of a fire or
2. to control the movement of smoke in a building when the HVAC system is operational in engineered smoke control systems.

Transition – A round or oval duct connection which allows a rectangular damper to fasten to a round or oval duct.

Underwriters Laboratories Standard 555 and 555S

Underwriters Laboratory Inc. (UL) is an independent, not-for-profit, non-governmental organization that tests thousands of types of products, materials, constructions and systems in effort to reduce injury, loss of life and property damage. UL listed products have demonstrated the ability to meet the stringent requirements of test standards which ensure performance and reliability.

UL555 FIRE DAMPER TEST

The UL555 Fire Damper test standard originated in 1966 to ensure fire dampers would function in fire conditions. The original standard has been revised several times to address new discoveries in fire protection and developing technology since 1966. The latest edition requires each fire rated damper to pass the following tests:

- **Fire Endurance/Hose Stream Test**

  The damper is exposed to a prescribed and regulated fire for either 1½ or 3 hours to determine the hourly classification of the damper assembly. Immediately after the fire exposure, the damper is hosed down with a heavy stream of water. This provides an extreme shock to the damper ensuring it will withstand the severity of all fire conditions.

- **Operational Reliability Test**

  Requires the damper to be cycled open and closed 250 times for dampers without actuators and 20,000 times for dampers with actuators. The damper is fouled with salt and dust prior to the test to simulate the most severe fire conditions.

- **Dynamic Closure Test**

  The damper is subjected to heated air flows and pressures and must demonstrate the ability to close against a minimum velocity of 2400 fpm and 4.5 in. w.g. pressure. Successful closure results in a rating of 2,000 fpm and 4 in. w.g. pressure. Higher airflow ratings of 3,000 fpm (tested to 3,400 fpm) and 4,000 fpm (tested to 4,400 fpm) are available. Higher pressure ratings of 6 in. w.g. (tested to 6.5 in. w.g.) and 8 in. w.g. (tested to 8.5 in. w.g.) are also available.

UL555S LEAKAGE RATED TESTING

In September 1983, UL issued UL555S, the test Standard for Smoke Dampers. Realizations that smoke causes more fatalities than fires led to its development. The latest edition requires each smoke rated damper to pass the following tests:

- **Cycling Test**

  Like a fire damper, the smoke damper is fouled with salt and dust. The damper/actuator assembly is then cycled (20,000 times for two-position operation and 100,000 times for modulating operation) to ensure satisfactory operation.

- **Temperature Degradation Test**

  The damper/actuator assembly is exposed to elevated temperatures for 30 minutes and then immediately cycled three times.

- **Operation Test**

  The damper/actuator assembly is exposed to heated (250ºF or 350ºF) airflow (minimum 2,400 fpm and 4.5 in. w.g. pressure) for 15 minutes. After 15 minutes, the damper is closed and reopened. The damper is allowed to cool and the open/close procedure is repeated three times at ambient temperature. The heat is re-introduced and one additional cycle is conducted at the heated airflow. Successful operation at the minimum airflow results in a rating of 2,000 fpm and 4 in. w.g. pressure. Higher ratings are available (refer to UL555 Dynamic Closure Test for details).

- ***Leakage Test***

  The leakage test is a continuation of the operation test and is conducted on the following representative sizes:

  - minimum width by maximum height
  - maximum width by minimum height
  - maximum width by maximum height

  Leakage tests are conducted at a minimum of 4" w.g. pressure differential and measured in cfm per square foot of damper area. Based on the test results, a smoke damper receives a leakage rating from Class 1 (lowest leakage) to Class 3 (highest leakage).

UL555C CEILING FIRE DAMPER TEST

The UL555C Ceiling Damper Test Standard (First Edition) was introduced in 1992. It was previously part of UL555.

- ***Fire-Endurance/Heat Radiation Test***

  The damper is exposed to a controlled fire test that follows a Time-Temperature Curve. The evaluation monitors amount of heat transfer through the ceiling membrane and compares the performance to rated assemblies incorporating hinged door sheet metal type dampers. The test continues until failure or until ceiling damper has withstood the test conditions for a period of time equal to the maximum fire resistance rating of the assembly.

- ***Operational Reliability Test***

  This test evaluates the closing reliability of the damper on the basis that air-conditioning and ventilation systems are automatically shut down during the event of a fire. Damper must demonstrate that performance is not impaired after repeated operation from open to close position.

- ***Dust & Salt-Spray Test***

  This damper is subjected to dust and salt spray environment for a period of time. After full exposure damper is tested for closing.

CODES AND STANDARDS

A code is a set of requirements written with the intent of becoming law. A code becomes law when it is adopted by a governing body or authority having jurisdiction. A standard, on the other hand, is not written with the intent of becoming law, even though it may be adopted as law or become part of a code. A standard is written to define a level of performance and may include different tests which must be passed in order to comply with the standard.

There are currently two active building codes in the United States. They are:

- The International Building Code (IBC), published by the International Code Council (ICC)
- NFPA 5000 published by the National Fire Protection Association

Of the two active codes, the IBC has been adopted by the most jurisdictions throughout the United States.

