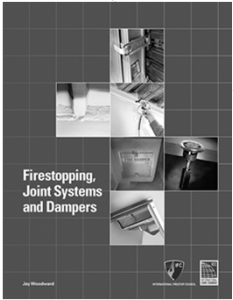


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**2015 IBC Dampers,
Penetration Firestops
and Joint Systems**

**Based on the 2015
International Building
Code®, (IBC®)**

Presenter




- Jay Woodward
- ICC Senior Staff Architect

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International Green Construction Code Chapter 3: Jurisdictional Requirements

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- Polling questions



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Outline

- Introduction** – Basics of fire-resistance ratings and fire-protection ratings
- Definitions**
- Damper provisions** – Testing, ratings, actuation, and where required
- Penetrations** – Definitions, test standards, where protection is required, installation, inspection and maintenance

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Outline (continued)

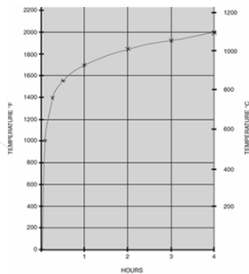
- **Fire-resistant joint systems** – Test criteria, where joint systems are required, voids at intersection of floor and exterior curtain wall, joints in smoke barriers
- **Miscellaneous items** – Mineral wool vs. mineral fiber, compression and support of insulation, engineering judgments, inspection and installation process, information on plans, combustibles located within a plenum

Openings and penetrations in a fire-resistance-rated and/or smoke-resistant assembly create a potential weak link or hole that could dramatically reduce the assembly's effectiveness or render it completely ineffective, if they are not properly protected.

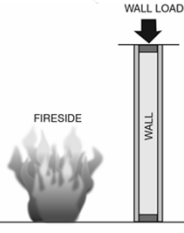
- This class looks at the requirements for dampers, penetration firestop systems and joint systems that help protect openings and penetrations so the assembly can perform as intended and maintain its rating.

Time-temperature curve for test

- The average test furnace temperatures used in the tests are:
 - 1,000°F at 5 minutes
 - 1,400°F at 15 minutes
 - 1,550°F at 30 minutes
 - 1,700°F at 60 minutes
 - 1,850°F at 120 minutes
 - 1,925°F at 180 minutes
 - 2,000°F at 240 minutes



Fire-resistance ratings and fire tests

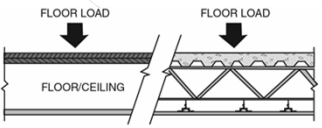


ASSEMBLY MUST:

- SUSTAIN APPLIED LOAD
- HAVE NO PASSAGE OF FLAME OR GAS HOT ENOUGH TO IGNITE COTTON WASTE
- HAVE AVERAGE TEMPERATURE RISE ON UNEXPOSED SURFACE NOT MORE THAN 250°F ABOVE INITIAL TEMPERATURE OR MORE THAN 325°F AT ANY POINT
- MAINTAIN STRUCTURAL INTEGRITY TO PREVENT A THROUGH PROJECTION OF WATER DURING HOSE STREAM TEST

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Fire-resistance ratings and fire tests



ASSEMBLY MUST:

- SUSTAIN APPLIED LOAD
- HAVE NO PASSAGE OF FLAME OR GAS HOT ENOUGH TO IGNITE COTTON WASTE
- HAVE AVERAGE TEMPERATURE RISE ON UNEXPOSED SURFACE NOT MORE THAN 250°F ABOVE INITIAL TEMPERATURE OR MORE THAN 325°F AT ANY POINT

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Definition: Fire protection rating

FIRE PROTECTION RATING.

The period of time that an opening protective will maintain the ability to confine a fire as determined by tests prescribed in Section 716. Ratings are stated in hours or minutes.

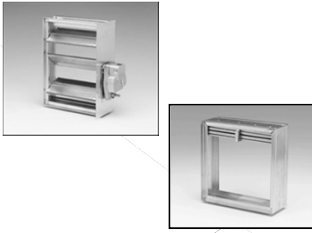


Assemblies with a fire-protection rating just plug the hole to stop the flames – they don't limit heat transfer through the assembly.

