

Life Safety Dampers: Code-Required Testing

Larry Felker | Belimo Americas



Building codes require installation of life safety dampers for several purposes. Most are used as part of compartmentalization to prevent the spread of fire and smoke in a life-threatening event. Smoke control systems employ dampers to prevent the spread of smoke or to remove it, while some dampers can be used for other types of fire and smoke control. Periodic testing of all life safety dampers is required.

Codes and Referenced Standards

While the International Building Code¹ (IBC) defines the requirements for *installation* of life safety dampers, it is the International Fire Code² (IFC) that defines the requirements for their *periodic testing*. Section 706.1 Maintaining Protection of the IFC references NFPA 80³ (fire) and NFPA 105 (smoke)⁴ for those requirements.

Some clarification or additional requirements and exceptions are contained in the IBC and IFC. Dampers installed per Chapter 7 of the IBC are part of fire-resistance-rated construction and the dampers are referred to as “containment dampers.” In contrast, dampers installed per Chapter 9 are referred to as “smoke control system dampers.”

Owner’s Responsibility

The building owner is responsible for maintaining fire-resistance-rated construction. This is clearly stated in IFC Section 701.6 Owner’s Responsibility and includes “construction installed to resist the passage of smoke.” The owner shall maintain records of inspections and repairs.

Section 907 of the IFC deals with fire alarm and detection systems and includes “life safety systems” which are more inclusive. Section 907.8.5 Inspection, Testing and Maintenance also states that the building owner is responsible. A record of inspection, testing, and maintenance must be kept. This is also stated in NFPA 80 and NFPA 105 which are more specific to dampers. An up to date log book is normally enough for examination by the building official or fire marshal during

inspections. This, however, is the provenance of the authority having jurisdiction.

In both the IFC and IBC Section 909.3 Special Inspection and Test Requirements, commissioning of a smoke control system is required to be subject to special inspections and tests, in addition to ordinary inspections and tests. IBC Section 1704 references the professional qualifications and record keeping requirements.

Section 909.18.8.2 Qualifications of the IFC and the IBC Section 1705.18.2 establish that qualifications require that smoke control testing (commissioning) agents “shall have expertise in fire protection, engineering, mechanical engineering and certification as air balancers.” However, no qualifications are explicitly stated for periodic testing.

Some of the larger owners and hospitals have qualified people on staff to perform the testing. Others ignore the requirements or are not aware they exist. Service contracts should include periodic testing either by the ventilation or mechanical contractor themselves, or by a sub with whom they contract.

Local code officials may have expectations and owner prudence would indicate that a test, adjust, and balance (TAB) contractor or otherwise qualified agent perform or oversee the work. In any event, TAB contractors should make their building owners aware of the code requirement and, when attending local ICC or ASHRAE meetings, inform mechanical contractors and engineers of their capabilities.

Testing Requirements

The IBC does not mention any periodic damper testing requirements within Chapter 7. IFC Section 706 covers duct and air-transfer openings. Section 706.1 Maintaining Protection, states that dampers protecting openings shall be maintained in accordance with NFPA 80 and NFPA 105.

IFC Section 717.4 Access and Identification requires proper access to dampers. It also requires a minimum of half-inch high labels with capital letters identifying the damper type –

fire/smoke, smoke, or fire damper. While this is not a testing requirement, it makes locating the dampers, and thus facilitates testing, possible. There is no further mention of testing requirements in Chapter 7 of either code.

Chapter 9 of both the IBC and IFC have the most detail regarding testing requirements. Both have the same Section 909.12 Detection and Control Systems requiring fire alarm and controls, as well as associated equipment be listed to UL 864⁵ and UUKL listing if used for smoke control. UL 864 requires all equipment listed to it to be capable of a weekly self-test.

Actuated dampers are not investigated to UL 864 standards and are excluded from the weekly self-test as long as the fire code official approves. Infrequently, there is confusion about the above requirement between UL 864 and the UL 555 family of standards.⁶ UL will not investigate dampers to UL 864 and listing to one of the UL 555 family of standards is correct.

The exception to 909.12.1 allows components that could interfere with building operation to be bypassed and that Section 909.20.6 of the IFC should be followed. The most common situation where dampers should not be tested is at the intakes or outlets of fans. If the fan is running and a damper closes, negative duct pressure (suction) or positive pressure (discharge) can collapse ducts or split the seams and the fans may shut-down on static pressure limits, which are usually manually reset. As the smoke control fans and dampers are typically part of the fire alarm equipment and non-dedicated equipment part of the building management system, care must be taken to avoid not just interference, but actual damage.