NATIONAL FIRE PROTECTION ASSOCIATION

NFPA is a non profit organization which promotes fire safety. NFPA publishes numerous codes and standards developed through research. The codes and standards they publish provide a basis for model building code requirements and sometimes actually become a part of the codes. Some of the more recognized codes and standards they publish are:

- NFPA101 — Life Safety Code
- NFPA90A — Standard for the Installation of Air-Conditioning and Ventilating Systems
- NFPA92A — Recommended Practice for Smoke-Control Systems
- NFPA92B — Smoke Management Systems in Malls, Atria and Large Areas

CODE REQUIREMENTS FOR THE USE OF FIRE SMOKE DAMPERS

The International Building Code refers to the following types of fire rated construction:

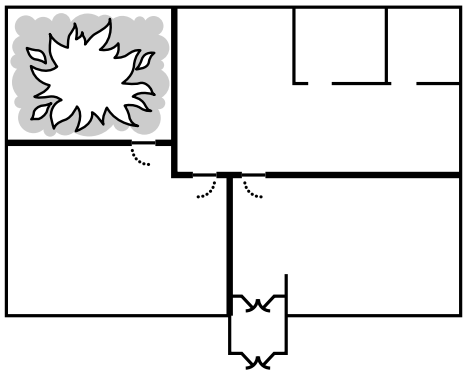
- Fire Walls
- Fire Barriers
- Fire Partitions
- Smoke Barriers
- Smoke Partitions

Fire walls and barriers have higher fire resistance ratings than fire partitions. Fire partitions and smoke barriers have 1 hour fire resistance ratings while smoke partitions are not required to have a fire resistance rating. Generally speaking, fire dampers are required where ducts penetrate fire barriers and smoke dampers are required where ducts penetrate smoke barriers. Combination fire smoke dampers are required where ducts penetrate barriers serving both purposes like shaft enclosures.

DAMPER APPLICATION AND SELECTION

FIRE DAMPER APPLICATION AND SELECTION

Compartmentation is an integral component of building design and construction. Compartments are formed by subdividing each floor with numerous fire restrictive partitions and/or walls. In the event of a fire, these fire "boundaries" will restrict the spread of flame and heat. Containing the fire to the compartment of origin minimizes life and property loss and helps firefighters extinguish the blaze.



Fire rated partitions contain fire damage to the compartment of fire origin.

A common way for fire to spread from one compartment to another is through the HVAC ductwork; therefore fire dampers are installed in the plane of the fire wall to protect these openings. Upon detection of heat, the fusible link (usually rated for 165^{o}F or 212^{o}F) melts closing the fire damper blades and blocking the flame from penetrating the partition into the adjoining compartment.

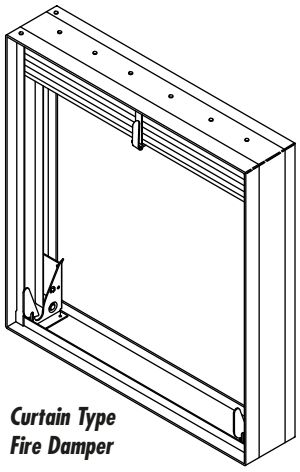
There are three significant considerations when selecting and applying a fire damper:

- ***Hourly Fire Resistance Rating***
  The hourly rating comes from the UL555 Fire Endurance Test. It indicates how long a damper will block a fire. There are typically two ratings for fire dampers in the United States, 1½ and 3 hours. Any fire resistant barrier with less than a 3 hour rating requires a 1½ hour rated fire damper. Any fire resistant barrier with a 3 hour or more rating requires a 3 hour rated fire damper. These requirements are based on recommendations made by the National Fire Protection Association (NFPA).

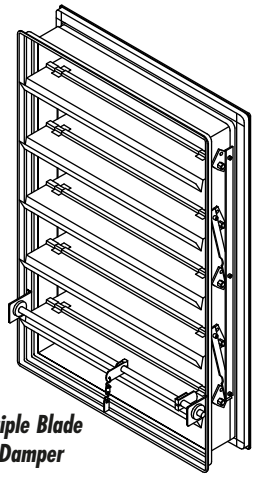
> ***NFPA90A***
>
> Fire dampers used for the protection of openings in walls, partitions, or floors with fire resistance ratings of less than 3 hours shall have a 1½ hour fire protection rating in accordance with UL555, Standard for Safety Fire Dampers.
>
> Fire Dampers used for the protection of openings in walls, partitions, or floors having a fire resistance rating of 3 hours or more shall have a 3 hour fire protection rating in accordance with UL555, Standard for Safety Fire Dampers.

- ***Airflow Closure Rating***

  Fire dampers are rated for either static or dynamic HVAC systems. Static fire dampers have not been tested for closure under airflow and therefore can only be applied in HVAC systems that are designed to shut down in the event of a fire. Dynamic fire dampers have been tested for closure under airflow and carry both an airflow velocity (FPM) and pressure differential rating. The minimum airflow and pressure differential rating of dynamic fire dampers is 2,000 fpm and 4 in. w.g. Ratings of 3,000 fpm or 4,000 fpm and 6 in. w.g. or 8 in. w.g. are available. A dynamic fire damper should be selected based on the conditions it will operate in after installation.



