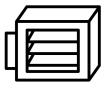
Fire and smoke dampers



These are essential components in building safety systems, designed to prevent the spread of fire and smoke through heating, ventilation, and air conditioning (HVAC) ducts. In Canadian construction, their installation, inspection, and maintenance are governed by specific codes and standards to ensure occupant safety.

Types of Dampers

Fire Dampers: Installed in HVAC ducts that penetrate fire-rated walls or floors, fire dampers close automatically when a rise in temperature is detected, preventing the spread of fire. They are typically equipped with a fusible link—a metal element that melts at a specific temperature, releasing the damper to close.

Smoke Dampers: These dampers are designed to restrict the movement of smoke within ductwork. They are activated by smoke detectors and can close automatically upon detection of smoke, helping to contain it within a specific area.

Combination Fire/Smoke Dampers: Serving dual purposes, these dampers prevent the spread of both fire and smoke. They are activated by either heat (via fusible links) or smoke detectors, depending on what is detected.

Activation Mechanisms

In **fire dampers**, **fusible links** are designed to melt at a predetermined temperature (commonly 165°F or 74°C). When the link melts, it releases the damper blades, allowing them to close and block the duct, thereby preventing fire from passing through.

Smoke dampers are connected to **smoke detectors** installed within the ductwork or adjacent spaces. Upon detecting smoke, these detectors send a signal to the damper's actuator, prompting it to close and prevent smoke from spreading.

Integration with Fire Alarm Systems

In Canadian buildings, smoke dampers are often integrated with the building's fire alarm system. Smoke detectors connected to the fire alarm system can trigger the closure of smoke dampers upon detecting smoke. Additionally, the position of these dampers (open or closed) is typically monitored by the fire alarm system to ensure proper operation.

Inspection and Testing

The National Fire Code of Canada (NFC) 2020 mandates the inspection and testing of fire dampers, smoke dampers, combination smoke/fire dampers, and fire stop flaps in accordance with NFPA 80, "Standard for Fire Doors and Other Opening Protectives." This requirement is detailed in **Section 2.2.2.4 of the NFC 2020**.

2.2.2.4 of the NFC 2020 code //***Link to download the code here**

Inspection and Maintenance

1. Defects that interfere with the operation of closures in fire separations shall be corrected, and such closures shall be maintained to ensure that they are operable at all times by
    a. keeping fusible links and other heat-actuated devices undamaged and free of paint and dirt,
    b. keeping guides, bearings and stay rolls clean and lubricated,
    c. making necessary adjustments and repairs to door hardware and accessories to ensure proper closing and latching, and
    d. repairing or replacing inoperative parts of hold-open devices and automatic releasing devices.
2. Except where they are equipped with hold-open devices conforming to the NBC, doors in fire separations that are required to be equipped with self-closing devices shall be inspected at intervals not greater than 24 h to ensure that they remain in the closed position when not in use.
3. Doors in fire separations shall be operated at intervals not greater than one month to ensure that they are properly maintained in accordance with Sentence (1), as specified in the fire safety plan prepared in conformance with Section 2.8.
4. Closures in fire separations shall not be obstructed, blocked, wedged open, or altered in any way that would prevent the intended operation of the closure.
5. Fire dampers, smoke dampers, combination smoke/fire dampers and fire stop flaps shall be
    a. inspected at intervals not greater than 12 months to ensure that they are in place and not obviously damaged or obstructed, and
    b. tested in accordance with NFPA 80, “Standard for Fire Doors and Other Opening Protectives.”

Common AHJ Inspection Non-Compliance Issues with Fire and Smoke Dampers

Below are some typical non-compliance issues observed during inspections, along with examples to illustrate their potential consequences.

Improper Installation

Issue: Dampers are not installed per manufacturer or National Building Code of Canada (NBC) requirements.
An example of this would be that the fire dampers installed upside-down, preventing the fusible link from operating correctly.
Lesson Learned: Proper orientation is critical to ensure dampers function as designed.

Obstructed Dampers

Issue: Dampers are blocked by debris, insulation, duct sealant, or structural components.
An example of this would be that the fire damper being obstructed by improperly routed electrical conduits. The damper will not close, leaving the fire barrier compromised.
Lesson Learned: Ensure ducts and dampers remain free from obstructions during and after construction.

Damaged or Misaligned Components

Issue: Bent or misaligned blades prevent proper operation.
An example of this would be that an inspection revealed that a fire damper's blades were bent due to mishandling during installation. The damper failed to close fully during a test, invalidating the fire-resistance rating of the assembly.
Lesson Learned: Handle components carefully and verify alignment during installation.

Missing or Improper Fusible Links

Issue: Fusible links are missing, painted over, or replaced with non-certified components.
An example of this would be that a fusible link was found to be replaced with a standard metal wire to avoid procurement delays. This wire will not melt at the required temperature during a fire test, resulting in non-compliance.
Lesson Learned: Use only certified fusible links and inspect them regularly.

Non-Functional Actuators

Issue: Smoke damper actuators are disconnected, damaged, or improperly wired.
An example of this would be that the actuators are not connected to the building's power supply. This oversight will leave the smoke control system ineffective.
Lesson Learned: Verify all actuator connections and functionality during commissioning.

Inadequate Firestopping Around Dampers

Issue: Improper or insufficient firestopping compromises the fire resistance of assemblies.
An example of this would be the firestopping around a fire damper penetration being incomplete. During the test, flames will bypass the damper through gaps, spreading to adjacent areas.
Lesson Learned: Ensure all firestopping materials meet UL/ULC requirements and are properly installed.

Lack of Access for Maintenance

Issue: Dampers are installed in inaccessible locations, making inspection and maintenance difficult.
An example of this would be that the fire dampers are installed above hard ceilings without access panels. As a result, annual inspections are skipped, violating the National Fire Code of Canada.
Lesson Learned: Provide accessible openings for all dampers to facilitate regular inspections and testing.

Testing and Maintenance Deficiencies

Issue: Testing and maintenance are not performed as required or are improperly documented.
An example would be that during AHJ inspection if dampers are found non-functional, it could result in costly retrofits and fines.
Lesson Learned: Maintain up-to-date records of all inspections, testing, and maintenance activities.

Fire Alarm System Integration Failures

Issue: Dampers are not properly connected to the fire alarm system for activation and monitoring.
An example of this would be that smoke dampers do not close during a fire alarm test because they were not integrated into the fire alarm system.
Lesson Learned: Coordinate between HVAC and fire alarm contractors to ensure full integration.

Use of Non-Approved Materials

Issue: Use of materials that do not meet fire resistance standards.
An example of this would be if a non-approved seal is used to seal damper sleeves instead of fire-rated sealant. During a fire, the tape would melt, allowing flames to bypass the damper.
Lesson Learned: Verify that all materials used comply with fire resistance and safety standards.

Installation Challenges and Recommendations

Coordination Issues

Lack of coordination between mechanical, electrical, and fire protection teams during installation often results in non-functional systems.
Recommendation: Establish clear communication protocols and hold coordination meetings.

Tight Spaces

Installing dampers in tight or crowded spaces can lead to misalignments or obstructed movement.
Recommendation: Allocate sufficient space during the design phase for proper damper operation.

Improper Duct Transitions

Poorly fabricated duct transitions can interfere with damper operation.
Recommendation: Ensure transitions are smooth and follow manufacturer guidelines.