IFC Section 909.20 is maintenance. Sections 909.20.1 through 909.20.6 detail requirements. Operational testing of each control sequence and device must be tested semi-annually for dedicated systems, while non-dedicated systems must be tested annually. Dampers are specifically included in Section 909.20.3. Section 909.20.6 Components Bypassing Weekly Test requires semiannual testing. Dedicated system dampers must be tested semi-annually per NFPA 105, and non-dedicated dampers must be tested annually. Since they are not UL 864 listed, the NFPA standard regulates their testing frequency.

Other dampers that need testing may be installed per IBC 909.20 Smokeproof Enclosures. They should be tested per smoke control system damper requirements.

Fire extinguishing equipment other than sprinklers is covered in IFC Section 904 Alternative Automatic Fire-Extinguishing Systems. In Section 904.8.5 Auxiliary Equipment, the re-

quirement exists for components, including dampers, to be operated at “12-month intervals.” Section 904.12.3 covers carbon dioxide systems. It recognizes that dampers may be installed in a duct as part of the system. Section 904.8.1 System Test requires yearly inspection and testing. NFPA 12⁷ is referenced in Table 901.6.1 Fire Protection System Maintenance Standards, and as with all systems, records must be maintained.

The IFC Section 910 Smoke and Heat Removal states that smoke and heat vents are required to be inspected annually and operationally tested not less than every five years. Section 910.5.2 states that mechanical smoke removal equipment should be tested and maintained according to NFPA 204⁸ and manufacturer’s instructions. These systems should be inspected and tested annually, and all ancillary equipment should be included. This would include any associated fan discharge dampers. Again, a record must be kept. These dampers are not typically considered to be smoke control related per se, but in specific cases may be interpreted to be so. Table 1 summarizes these explanations.

Table 1

Chapter 7 Containment Dampers	
Commissioning	
End of first year	
Every 4 years except in hospitals every 6 years	
Chapter 9 Smoke Control System Dampers	
Dedicated	Non-dedicated
Commissioning	Commissioning
Semi-annually	Annually
Chapter 9 Mechanical smoke removal dampers	
Commissioning	
Annually	
Auxiliary fire extinguishing equipment (CO₂)	
Commissioning	
Annually	
Fire detection & smoke control systems	
Dedicated	Non-dedicated
Weekly self-test	Not required ⁱ

i. Subject to the Exception in 909.12.1

Dampers

There are four essential types of life safety dampers:

- 1) Ceiling radiation
- 2) Fire

- 3) Smoke
- 4) Combination fire and smoke

Depending on the application, they have varying requirements for periodic testing. Further details will be covered in Part II of this series in early 2019.*

In summary, building owners are responsible for maintaining and periodic testing of life safety dampers. The IFC references NFPA 80 and NFPA 105 for some details but states the requirements in Chapter 7 and Chapter 9. Table 1 has a summary of the requirements as detailed above. Part 2 of this article will explain the primary types of life safety dampers and their periodic testing requirements. ■

**This is the first article in a series. Part II will appear in the next issue of The NEBB Professional and will explain the primary types of life safety dampers and their periodic testing requirements.*

About the Author

A specialist in fire and smoke dampers and actuators, Larry Felker is fire- and smoke-product manager for Belimo Americas. He is vice chair of Air Movement and Control

Association (AMCA) International's Fire and Smoke Damper Task Force, a member of the International Code Council, the National Fire Protection Association and the Society of Fire Protection Engineers, as well as a life member of ASHRAE. He is co-author of the book "Dampers and Airflow Control" published by ASHRAE Special Publications in 2010.

1 International Building Code 2018, International Code Council, Inc. (ICC), Country Club Hills, IL 60478-5795

2 International Fire Code 2018, *ibid.*

3 NFPA 80 Standard for Fire Doors and Other Opening Protectives, 2016 Edition, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471

4 NFPA 105 Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives, 2016 Edition, *ibid.*

5 UL 864 Standard for Safety Control Units and Accessories for Fire Alarm Systems, 10th Edition, 2018, Underwriters Laboratories Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062-2096. UUKL is a list of smoke control approved components and systems within UL 864.

6 <https://ulstandards.ul.com/access-standards/>, *ibid.* Also see IBC 717.3 Damper testing, ratings and actuation.

7 NFPA 12 Standard on Carbon Dioxide Extinguishing Systems, *op. cit.*

8 NFPA 204: Standard for Smoke and Heat Venting, 2018, *op. cit.*

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Life Safety Dampers: Code-Required Testing (Part 2)

Larry Felker | Belimo Americas



Part 1 of this article, (featured in the 2018 Q4 issue of The NEBB Professional), covered the International Building Code (IBC)¹ and International Fire Code (IFC)² testing requirements for life safety dampers.