Curtain Type Fire Damper



Multiple Blade Fire Damper

- ***Blade Design***

  Fire dampers are manufactured as two basic types. They are curtain type and multiple blade type. Multiple blade dynamic fire dampers can be more "user friendly" than curtain type dynamic fire dampers. In most cases, they are easier to test and re-open, and can currently be manufactured in larger sizes. The only disadvantage to using multiple blade dynamic fire dampers is the blades are in the air stream. The affect that they can have on performance must be considered.

SMOKE DAMPER APPLICATION AND SELECTION

Smoke dampers have two general applications:

1. Part of a "Passive Smoke Control System" where they simply close upon detection of smoke preventing the circulation of air and smoke through a duct or a ventilation opening.
2. Part of an "Engineered Smoke Control System" designed to control smoke migration using walls and floors as barriers and fans to create pressure differences. Pressurizing the areas surrounding the fire prevents the spread of smoke into other areas.

Smoke dampers are motorized with either an electric or pneumatic actuator. They are controlled by a smoke or heat detector signal, fire alarm or some other building control system.

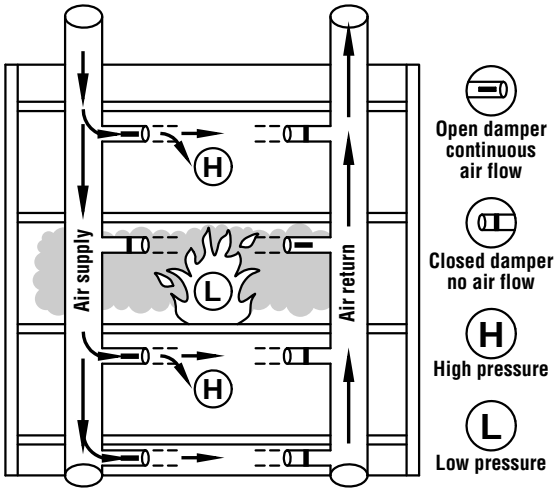
Smoke dampers are qualified under UL Standard 555S "Smoke Dampers" and are always supplied with the appropriate factory mounted actuator and UL label. There are four significant considerations when selecting and applying a smoke damper:

- ***Leakage Rating***

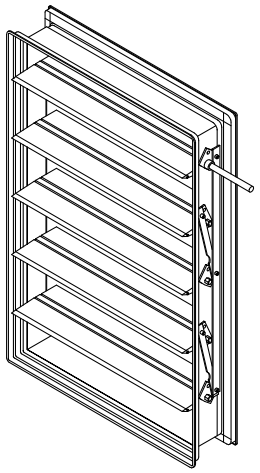
  Class 1 (lowest leakage), 2 or 3 (highest leakage).

- ***Elevated Temperature Rating***

  250ºF, 350ºF



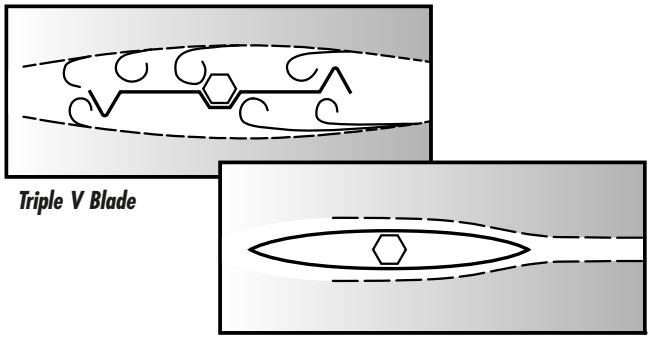
Engineered Smoke Control System – Smoke is contained to the fire zone by higher pressures in adjacent zones.



Smoke Damper

- ***Operational Rating***

  UL555S requires all smoke dampers to be rated for operation with an approved actuator at a minimum airflow velocity of 2000 fpm when open and against a minimum pressure of 4 inches of w.g. during closure. Ratings of 3,000 fpm or 4,000 fpm and 6 in. w.g. or 8 in. w.g. may also be available. Smoke dampers should be specified based on the conditions they will be exposed to in their application.



Triple V Blade

Airfoil Blade

- ***Blade Design***

  There are, essentially, two types of blades: triple vee-groove and airfoil. Triple vee-groove blades are used in HVAC systems with velocities up to 2,000 fpm. Airfoil blades are used in HVAC systems with velocities greater than 2,000 fpm. Airfoil blade design advantages include lower resistance to airflow, lower pressure drop and less turbulence.

COMBINATION FIRE/SMOKE DAMPER APPLICATION AND SELECTION

A combination fire/smoke damper functions as both a fire damper and a smoke damper in a single unit. HVAC system designers often combine smoke barriers and fire rated partitions requiring both a fire damper and a smoke damper to be installed in the same location. In this situation, a combination fire/smoke damper is recommended. This type of damper must meet the requirements of both UL Standard 555 as a fire damper and 555S as a smoke damper.

