



Design Tips for Fire and Smoke Barriers

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William Koffel

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- Founder & President, Koffel Associates
- 40+ years experience
- Member of several NFPA Technical Committees including NFPA 80 and NFPA 105
- AMCA Code Consultant



Design Tips for Fire and Smoke Barriers

Purpose and Learning Objectives

The purpose of this presentation is to inform industry professionals about compartmentalization requirements driving fire/smoke damper requirements, and to explain lifetime testing requirements.

At the end of this presentation you will be able to:

1. Identify at least three factors used in selecting the correct fire or smoke damper.
2. Explain the code requirements for access to fire and smoke dampers.
3. Identify the frequency at which fire and smoke dampers are required to be inspected and tested.
4. Describe recent code changes regarding the use of dampers capable of remote inspection.

Overview of Fire and Smoke Barriers

Types of Wall Assemblies

- Exterior walls
 - Dampers required where protected openings required
- Fire walls
 - Ducts and air transfer openings restricted
- Fire barriers
 - IBC contains special provisions for horizontal assemblies
 - Both IBC and NFPA contain special provisions for shafts and exit enclosures
- Fire partitions – No such assembly in NFPA
- Smoke barriers
- Smoke partitions

Fire Tested Wall Assemblies

- In accordance with ASTM E119/UL263
- Resist passage of heat and hot gases
- Structural integrity during the test fire
- Have something left at the end of the test

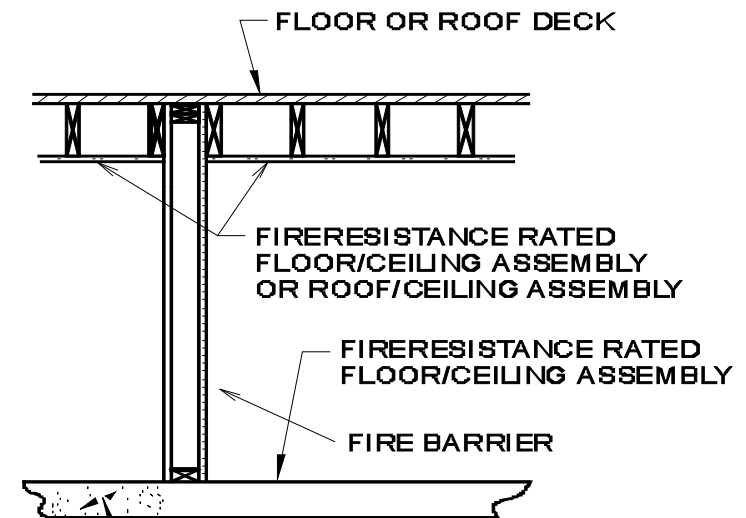
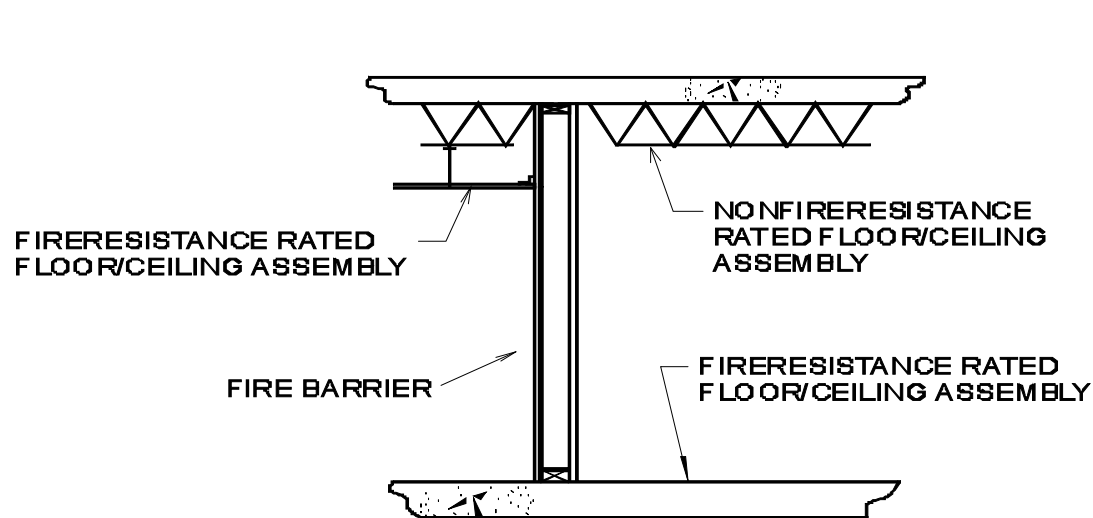
Five Points