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Dampers

IBC Section 717



Dampers, Penetration Firestops and Joint Systems

Five general types of dampers

Each type of damper has a very specific application and is tested to show compliance with the intended application

- It is important to verify that the specified and installed damper is the correct damper for that application

- Fire damper
- Smoke damper
- Combination fire and smoke damper
- Corridor damper
- Ceiling radiation damper

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Damper test standards

Fire dampers - UL 555

Smoke dampers - UL 555S

Ceiling radiation dampers - UL 555C or tested as a part of FR-rated horizontal assembly

Combination damper - UL 555 and UL 555S

- All dampers are listed and must have a label
- Must be installed in accordance with manufacturer's installation instructions
- Where smoke and fire damper are required, may use separate dampers or combination damper

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Fire damper ratings

**TABLE 717.3.2.1
FIRE DAMPER RATING
(IMC Table 607.3.2.1)**

| TYPE OF PENETRATION | MINIMUM DAMPER RATING (hours) |
|--|-------------------------------|
| Less than 3-hour fire-resistance-rated assemblies | 1.5 |
| 3-hour or greater fire-resistance-rated assemblies | 3 |

Fire dampers shall have the minimum fire protection rating specified in Table 717.3.2.1

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Smoke damper ratings

| Class | Maximum Leakage (CFM/ft ²) | | | | |
|-------|--|----------|----------|-----------|-----------|
| | 4 in. WG | 6 in. WG | 8 in. WG | 10 in. WG | 12 in. WG |
| I | 8.0 | 9.5 | 11.0 | 12.5 | 14.0 |
| II | 20.0 | 24.0 | 28.0 | 31.5 | 35.0 |
| III | 80.0 | 96.0 | 112.0 | 125.0 | 140.0 |

Smoke dampers are tested at elevated temperatures and must be labeled with the temperature used to determine the leakage ratings


- Temperature ratings in increments of 100°F (250°F minimum)
 - 250°F rating is generally adequate, but Section 909.10 may require a higher rating for some smoke control systems

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Remember, fire dampers and smoke dampers are tested to different standards

Combination Fire and Smoke Dampers

UL Classification Marking



COMBINATION FIRE AND SMOKE DAMPER
FIRE RESISTANCE RATING 1-1/2 HOUR
LEAKAGE RESISTANCE CLASS I - 350°F
No. _____

Additional Marking

Airflow rating (2000 fpm minimum, and 1000 fpm increments); Closure pressure rating (4 in. WG minimum and 2 in. WG increments)

- Verify by looking at the label that the correct damper is being used.

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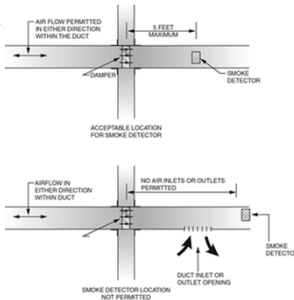
Fire damper and ceiling radiation damper actuation

Done by one of the following:

- Operating temperature approximately 50°F above normal temperature in the duct
 - But not less than 160°F
- Operating temperature up to 350°F allowed for smoke control system



Smoke damper actuation



Access and identification

Approved means of access must be provided:

- Large enough to permit inspection and maintenance
- Shall not reduce fire-resistance of assembly
- Be identified



Where dampers are required

- ⦿ Section 717.5 lists locations where dampers are required for walls and specifies the type of damper required at each location
- ⦿ Section 717.6 specifies the location and type of damper required for horizontal assemblies

