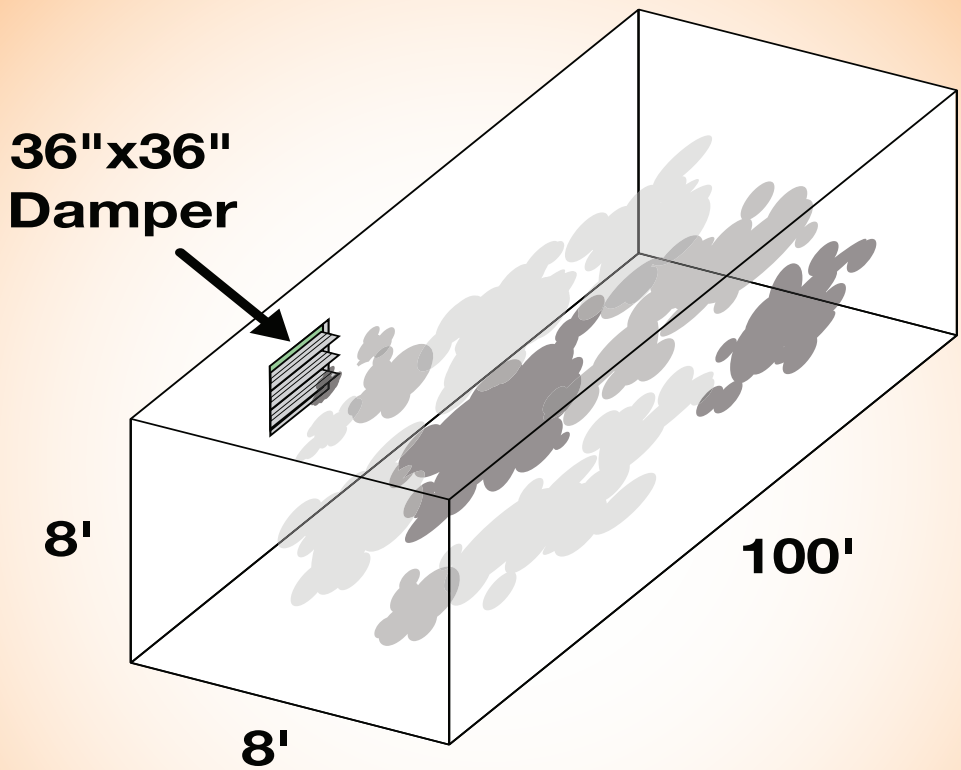
A zone control damper



Specifying Life Safety Dampers

By Marty Gissel

Introduction

Life safety dampers may appear to be straightforward products. You select a fire damper if you want to stop the spread of fire, a smoke damper if you want to stop the spread of smoke, and a combination fire-smoke damper if you want to stop the spread of both. However, specifying a proper damper for a given application can literally be the difference between life and death. The purpose of this article is to explain how to properly specify life safety dampers to maximize their benefit to building owners and occupants.

About the Author

Marty Gissel has an experience of 19 years in the damper industry. He is a Member of the UL555 Standards Technical Panel (STP); Member of NFPA 80 and 105 Committee; Chairman – Air Control Product Certified Ratings Program (AMCA 511) of Air Movement & Control Association (AMCA); Vice Chair – Damper Engineering Committee of AMCA; Member – Code Action Review Committee (CARC) of AMCA; and Member – Life-Safety Damper Marketing Task Force.

What Makes a Damper a Life Safety Damper?

The term 'life safety damper' is a catchall phrase used to describe fire dampers, smoke dampers and combination fire-smoke dampers. The use of these products is mandated by building codes and specified by engineers to protect both lives and property. However, in general, life safety dampers have two purposes. The first is to protect duct and air transfer openings in fire and smoke rated walls and floors. In these applications, the damper's purpose is simply to contain the fire and/or smoke in the zone it originated in. The second purpose of life safety dampers is to be a part of an engineered smoke control system. Smoke control systems are designed to maintain tenable conditions in egress areas as occupants exit a building, and to allow emergency response personnel to rescue occupants and control the fire. Smoke and combination fire-smoke dampers are often critical components of these systems.

Figure 1 and *2* will help to explain how fire-smoke dampers can be used as part of a smoke control system. *Figure 1* shows

continued on page 52

continued from page 50

a three-storey building with a supply shaft and an exhaust shaft. Under normal conditions all the dampers are open to allow the space to be ventilated and the air to be conditioned. However, in the event of a fire, once smoke is detected and the zone of the fire's origin is identified, the building's smoke control system takes control of the dampers. As *Figure 2* shows, the dampers are used to create a positive pressure in the smoke zones outside the zone of origin and a negative pressure in the zone of origin. This not only prevents smoke from entering the other smoke compartments, but also exhausts smoke from the zone of origin giving occupants within that zone the best opportunity to escape from the building.