- Required fire-resistance rating
- Continuity
- **Openings and penetrations**
- Types of materials
- Structural robustness

Fire Barriers

- Fire barriers are used in the following applications:
 - Fire area separations
 - Mixed occupancy separations
 - Incidental use areas
 - Hazardous area separations
 - **Exit enclosures – openings and penetrations restricted**
 - **Shaft enclosures**
 - **Horizontal exits**
 - **IBC – smoke damper required**
 - **NFPA – restricts duct penetrations**
 - Corridor walls – **NFPA only**

Continuity



Summary of Fire Barriers

Issue	Requirement
Required Fire-Resistance Rating	Depends upon specific use
Required continuity	Floor/ceiling below to deck above
Openings	General: Aggregate glazing area (or width) <25% wall area/length; maximum size 120 sf. Specific: Rules based on use of barrier
Dampers	Depends on Code, application, and fire resistance rating

Fire Partitions

- Fire partitions are used in the following applications:
 - Dwelling unit separations
 - Sleeping units in Group R-1, R-2 and I-1
 - Tenant separation in covered malls
 - Exit access corridor walls
 - Elevator lobby separation
- Remember, NFPA does not use this phrase.

Summary of Fire Partitions

Issue	Requirement
Required Fire-Resistance Rating	1 hour, with exceptions, depending on use. For corridors see Table in Chapter 10 – IBC only
Required continuity	Floor/ceiling below to deck above or tight to underside of fire-resistance rated assembly. Supported by fire-resistance rated construction, except in corridors, tenant, and guestroom separations in Types IIIB and VB construction
Openings	20 minutes (w/o hose stream) for corridors 45 minutes for all others
Dampers	Required but exceptions generally apply

Smoke Barriers

- Smoke barriers are used in the following applications:
 - Group I-2
 - Group I-3
 - Areas or refuge
 - Other specific applications

Summary of Smoke Barriers

Issue	Requirement
Required Fire-Resistance Rating	1-hour with the exception that a construction of a minimum 0.1” thick steel in Group I-3 buildings is allowed
Required continuity	Horizontal: Outside wall to outside wall Vertical: Floor to slab or deck above, continuous through interstitial spaces Supporting construction may be required based upon the applicable codes
Openings	20 minutes – but not a true fire door Smoke- and draft-controlled doors tested in accordance with UL 1784 – one edition of the IBC
Dampers	Smoke dampers required although exception for health care