The things to consider when selecting and applying a combination fire smoke damper are the same as those for fire dampers and smoke dampers. They are:

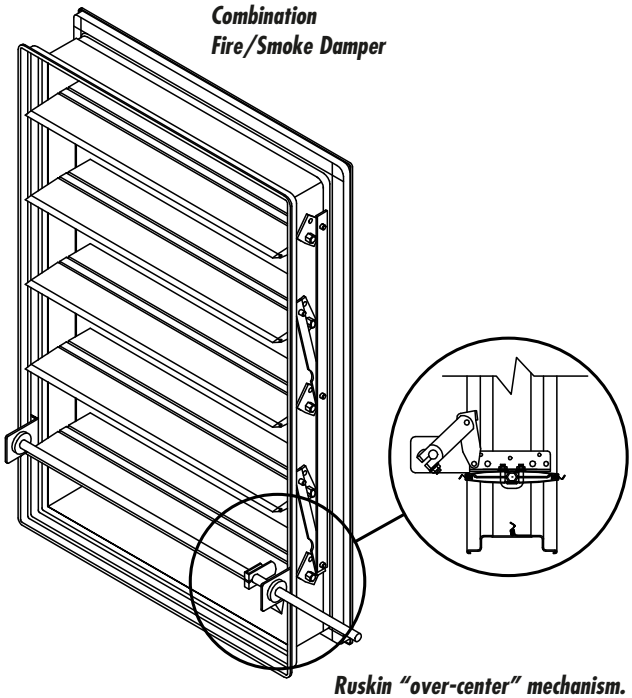
- Hourly Fire Resistance Rating
- Leakage Rating
- Elevated Temperature Rating
- Operational Rating
- Blade Design

Refer to the previous application and selection sections for more information.

IMPORTANT NOTE

Some combination fire/smoke dampers (single section sizes) use fusible links and springs which melt and cause the damper to close instantaneously. Ruskin utilizes quick acting electric and pneumatic fuse links and an "over-center" mechanism (on all sizes) which allows the damper to close and lock in a controlled manner via the actuator spring. This prevents costly duct disruption that can be caused by the damper closing instantaneously.

Combination Fire/Smoke Damper



Ruskin "over-center" mechanism.

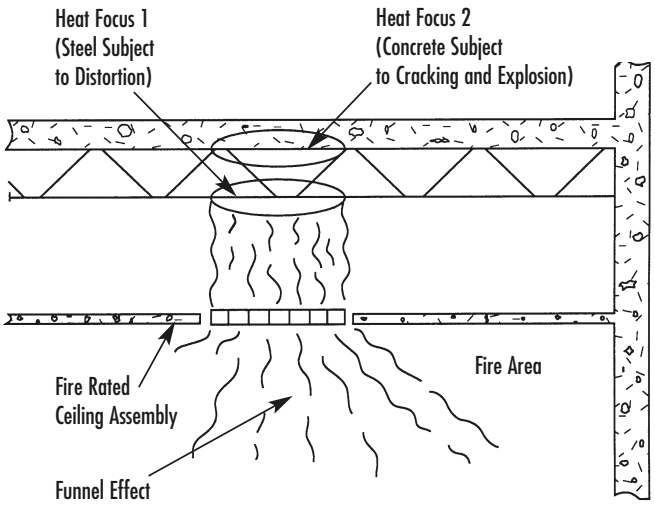
CEILING DAMPER APPLICATION AND SELECTION

Ceiling fire dampers are also known as “Radiation” dampers and that describes what makes them different from standard fire dampers. They are installed on grilles and diffusers. Should a fire occur they close the openings created by these devices to protect the structure above from excessive heat and subsequent collapse by providing a fire and heat barrier between the fire area and the structural floor. The test standard by which they are evaluated is UL555C.

The process of selecting a ceiling fire damper involves one major consideration:

- Floor/ceiling or roof/ceiling assembly design

Ceiling fire dampers are not assigned hourly ratings themselves. They are listed for use as a component in assemblies tested with air inlet/outlet opening in the membrane. These assemblies have a specific hourly fire resistance rating, and ceiling fire dampers can normally be used in any assembly with a restrained or unrestrained rating of 3 hours or less.



IMPORTANT NOTE

Problems arise when holes are cut to accommodate air inlet/outlet devices in ceilings tested without any openings. Ceiling fire dampers should be installed to close the openings but because no damper was tested with the ceiling, it is “smart” to install ceiling fire dampers that provide maximum protection. Ceiling fire dampers that provide maximum protection are normally those tested as components of ceilings constructed from wood members.

ACTUATOR SELECTION AND MOUNTING

Selecting the appropriate actuator to drive a smoke or fire/smoke damper open and closed is an important part of the damper selection process. Qualifications of the damper under UL Standards 555 and 555S require testing both the damper and its installed actuator. This limits the approved actuators that can be used on smoke and fire/smoke dampers. Actuators must be furnished by the damper manufacturer and installed at the damper factory.

IMPORTANT NOTE

Actuators utilized on fire/smoke dampers may be required to hold the damper open for prolonged periods of time. UL does not test for prolonged periods of holding, therefore it is important to choose a damper which utilizes an actuator rated for holding periods of at least 6 months and 1 year if possible.

ACTUATOR TYPE SELECTION

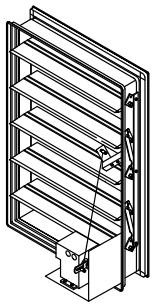
Actuators may be electric or pneumatic based on the control system that will operate the dampers and any other appropriate factor. Pneumatic actuators generally have a lower cost than electric, however they require 25 to 30 psi control air to each actuator location. Electric actuators are available in 24VAC, 120VAC and 230VAC at 60Hz or 50Hz. Actuators for modulating control are also available.