Chapter 7 of the IBC covers installation requirements for containment dampers. Along with fire alarm and sprinklers, Chapter 9 covers requirements for smoke control systems, including dampers. The same chapters of the IFC cover maintenance and testing requirements.

The different sections of the codes were detailed and summarized in Part 1 of this article. Table 1 provides a summary of the sections of the codes covered.

Table 1

Chapter 7 Containment Dampers	
Commissioning End of first year Every 4 years; every 6 years for hospitals	
Chapter 9 Smoke Control System Dampers	
Dedicated Commissioning Semi-annually	Non-dedicated Commissioning Annually
Chapter 9 Mechanical Smoke Removal Dampers	
Commissioning Annually	
Auxiliary Fire Extinguishing Equipment	
Commissioning Annually	
Fire Detection & Smoke Control Systems	
Dedicated Weekly self-test	Non-dedicated Per Chapter 9 above

The Four Types of Life Safety Dampers

The four general types of dampers are:

- 1) ceiling radiation dampers
- 2) fire dampers
- 3) smoke dampers

- 4) combination fire and smoke dampers (including corridor dampers)

Corridor dampers are combination fire and smoke dampers intended for installation where ducts penetrate ceilings of internal corridors. Note that variations of each damper type exist with added grills, angle connections, flanges, or other connections, but will not be discussed here.

During the periodic inspection and testing of these dampers, defects may be uncovered that the owner must correct. The agent doing the periodic maintenance is required to log defects and update the log once the problem has been corrected. This requirement is per the NFPA 80³ and NFPA 105⁴ standards which are referenced in the IFC. While the UL 555 family of standards⁵ is applied at the factory and during installation, they do not regulate existing appliances.⁶

Ceiling Radiation Dampers

Figure 1 shows two ceiling radiation dampers. They are spring loaded with a fusible link that releases the spring to close the insulated blades. These dampers restrict the transfer of heat into the spaces above drop ceilings or ceiling-mounted ducted diffusers. They are not tested for fire resistance or smoke leakage but do restrict fire and smoke to some degree simply by blocking a duct or drop-in grill in a ceiling. The same is true of the other types of dampers for heat, fire, or smoke. Application and installation information can be found on most damper manufacturer websites.⁷

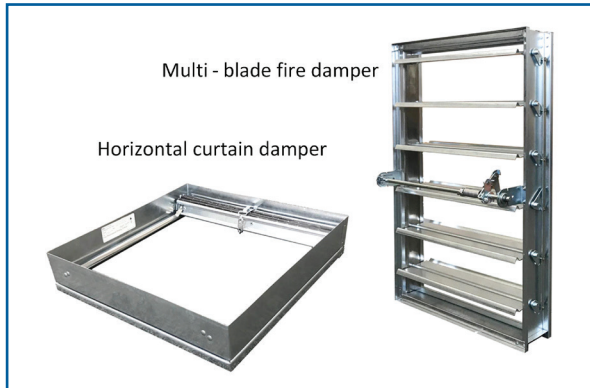
Figure 1. Ceiling Radiation Dampers (Photo courtesy of United Enertech)



No requirement exists in the IBC or IFC for periodic testing.

Curtain dampers are the most common type of fire damper. They prevent the passage of flames but are not tested for heat transfer or smoke leakage. Horizontal and dynamic curtain dampers are spring loaded, while static vertical damper blades simply drop via gravity. Some larger and sturdier fire dampers are single- or multi-blade type with a fusible link and shaft spring to release the blades. See Figure 2 for examples.

Figure 2. Fire Dampers (Photo courtesy of Pottorff)



Few fire dampers are actuated, but if so, they are of the same construction as the combination fire and smoke damper shown in Figure 4. Fire dampers are installed per Chapter 7 and are for containment. They must be tested in accordance to the schedule in Table 1. That is, at commissioning, end of the first year, and every four years thereafter except in hospitals, which is every 6 years.

Smoke Dampers

Smoke dampers resist smoke passage but are not tested for heat transfer or flame resistance. They may be made of aluminum, as shown in Figure 3. All smoke dampers are actuated, as there is no mechanical way to sense smoke and electrical methods are required. The actuator can be jackshaft or axle shaft mounted if the damper is within two feet of the barrier or partition it protects. Note there is no heat sensitive device.

Figure 3. Smoke Damper (Photograph courtesy TAMCO)



If smoke dampers are part of a Chapter 7 installation, then the containment portion of the schedule applies. If installed per Chapter 9, they are tested according to the smoke control damper requirements. That is, semi-annually for dedicated systems and annually for non-dedicated systems.