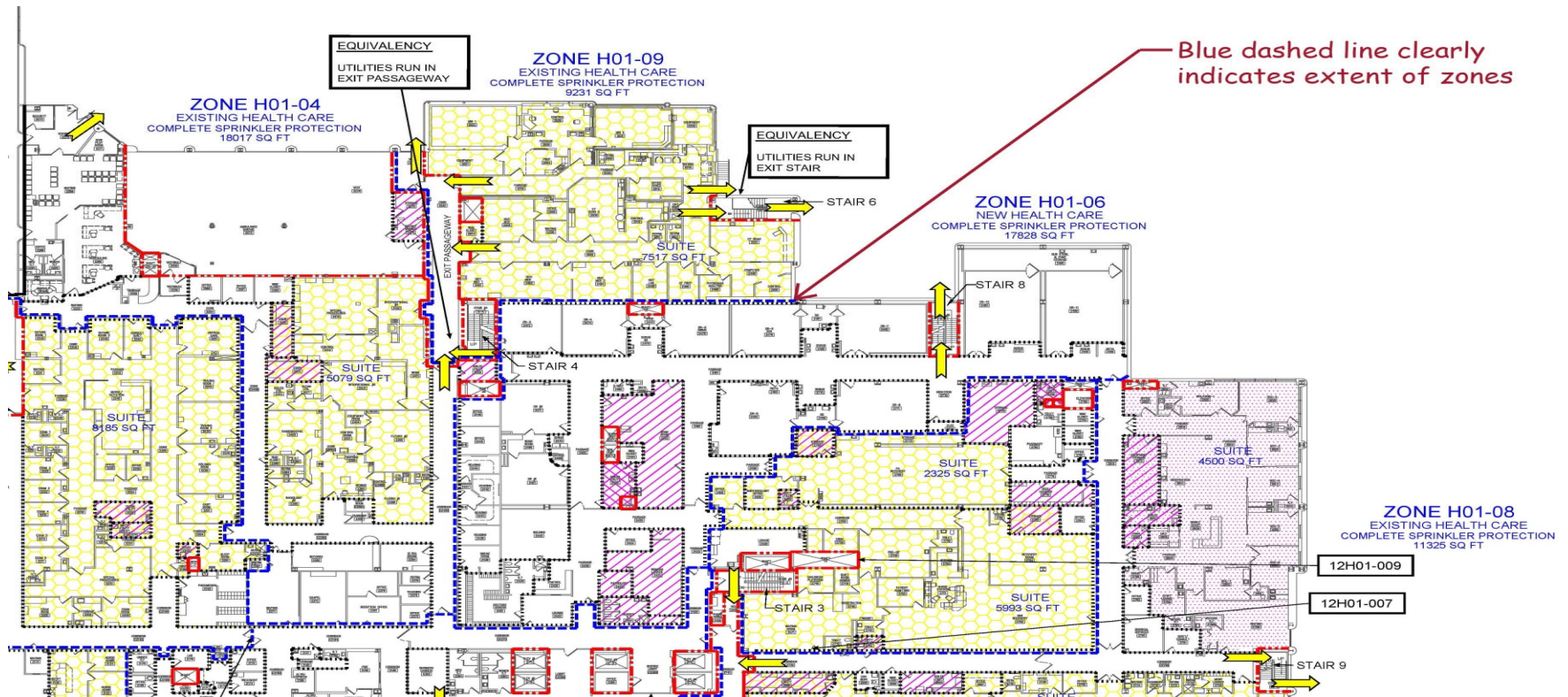
Smoke Partitions

- Smoke partitions are used in the following applications:
 - Corridor walls in Group I-2 – IBC only
 - Sprinkler protected hazardous areas – NFPA

Summary of Smoke Partitions

Issue	Requirements
Required Fire-Resistance Rating	Not required (unless otherwise required)
Required continuity	Floor/ceiling below to deck above or tight to underside of ceiling membrane in ceiling membrane designed to limit passage of smoke - Difference between NFPA/ICC for ceiling tiles
Openings	Windows: Sealed to resist free passage of smoke Doors: No louvers Self closing, or automatic closing by smoke detectors
Dampers	Smoke dampers required in air transfer openings

Drawing Information





Smoke and Fire Dampers

- ANSI/UL 555 – *Standard for Fire Dampers*
 - Installed in the wall
 - Rating
 - 1.5 hr. and 3 hr.
- ANSI/UL 555S – *Standard for Smoke Dampers*
 - Installed to prevent smoke migration in HVAC system

Other Dampers

- Combination fire/smoke dampers – *UL 555 and UL 555S*
- Ceiling radiation dampers – *UL 555C and tested as part of a rated assembly*
- Corridor dampers – *UL 555 and UL 555S*

Special Considerations

- Smoke control systems – Alternative protection shall be used if damper will interfere with operation of the system.
- Hazardous exhaust ducts
 - Comply with the mechanical code
 - Dampers typically prohibited

Smoke and Fire Dampers - Access

- Access required to permit inspection and testing.
- Access points shall be permanently identified.