ACTUATOR MODEL SELECTION

Each specific actuator model has a series of maximum damper size ratings depending on the damper model, airflow velocity through the open damper, and the maximum pressure differentials that will build up across the closed damper. Typically actuators for damper applications are selected based on the number of square feet of damper they will be controlling.

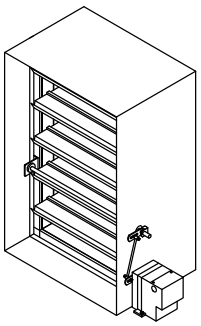
ACTUATOR MOUNTING OPTIONS

Actuators are commonly mounted external to the damper (out of the air stream), however, internally mounted (in the air stream) actuators are sometimes acceptable, particularly on large multiple section dampers. External mounting is recommended because the actuator is more accessible making it easier to test and maintain.



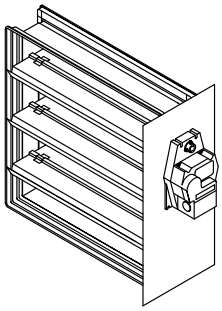
- **Internal Mounting**

  Actuators can be internally mounted to accommodate installations where space constraints prevent the use of the more desirable external installation. Internally mounted actuators are more difficult to test and maintain, reduce the free area in the damper creating a higher pressure drop and may be exposed to temperatures exceeding the elevated temperature rating in the event of a fire.



- **External on a Sleeve**

  All combination fire/smoke dampers require a sleeve for proper installation. Typically the manufacturer supplies the damper complete with a sleeve with the actuator mounted on the outside of the sleeve.



- **External on a Sideplate**

  Smoke dampers do not require a sleeve for proper installation. If a sleeve is not desired, the actuator can still be mounted externally on a sideplate. For installation, a slot the width of the sideplate is cut into the duct and the sideplate then fills that opening.

SLEEVE REQUIREMENTS

UL requires all fire and combination fire/smoke dampers be mounted in a steel sleeve of the appropriate gage and length prior to installation. The damper/sleeve assembly is then installed in the fire wall or floor opening with retaining angles attached to the sleeve. The damper assembly then becomes part of the wall/floor and the duct is connected to the end of the damper sleeve.

SLEEVE LENGTH

The length of the damper sleeve is determined by the thickness of the wall/floor it will be installed in as well as the actuator, accessories and options on the damper. UL imposes the following regulations on sleeve length:

1. The sleeve may not extend more than 6" beyond the wall/floor on the non-actuator/non-access door equipped side.
2. The sleeve may not extend more than 16" beyond the wall on the actuator/access door equipped side.
3. The sleeve must extend far enough beyond the wall to install the necessary retaining angles (usually 1½") and duct-to-sleeve connections (minimum of 1½").
4. The sleeve must extend far enough beyond the wall/floor to properly install the actuator and any required options.

WALL THICKNESS	MINIMUM SLEEVE LENGTH REQUIRED
4" to 6"	17" to 20"
7" to 10"	20" to 24"
11" to 13"	24" to 28"

SLEEVE THICKNESS

Sleeve gauge or thickness is determined by the size of the damper and the gauge of the duct to which it will be connected. The bigger the damper the lower gauge, or thicker, the sleeve is required to be. The sleeve thickness must also be equal to or thicker than the duct connected to it.

DUCT-TO-SLEEVE CONNECTIONS

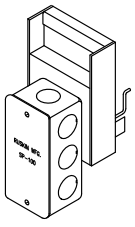
UL allows two different types of duct-to-sleeve connections: Breakaway and rigid. UL defines a rigid connection as any connection that has not been tested and qualified as a breakaway connection. There are several qualified breakaway connections as defined in UL Standard 555. Damper manufacturers are required to list all breakaway connections.

MINIMUM SLEEVE THICKNESS FOR FIRE DAMPERS

Type of Duct to Sleeve Connection	Duct	Duct Dimension	Sleeve Gauge
Rigid	Round Rectangular	24" maximum diameter 36" maximum width or 24" maximum height	16 (.060")
Rigid	Round Rectangular	over 24" diameter over 36" width or over 24" height	14 (.075")
Breakaway	Round or Rectangular	12" wide and under 13" – 30" wide 31" – 54" wide 55" – 84" wide 85" wide and over	26 (.018") 24 (.024") 22 (.030") 20 (.036") 18 (.048")

FIRE/SMOKE DAMPER OPTIONS AND VARIATIONS

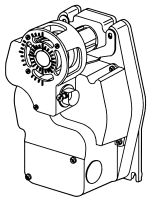
Several options and accessories are available on smoke and fire/smoke dampers:



SP100

SP100 SWITCH PACKAGE OR SPH2

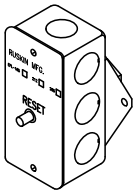
Provides the ability to remotely indicate damper blade position. The SP100 consists of a switch box and a rod connected to a damper blade. The position of the blades governs which switch is opened and which is closed. This option is an integral part of the TS150EZ FireStat. The SPH2 is a switch package, consisting of two adjustable cams, for use with direct coupled actuators. It mounts over the actuator hub and set screws.