Quick reference – Damper requirements for walls

| Section | Wall type | Referenced from | Type of damper |
|-------------------------------------|----------------------------------|-----------------|---------------------------|
| 717.5.1 (IMC 607.5.1) | Fire walls | 706.11 | Fire damper |
| 717.5.1.1 (IMC 607.5.1.1) | Fire wall – Horizontal exits | 706.11 | Fire damper, Smoke damper |
| 717.5.2 (IMC 607.5.2) | Fire barriers | 707.10 | Fire damper |
| 717.5.2.1 (IMC 607.5.2.1) | Fire barriers – Horizontal exits | 707.10 | Fire damper, Smoke damper |
| 717.5.3 (IMC 607.5.3) | Shaft enclosures | 713.10 | Fire damper, Smoke damper |
| 717.5.4 (IMC 607.5.3) | Fire partitions | 708.9 | Fire damper |
| 717.5.4.1 (IMC 607.5.3 and 607.5.4) | Fire partitions – Corridors | 708.9 | Fire damper, Smoke damper |
| 717.5.5 (IMC 607.5.4) | Smoke barriers | 709.8 | Smoke damper |
| 717.5.6 (IMC 607.5.6) | Exterior walls | 705.10 | Fire damper |
| 717.5.7 (IMC 607.5.7) | Smoke partitions | 710.8 | Smoke damper |

Fire barriers – Section 717.5.2

- ⦿ Ducts and air transfer openings shall be protected with fire dampers
- ⦿ Three exceptions may eliminate requirement
- ⦿ Duct and air transfer openings into exits are generally prohibited
 - › **Horizontal exits:** Where the fire barrier serves as a horizontal exit, a listed smoke damper must also be installed. (In addition to the generally required fire damper)

Fire barriers – Section 717.5.2

The diagram illustrates two scenarios for fire barriers. The top scenario shows a vertical shaft with a horizontal duct penetration. Labels include 'DUCT PENETRATION', 'FIRE DAMPER REQUIRED' (pointing to a damper in the duct), and 'AIR TRANSFER OPENING'. Below this, a note states 'GENERAL REQUIREMENT FOR FIRE BARRIERS'. The bottom scenario shows a horizontal shaft passing through a vertical fire barrier. Labels include 'FIRE AND SMOKE DAMPER - OR COMBINATION DAMPER REQUIRED' (pointing to a damper in the shaft) and 'HORIZONTAL EXIT USING FIRE BARRIER'. A note below states 'REQUIREMENT FOR FIRE BARRIER USED AS HORIZONTAL EXIT'. The bottom left corner features a 'FEATURED TOPIC WEBINAR SERIES' logo and the text 'Dampers, Penetration Firestops and Joint Systems'. The page number '25' is in the bottom right corner.

Shaft enclosures – Section 717.5.3

Shaft enclosures that are permitted to be penetrated by ducts or air transfer openings shall be protected with fire and smoke dampers

- > **Note:** Some shafts (grease ducts and hazardous exhaust systems) are required to be independent and do not allow shaft penetrations

© Five exceptions may eliminate damper requirement

The diagram shows a vertical shaft enclosure. Labels include 'CONTINUOUS AIRFLOW UPWARD TO OUTSIDE' (pointing to an opening at the top), 'PENETRATION FIRESTOP SYSTEM REQUIRED PER 717.5.2 (714) THROUGH 714.3.5' (pointing to a firestop in the shaft), 'SHAFT ENCLOSURE PER SECTION 713' (pointing to the shaft enclosure walls), and 'STEEL EXHAUST DUCT' (pointing to a duct at the bottom). The bottom left corner features a 'FEATURED TOPIC WEBINAR SERIES' logo and the text 'Dampers, Penetration Firestops and Joint Systems'. The page number '26' is in the bottom right corner.

Shaft enclosures – Exception 1.1

The diagram shows a vertical shaft enclosure with a horizontal duct penetration. Labels include 'CONTINUOUS AIRFLOW UPWARD TO OUTSIDE' (pointing to an opening at the top), 'PENETRATION FIRESTOP SYSTEM REQUIRED PER 717.5.2 (714) THROUGH 714.3.5' (pointing to a firestop in the shaft), 'SHAFT ENCLOSURE PER SECTION 713' (pointing to the shaft enclosure walls), and 'STEEL EXHAUST DUCT' (pointing to a duct at the bottom). The bottom left corner features a 'FEATURED TOPIC WEBINAR SERIES' logo and the text 'Dampers, Penetration Firestops and Joint Systems'. The page number '27' is in the bottom right corner.