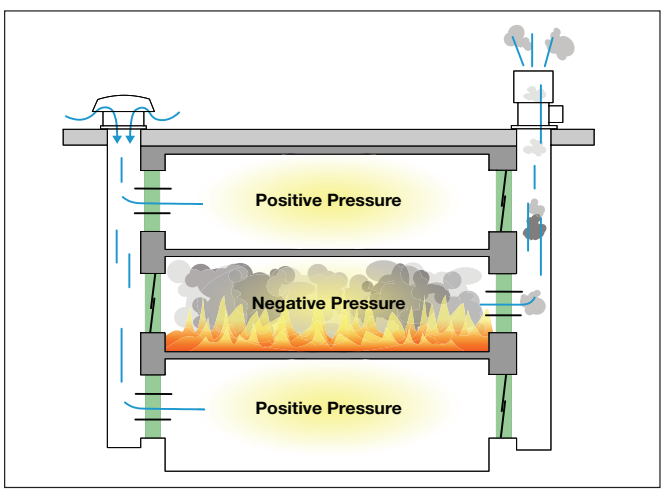


Figure 1: Typical building with supply and exhaust shafts

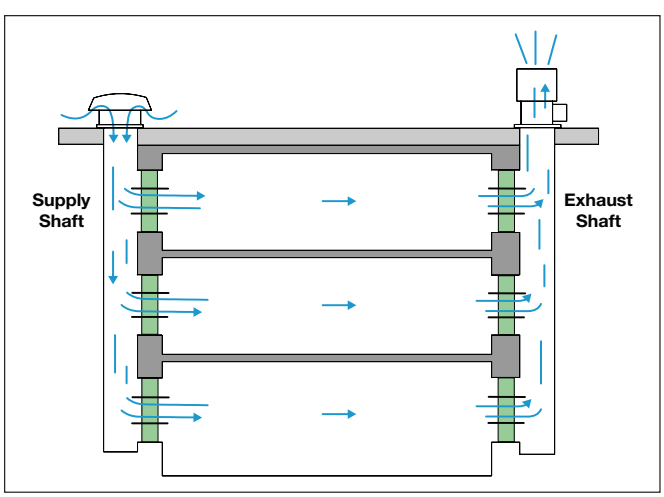


Figure 2: Fire-smoke dampers in a mechanical smoke control system

Life Safety Damper Test Standards

In this article, we will look at the standards published by Underwriters Laboratories (UL). UL publishes two standards for life safety dampers: Fire Dampers – UL 555 and Smoke Dampers – UL 555S. These standards contain many tests that result in important ratings that need to be part of a proper life safety damper specification. Once the product is certified, it is ready to be installed in any building.

Fire Dampers

The first and most basic rating that a fire or fire-smoke damper receives is its hourly fire resistance rating. Dampers can be tested for either 1½ hours or 3 hours. Both; the International Building Code (IBC) and NFPA's Life Safety Code (NFPA 101) require duct and air transfer opening penetrations through fire resistance-rated assemblies of less than 3 hours to be protected by 1½ hour rated fire dampers. Penetrations through fire-resistance rated assemblies rated for 3 hours or more are to be protected by 3 hour rated dampers.

Next, the temperature of a damper's closure device must be selected. On fire dampers designed without an actuator, the closure device is typically a fusible link. Fire and fire-smoke dampers designed to operate with an actuator usually use a bimetallic disc type thermostat as the closure device. When the rated temperature of the thermostat is reached, electrical power (or air pressure in the case of a pneumatic actuator) to the actuator is disconnected. This causes the actuator's built-in spring to close the damper.

When the rated temperature of the primary closure device is reached the damper will close. Dampers with two closure devices also require position indication switches (discussed below) that inform the smoke control system whether the damper is open or closed.

The final key decision point that needs to go into properly specifying a fire damper is whether the damper is to be static or dynamic rated. Static rated dampers have not been tested to close against airflow. Thus, static dampers should only be used in HVAC systems that are designed to shutdown immediately upon detection of fire or smoke. Dynamic rated dampers on the other hand are tested and rated to close against airflow.

Smoke Dampers

All smoke dampers are rated to close against airflow. Note that combination fire-smoke dampers must meet the requirements of both fire dampers and smoke dampers so when smoke dampers are referenced in this section, the requirement applies to fire-smoke dampers as well. The operation of smoke dampers is accomplished by use of an electric or pneumatic actuator. Because the actuator is the operating mechanism for smoke dampers, all of the ratings that a smoke damper carries are for the damper and actuator together as an assembly. Thus, UL 555S requires actuators to come factory mounted from the damper manufacturer. They cannot be installed in the field.

UL 555S classified smoke damper and actuator assemblies also carry an operational temperature rating.

As discussed above, it is often desirable for a smoke or fire-smoke damper to be able to communicate its current position (i.e. open or closed). This is accomplished by way of 'position indication switches'. Position indication can either be built into the damper's actuator (often referred to as limit switches or auxiliary switches), or there can be a separate switch package that is mounted by the damper manufacturer.

continued on page 54

continued from page 52

The final rating that a smoke damper receives is a leakage rating. UL 555S has three leakage classifications. As shown in *Table 1*, these leakage classifications define the maximum allowable leakage through a damper at the damper's rated pressure.

Table 1: Maximum allowable leakage cfm/ft² (L/s/m²)

Classification	4" wc (1 kPa)	8" wc (2 kPa)
I	8 (41)	11 (57)
II	20 (102)	28 (144)
III	80 (406)	112 (574)

The amount of time required to fill the hallway varies widely depending on the leakage class of the damper:

Class I Damper: 89 minutes

Class II Damper: 36 minutes

Class III Damper: 9 minutes

Conclusion

As we have discussed, there are many aspects of a damper's performance that must be taken into consideration when specifying these products. When specifying dampers for any building, we need to take into account these points. We should know the type of applications, and Certifications with the leakage class ratings.