SPH2

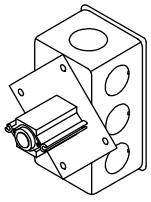
EFL (ELECTRIC FUSE LINK)

The EFL is an electric, manually resettable link that replaces the traditional fuse link and the problems associated with it. The EFL is equipped with an electronic thermal sensing device that will interrupt power to the actuator when the fixed temperature (165^{O}F, 212^{O}F, 250^{O}F or 350^{O}F) is reached. The actuator's spring return mechanism closes the damper in a controlled manner upon power loss, usually 7 to 15 seconds. Upon cessation of fire conditions, the damper can be reopened by pressing the reset button located on the side of the EFL assembly.



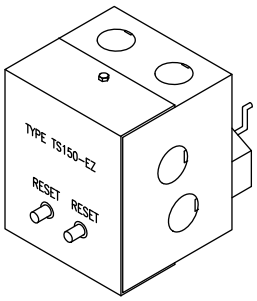
The EFL may also be wired into the smoke detection or other building control systems so the damper closes when a smoke signal is present. Once the smoke signal is cleared, the system automatically resets and the damper opens.

The EFL can only be furnished when the damper actuator is factory installed and wired to the thermal sensor before shipment. The EFL is standard on all Ruskin combination fire/smoke dampers and is easily resettable after testing or employment.

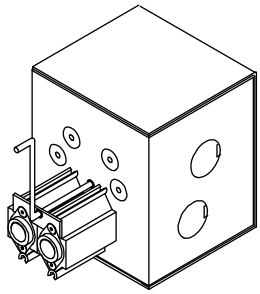


TS150EZ FIRESTAT

Ruskin's TS150EZ FireStat option allows remote override of a fire induced closure to permit operation in a dynamic smoke management system. The following features highlight the advantages of installing a TS150EZ on a fire/smoke damper:



- Quick response temperature replace fusible or mechanical type links. The sensors are tested with the damper/actuator assembly to ensure proper damper response to temperature conditions.
- Permits reopening damper at elevated temperatures above the standard 165ºF or 212ºF primary fire damper closure temperature requirements of most codes. This is essential in an engineered smoke management system.
- High limit sensor closes and locks the damper if the temperature continues to rise to 350ºF.
- SP100 Switch Package is included with the TS150EZ providing remote status indication of damper blade position. Permits interface with alarm systems to ensure proper operation and allowing easy on-line testing of dampers from a remote station.
- Damper automatically resets to normal position when alarm system is reset after false or nuisance alarms. Push button sensor reset at the damper is required only when temperature at the damper has exceeded the sensor classification.



DUCT SMOKE DETECTOR

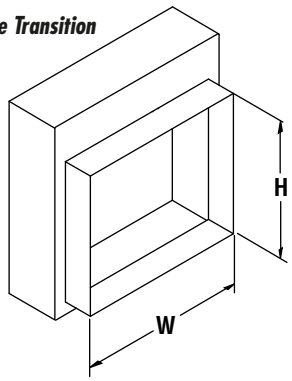
National and local standards recognize the ability of air duct systems to transfer smoke, toxic gases, and flame from one area to another. Sometimes smoke can be of such quantity as to be a serious hazard to life safety unless the blowers are shut down and the dampers are actuated. The primary purpose of duct smoke detection is to prevent injury, panic, and property damage by reducing the spread of smoke.

A duct smoke detector is a device, or group of devices, used to detect the presence of smoke in the duct work. When smoke is detected in the duct, the electric supply to the damper actuator is cut off by the detector causing the damper to close. Duct smoke detection can also serve to protect air conditioning system itself from fire and smoke damage, and can be used to assist in equipment protection applications, such as ventilation/exhaust duct work of a mainframe computers and tape drives. The duct smoke detector may be used in conjunction with a Ruskin combination fire/smoke damper or a smoke damper and can be mounted at the factory, or shipped loose for field assembly. Most duct smoke detectors require some airflow to operate correctly. There are, however, area detectors that are approved for in duct installation, which do not require airflow. Ruskin can provide both types.

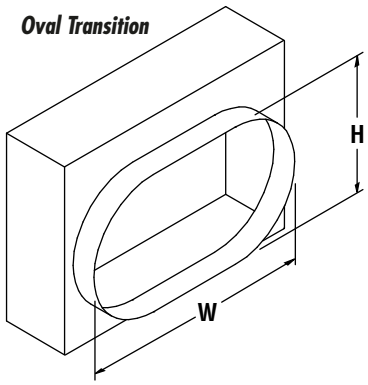
TRANSITION OPTIONS

Round, oval or rectangular transitions may be required for installations in different style duct work. Rectangular dampers are normally constructed 2" larger than the duct dimensions and provided with a factory sleeve. The sleeve is transitioned at each end with the appropriate collar depending on duct size and shape. Rectangular dampers are sometimes transitioned with rectangular collars to achieve a higher damper free area.