Smoke and Fire Dampers – Inspection and Testing

- Fire Dampers
 - Acceptance test
 - One year after installation
 - Every four years thereafter, except for hospitals which is every six years
- Smoke Dampers
 - Acceptance test
 - One year after installation
 - Every four years thereafter, except for hospitals which is every six years

New Developments - Instructions

- **NFPA 80 and NFPA 105 – 2019 Editions**

19.2.2* – For new damper installations, the damper manufacturer's installation and maintenance instructions shall be maintained on site.

A.19.2.2 – In order to verify a damper has been properly installed in accordance with the manufacturers' listing, such as a damper with a retaining angle on one side only, it is necessary to have this information onsite.

New Developments

- NFPA 80 and NFPA 105 – 2019 Editions recognize remote inspection

19.5.2.3.3.1 General

(A) Dampers inspected remotely shall be designed with the ability to A damper with remote inspection capability shall positively indicate when the damper is fully open and fully closed.

(B) Prior to using, the initial remote inspection shall include a visual inspection of the installed damper shall be performed damper in accordance with 19.5.2.3.2 .

(C) The visual inspection shall confirm that the position indication method accurately reflects the full-open and full-closed position of the damper.

New Developments

19.5.2.3.3.2 Test Procedure

- (A)** A signal from the damper's position indication device to shall confirm that the damper is in the full-open or full-closed position as required by the system design.
- (B)** The damper shall be commanded and confirmed to the full-closed or full-open position.
- (C)** The damper shall be confirmed to the original operating position as required by the system design.
- (D)** If the remote inspection fails to comply with 19.5.2.3.3.2(A) through 19.5.2.3.3.2(C) , a visual inspection shall be performed in accordance with 19.5.2.3.2.

New Developments – IBC 2021 Edition

- 717.4 Access, identification and periodic inspection and testing of fire and smoke dampers shall comply with Sections 717.4.1 through 717.4.3.
- 717.4.1 Access. Fire and smoke dampers shall be provided with an approved means of access that is large enough to permit inspection and maintenance of the damper and its operating parts. Dampers equipped with fusible links, internal operators, or both shall be provided with an access door that is not less than 12 inches square or provided with a removable duct section
- 717.4.1.1 The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access doors in ducts shall be tight fitting and suitable for the required duct construction.
- **717.4.1.2 Restricted Access. Where space constraints or physical barriers restrict access to a damper for periodic inspection and testing, the damper shall be a single- or multi-blade type damper and shall comply with the remote inspection requirements of NFPA 80 or NFPA 105.**
- 717.4.2 Identification. (No Change)
- **717.4.3 Periodic inspection and testing. Periodic inspection and testing of fire dampers shall be in accordance with NFPA 80. Periodic inspection and testing of smoke dampers shall be in accordance with NFPA 105. Periodic inspection and testing of combination fire/smoke dampers shall be in accordance with NFPA 80 and NFPA 105.**

Resources

- **AMCA International:** www.amca.org
- **2019 AMCA *inmotion* Magazine:** <http://bit.ly/AMCAinmotion2019>
 - Remote Periodic Testing of Life-Safety Dampers
- **AMCA Publication:** www.amca.org/store
 - **503-08:** Fire, Ceiling (Radiation), Smoke and Fire/Smoke Dampers Application Manual (Free PDF download)
- **AMCA White Papers:** <https://www.amca.org/educate/#articles-and-technical-papers>
 - Fire and Smoke Dampers: Best Practice Design Tips
- **National Fire Protection Association (NFPA):** www.nfpa.org



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