Combination Fire and Smoke Dampers

Combination fire and smoke dampers prevent the passage of flames and limit smoke passage. They can be applied in either Chapter 7 or Chapter 9 applications. Figure 4 shows a typical combination damper. The 2"x 4" box below the damper contains a heat-sensitive bimetal. A smoke detector, or relay from the fire alarm/smoke control system, breaks power if smoke is detected.

Combination dampers must be tested according to the schedule shown in Table 1. Again, the frequency depends on whether the damper is installed per Chapter 7 or Chapter 9.

Figure 4. Combination Fire and Smoke Damper (Photograph courtesy Ruskin Company)



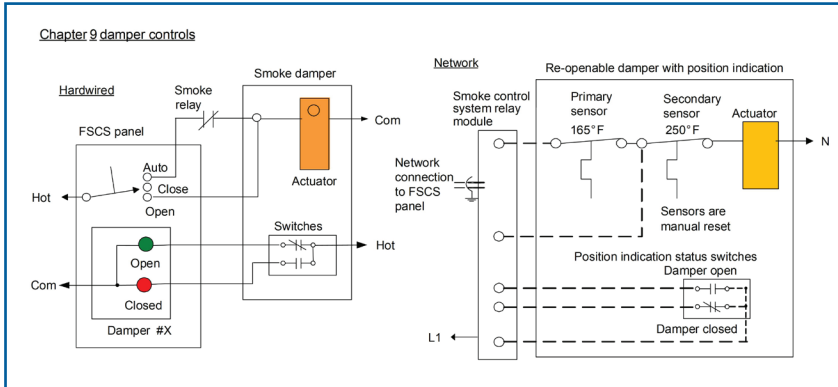
Distinguishing Containment from Smoke Control Dampers

Without examining adequate drawings for a system, it is impossible to be 100 percent certain of the purpose of each damper. However, the controls are most often a deciding indicator.

Figure 5 shows two common smoke system control methods for Chapter 9 dampers. The left drawing shows a smoke damper, while the right drawing shows a re-openable combination damper (smoke relay and fire fighters' smoke control not shown). Position switches could be actuator auxiliary switches, damper blade switches, or magnetic switches. The point is that Chapter 9 dampers have the controls, while Chapter 7 dampers rarely have them.

The presence of switches alone is not definitive, as local position indication may be the purpose. Wiring from the fire fighters' smoke control panel, or a relay connected via the

Figure 5. Common Smoke Control System Damper Controls



fire alarm or building management system, provides open-closed control override. One or two modules are required, depending on the manufacturer of the smoke control system. In some cases, the power wiring to the actuators is in a local relay panel providing override control to multiple dampers and the controls are not at the damper itself.

Figure 6 shows the damper connections in an installation. The presence of several controls on the damper and red conduit is a good indication that the damper is part of the smoke

Figure 6. Fire Alarm/Smoke Control System Connection to Combination Damper (Photograph courtesy Fire Safety First)



control system. If any red wiring is seen attaching to a damper actuator, it is suggestive of a fire fighters' smoke control system connection.

In summary, the IFC requires periodic testing of life safety dampers to ensure functioning in case of a life-threatening event. A summary of the schedule is given in Table 1.

In order to determine which dampers must be tested to what schedule, it is helpful to know the different damper

types. There is sometimes confusion about the standards and codes with respect to life safety dampers, but by carefully reviewing the summarized information above, you should be able to gain some clarity. ■

About the Author

A specialist in fire and smoke dampers and actuators, Larry Felker is fire- and smoke-product manager for Belimo Americas. He is vice chair of Air Movement and Control Association (AMCA) International's Fire and Smoke Damper Task Force, a member of the International Code Council, the National Fire Protection Association, and the Society of Fire Protection Engineers, and a life member of ASHRAE. He is co-author of the book "Dampers and Airflow Control," published by ASHRAE Special Publications in 2010.

- 1 International Building Code 2018, International Code Council, Inc. (ICC), Country Club Hills, IL 60478.
- 2 International Fire Code 2018, *ibid*.
- 3 NFPA 80 Standard for Fire Doors and Other Opening Protectives, 2016 Edition, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.
- 4 NFPA 105 Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives, 2016 Edition, *ibid*.
- 5 <https://ulstandards.ul.com/access-standards/>, Underwriters Laboratories Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062-2096.
- 6 See Dampers Marking and Application Guide, July 2016. Underwriters Laboratories Inc. (UL), *ibid*. https://www.ul.com/wp-content/uploads/2014/04/Dampers_MG.pdf
- 7 For example see http://www.greenheck.com/media/pdf/manuals/826252CRDPacket_iom.pdf

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