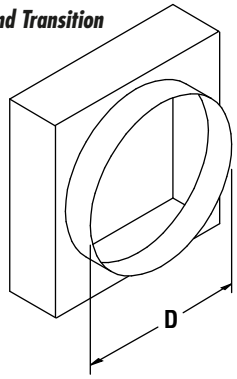
Square Transition



Oval Transition



Round Transition



DAMPER INSTALLATION REQUIREMENTS

All fire/smoke damper manufacturers are required to provide installation instructions detailing the UL approved installation methods and procedures for each model damper. These instructions must be followed accurately to maintain the dampers UL listing. Installation requirements may vary between different manufacturers as a manufacturer may qualify for different installation methods.

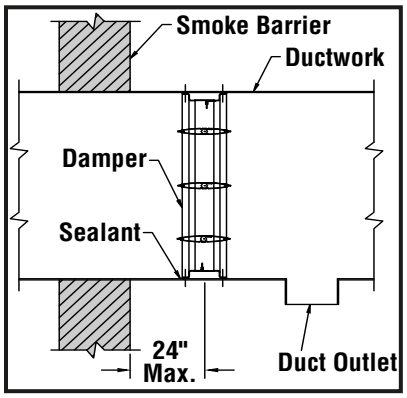
Like a typical fire damper installation, combination fire/smoke dampers are required to be enclosed in a sleeve and installed within the plane of a fire rated wall or floor. Smoke dampers may be installed directly in the ductwork and are not required to be enclosed in a sleeve.

MAXIMUM DAMPER SIZE LIMITATIONS

Combination fire/smoke dampers and smoke dampers have maximum UL listed single section damper sizes for smaller openings and a maximum UL listed multiple section damper size for larger openings. Size limitations are based solely upon what size dampers were actually tested and qualified at the UL Laboratory to meet the UL555 and UL555S requirements.

SMOKE DAMPER INSTALLATION REQUIREMENTS

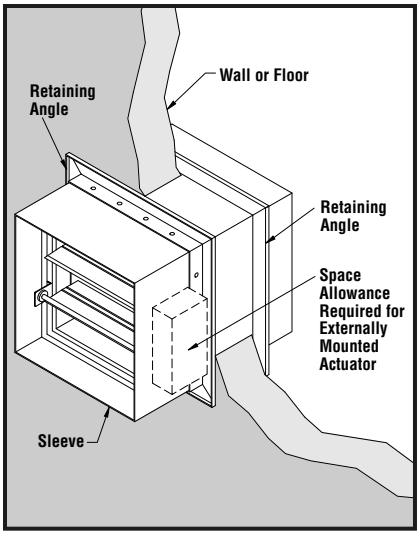
Smoke dampers have the following installation requirements:



- **Location**
  The smoke damper must be installed no more than 24" from the smoke barrier it is intended to protect.
- **Attachment**
  The manufacturer's installation instructions will include the approved method for attachment and spacing of the attachments.
- **Sealing**
  The joints between the damper frame and the duct must be sealed to prevent unwanted air leakage.

FIRE AND COMBINATION FIRE/SMOKE DAMPER INSTALLATION REQUIREMENTS

Combination fire/smoke dampers have the following installation requirements:



- **Opening clearance**
  Typically the fire wall opening must be a minimum of 1/4" larger than the width and height of the damper/sleeve assembly. The opening clearance must increase 1/8" for each foot the damper exceeds 24" on the width or height.
- **Sleeve requirements**
  The specific sleeve requirements depend on the damper size and type of duct to sleeve connection. As a general rule, the sleeve thickness must be equal to or thicker than the duct connected to it. See the Sleeve Requirements section of this manual for more details on UL sleeve length limitations.
- **Damper to sleeve connections**
  The manufacturer's installation instructions are required to show the method of attaching the damper to the sleeve and the spacing of the attachments.

- ***Securing sleeve***
  Ruskin's Picture Frame Mounting Angles (PFMA) or conventional UL approved retaining angles are attached to the sleeve of the damper on each side, top and bottom on both sides of the wall or floor. Ruskin's FAST Angle is fastened to both the sleeve and the wall or floor on only one side of the wall or top of the floor. All angles must overlap the partition a minimum of 1".

- ***Sealing***
  Application of sealant between the mounting angles and the fire rated partition is not required by UL. However, if a tight seal on these areas is specified, sealant can be applied per the manufacturers instructions.

- ***Duct to sleeve connections***
  Duct to sleeve connections can be rigid or breakaway type. See the Sleeve Requirements section of this manual for more details on approved UL duct-to-sleeve connections.

- ***Space envelope***
  When a fire smoke damper is installed it must fit in a space with room for wiring or piping. The actuator and accessories must be accessible for testing and service or replacement. Ruskin fire/smoke damper actuators and accessories are normally externally mounted on the right side of the sleeve as shown. If left side mount is required the damper can be turned upside down since there is no "top" or "bottom." In addition, Ruskin fire/smoke dampers are not air flow directional, so the damper may be installed with the actuator and accessories on either side of the wall or floor. Some damper sizes require the actuator to extend above or below the sleeve. Ruskin can factory mount the actuator to fit the application, if space above or below is limited and turning the damper over or rotating it on its axis will not work.

