Remote Fire and Smoke Damper Testing Methods

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Building codes require periodic testing of life-safety dampers. Actuated dampers, such as smoke and combination fire and smoke, may be remote tested per the 2019 versions of the NFPA 80\(^1\) and NFPA 105\(^2\) standards, which are referenced in the International Building Code (IBC)\(^3\) and International Fire Code (IFC).\(^4\) The initial remote inspection shall include a visual inspection confirming that the position indication method accurately reflects the full open and full closed positions.

Among the advantages of remote testing are code compliance before any intervention by the fire official, cost avoidance, no ceiling membrane disturbance, and ability to test inaccessible dampers. These equate to an overall safety increase without undue cost increase.

A small number of single- and multi-blade fire dampers are actuated. The same methods discussed below for combination fire and smoke can be used for these. They are not discussed here as a separate subject. In most cases, only smoke and combination fire and smoke dampers are actuated. Ceiling radiation and most fire dampers must be manually inspected and tested.

Actuated dampers are applied in two general building applications. First, those required to meet Chapter 7 of the IBC, Fire and Smoke Protection Features, requirements for structural fire resistance. These are referred to as “containment” or “compartmentation” dampers.

Second, those required in Chapter 9, Fire Protection and Life Safety Systems, for engineered smoke control systems. They are referred to as “smoke control system dampers.”

**Code Required Testing Frequency**

*Table 1* shows the intervals at which various types of life-safety dampers must be tested.

**Typical Actuated Life-Safety Dampers and Control Methods**

Variations exist in many situations; however, the following examples exemplify the majority of cases.

*Figure 1* shows the typical wiring for a Chapter 7 smoke damper. As shown, the smoke detector can also be wired to a fire alarm system—upon detection of smoke, the detector opens its contacts and removes power to the damper actuator, closing the damper.

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Figure 2 shows the typical wiring for a combination fire and smoke Chapter 7 containment damper. For a more complete description of the types of life-safety dampers see the three-part series “Basic Fire and Smoke Dampers” in the ICC Building Safety Journal. If smoke is detected, power to the actuator is removed and the damper springs closed. This damper also contains a heat responsive device (normally a bi-metal, not a fusible link) that is factory supplied at a temperature of 165°F (74°C) to 350°F (177°C). If the duct temperature rises above the damper’s heat responsive device setpoint the contact opens and removes power to the actuator thus closing the damper.

Visual inspection is the only means of noting the damper cycling for an inspection.

Figure 3 shows the wiring details of a smoke damper in a typical Chapter 9 application. In this case we see the damper is connected to the fire fighters’ smoke control system (FSCS) panel. In case of an event, the incident commander can override the dampers position or leave it in automatic. The position of the damper—open or closed—is indicated by lights in the control panel. The damper can be factory supplied with open or closed position switches (via actuator auxiliary switches or damper blade switches) to supply a signal to the control panel indicating the dampers position.

Figure 4 shows a re-openable combination fire and smoke damper. In this case there is a secondary heat responsive device (usually 250°F or 350°F (121°C or 177°C)) present. The primary heat responsive device (usually 165°F or 212°F (74°C or 100°C)) can be bypassed at the FSCS panel until the damper experiences the secondary heat responsive device temperature. At this point, the power will be removed from the actuator, closing the damper. It is assumed that 165°F (74°C) will be experienced due to a fire in a space. However, 250°F (121°C) indicates that the fire is near the barrier wall and the damper must close to prevent fire jumping the barrier. 350°F (177°C) is sometimes specified to give the fire fighters longer to remove smoke if the damper has been overridden open. Code is 250°F (121°C).

**Remote Damper Testing**

Only actuated dampers can be remotely tested for inspection if they incorporate factory supplied position indication. Therefore, ceiling dampers and curtain fire dampers using a fusible link must still be manually and visually tested. If actuated, single- and multi-blade fire dampers could be remote tested using the methods shown below.

Dampers installed per Chapter 9 requirements lend themselves to remote testing with no additional wiring. Remote operation and position indication are included initially and can be used for periodic testing. At times they are automatically tested in the weekly smoke control system equipment tests. When inspection and

### Table 1: Periodic testing requirements.

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<th>Dedicated</th>
<th>Non-Dedicated</th>
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<td>Fire Detection and Smoke Control Systems</td>
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<td>Weekly Self-Test</td>
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*Subject to the Exception in 909.12.1 of both IBC and IFC*
testing could interfere with normal functions, such as when fans must be off to avoid duct damage and safety concerns, step-by-step manual intervention allows testing. Both fire alarm and building automation system companies have UL 864 UUKL2 listed panels. Central connection to either can be used for remote testing depending on local codes. Typically, a networked system, rather than the hard-wired methods shown in Figures 3 and 4 would be used. The typical combination damper wired to a network module is shown in Figure 5.

A very large system may have as many panels as shown and an additional workstation that connects to both the building automation and the fire alarm and smoke control panels. Small systems may have only one panel with the fire alarm panel doing many smoke control functions as well as containing the FSCS panel overrides and position indication.

Since the controls must be installed for smoke control, there is no extra cost in equipment for remote testing with dampers installed for Chapter 9 smoke control systems. Not all systems use a digital graphics display. Most commonly a separate indication and override panel is used.

Chapter 7 containment dampers do not require central connections thus remote testing would require additional wiring. A trade-off exists between the extra initial cost and the periodic testing cost. Some building owners may desire more frequent testing to maintain
a higher level of safety. Life-safety dampers in many buildings do not have periodic testing performed. Remote testing can greatly increase the percentage of dampers to be periodically tested. Where dampers are hidden or difficult to access remote testing offers the benefits of ensuring testing as well as reducing the cost of that periodic testing—for example in hospitals, when ceiling containment must be maintained or lifts required to access the damper.

Figure 6 shows a cost-effective method of remote testing containment dampers. While the damper itself is usually in a duct and requires penetrating both the ceiling and duct for visual access, a local momentary override switch and position indication light panel can be utilized. The switch assembly is available from the damper manufacturer and should be ordered with the damper. The assembly can be key switch protected from tampering and/or located where convenient for maintenance but out of public access.

Electrical power drives the damper open via the actuator; the Open light is illuminated. The test switch breaks the power causing the actuator to spring closed; the Open light goes off and when the damper closes, the Closed light illuminates. Releasing the test switch returns the damper to the open position and the lights reverse. A smoke damper would use the same method and the wiring would be the same except there would be no 165°F (74°C) primary heat responsive device.

The use of a central controller for testing has wiring similar to that shown in Figures 5 and 7.

**Summary**

Remote testing of life-safety dampers is permitted in the 2019 NFPA standards that regulate actuated fire and smoke dampers. Existing controls applied to smoke control system dampers installed per IBC and IFC Chapter 9 already provide methods for remote testing. However, containment dampers installed per IBC and IFC Chapter 7 will require additional controls and wiring to allow remote testing.

The most common existing methods for actuated control of smoke and combination fire and smoke dampers are described.

Damper open and closed position verification upon command is the proof required. Two methods for
remote testing are discussed. One, a local test switch with position indication lights can be installed. Or two, use of the fire alarm or building automation system to remote test.

References

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