DAMPER MAINTENANCE

Owners of buildings or their agents should establish planned maintenance schedules for fire, smoke and combination fire/smoke dampers. Failure to properly maintain the dampers may be a contributing cause of fires and/or loss of life. Damper maintenance involves examining the damper to ensure it is not rusted or blocked and operating the damper via the actuator, with normal system airflow, to ensure the actuator performs after prolonged periods of holding. The National Fire Protection Association makes several recommendations regarding maintenance. These recommendations may be found in NFPA90A and NFPA92A. In addition, the damper and actuator manufacturers make maintenance and cycling recommendations in their product literature.

INSTALLATION QUESTIONS

HOW SHOULD FIRE/SMOKE DAMPERS BE INSTALLED?

Fire smoke dampers should be installed in accordance with the manufacturer's UL approved installation instructions.

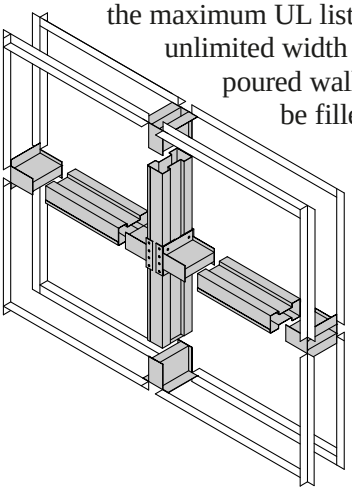
WHAT IF THE DAMPERS CANNOT BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S UL APPROVED INSTALLATION INSTRUCTIONS.

Sometimes it is impossible to adhere to the manufacturer provided installation instructions. Obviously this brings up the issue of keeping the UL label on the damper. Remodel work especially will present challenging installations. The proper procedure in these situations is to propose a solution based on good engineering judgment and have the solution evaluated by the local authority having jurisdiction.

There are a number of resources available to consult when looking for solutions to installations problems. Here are a few suggestions:

- Damper manufacturer representatives are usually well informed as to what alternative installations have been approved in the past.
- The damper manufacturer's applications support department often has experience with solutions to unconventional installations.
- Building code inspectors or officials could be an excellent source of information on unusual installations.
- The SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC systems illustrates many damper installations situations and includes suggested alternate methods for consideration.

HOW DO YOU INSTALL IN OPENINGS THAT ARE LARGER THAN THE MAXIMUM UL LISTED DAMPER SIZES?

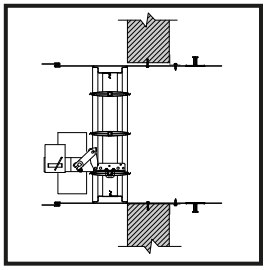


Steel mullions can be used to separate vertically mounted static fire dampers in wall openings larger than the maximum UL listed multiple section damper assembly. The damper cannot exceed 120" in height by unlimited width using vertical mullions every 120". Mullions can only be used in concrete block or poured walls with 7" minimum and 12" maximum thickness. Hollow concrete block walls must be filled with concrete before using mullions.

> ***IMPORTANT NOTE***
>
> ***UL (Underwriters Laboratories) does not recognize steel support mullions for use with dynamic fire dampers.***

WHAT IF A FIRE OR FIRE/SMOKE DAMPER CANNOT BE INSTALLED IN THE WALL?

Some damper manufacturer's have tested fire/smoke dampers for installation out of the wall. The distance the damper can be installed out of the wall varies with each manufacturer, but in no case can the damper be more than 16" out of the wall. Fire/smoke dampers tested for out of the wall installation are normally "wrapped" by some type of fire resistant material. Refer to the manufacturer's installation instructions for specific requirements.



HOW MUCH SPACE OUTSIDE THE DAMPER SLEEVE IS REQUIRED FOR THE ACTUATOR AND CONTROL OPTIONS? *(see page 12)*

The space envelope is dependent upon the type and make of the actuator. Enough space should be provided to allow for wiring or piping and the replacement of the actuator and other control options. The manufacturer should be contacted for envelope requirements.

WHAT IF A FIRE/SMOKE DAMPER MUST BE MODIFIED IN THE FIELD?

Once a fire smoke/damper leaves the factory subsequent changes (field modifications) must be approved by the Authority Having Jurisdiction (AHJ). Sometimes the AHJ approves the modification and sometimes he requires UL to determine the suitability of the modification before he approves it. UL determines suitability through one of the following:

- Field Inspection by a UL representative – A field inspection is scheduled if the modification or repair uses original parts and results in a construction that is in compliance with the current UL Follow-Up Service procedure.
- Field Evaluation or Field Investigation – A field evaluation is scheduled if the modification or repair uses parts not original to the product.

Field evaluations or inspections can be costly. Therefore, it is extremely important to specify and order the correct damper.

WHAT IF THE DAMPER IS REQUIRED TO BE "FIRESTOPPED"?

Questions have arisen in several instances where local code officials or system designers have required that contractors provide firestopping materials in fire damper and combination fire/smoke damper applications. There is no UL requirement to firestop the annular space between the damper/sleeve assembly and wall or floor. However, Ruskin fire and combination fire/smoke dampers have been tested and may be firestopped in accordance with the UL approved firestopping installation instructions. Consult Ruskin for more information.

IS AN ACCESS DOOR REQUIRED FOR EVERY FIRE OR FIRE/SMOKE DAMPER?

Yes, most building codes require fire or fire/smoke dampers to be accessible for inspection and servicing.

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