Fire partitions – Section 717.5.4

- ⦿ Ducts and air transfer openings shall be protected with fire dampers
 - > Four exceptions may eliminate requirement
- ⦿ Duct and air transfer openings into corridors will also require a smoke damper (whether through fire partition or ceiling of corridor enclosure)
 - > Two exceptions for corridor smoke dampers

Corridors – Section 717.5.4.1

Section lists the three types of dampers that may be needed for a corridor – In addition to the fire damper required for walls by Section 717.5.4

- ⦿ **Corridor damper** where ceiling constructed as required for corridor walls (708.4, Exception 3)
- ⦿ **Ceiling radiation damper** where ceiling is part of rated horizontal assembly (708.4, Exception 2)
- ⦿ **Smoke damper** wherever penetration into corridor “enclosure” and corridor requires smoke and draft control doors (per 716.5.3)

Corridors – Section 717.5.4.1

A smoke damper is required where a duct or air transfer opening penetrates protected corridors (Fire damper is also required by 717.5.4)

- ⦿ Applies to both walls or ceilings of “enclosure” (Items 1 and 3)
- ⦿ Applies even if wall is not a fire partition (701.2)
- ⦿ Two exceptions for smoke damper
- ⦿ Although focused on corridors, it also applies to elevator lobbies since referenced in 3006.3, Items 1 & 2
- ⦿ 2015 code text helps clarify type of damper required – but no technical change from 2012

Corridors – smoke dampers, Exception 2

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Corridors

A “corridor damper” is required where the ceiling of the enclosure is constructed as a wall (708.4, Exception 3) and is penetrated

- Corridor dampers are tested for this specific application – both fire and smoke damper test (Not ceiling radiation or horizontal damper)

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Smoke barriers – Section 717.5.5

Although smoke barriers generally have a 1-hour fire-resistance rating, only a smoke damper is required

- Damper actuated per Section 717.3.3.2
- Can apply to horizontal assembly (By definition and Section 709)
- Two exceptions can eliminate damper requirement

Smoke barriers typically used for

- Hospitals,
- Jails
- Ambulatory care facilities
- Underground buildings
- Lobbies for fire service or occupant evacuation elevators

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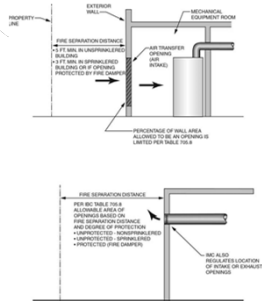
Exterior walls – Section 717.5.6

Openings in exterior walls required to have protected openings shall be protected with fire dampers

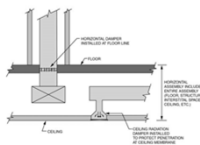
- ⦿ Openings are limited or prohibited based on Sections 705.10 and 705.8
- ⦿ No openings with fire separation distance of less than 3 feet. No unprotected openings if less than 5 feet in nonsprinklered building
- ⦿ A fire damper is a protected opening



Exterior walls – Section 717.5.6



Horizontal assemblies



- Important to use correct damper at correct location
- ⦿ For use in a floor – a horizontal damper. May be fire, smoke or combination
 - ⦿ For use in a ceiling – a ceiling radiation damper
 - ⦿ Always install correct damper and in accordance with manufacturers installation instructions



Horizontal assemblies

| | |
|---|---|
| <p>Horizontal damper</p> <ul style="list-style-type: none"> ⦿ Fire, smoke or combination damper tested in horizontal orientation ⦿ Tested to UL 555 and/or UL 555S but in a horizontal orientation in the floor of the assembly | <p>Ceiling radiation damper</p> <ul style="list-style-type: none"> ⦿ For installation in the ceiling membrane of a floor/ceiling or roof/ceiling assembly ⦿ Tested to UL 555C and limits heat transmission ⦿ Not acceptable to install a fire damper in a ceiling membrane |
|---|---|

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Horizontal assemblies

As with all dampers, horizontal dampers are to be installed as tested and listed

- ⦿ Currently (virtually all, if not all) are tested in noncombustible concrete floors
 - > Therefore it is inappropriate to install them in a combustible floor system, even if the floor has a concrete topping
 - > Review listing and manufacturer's installation instructions
 - > Also verify for steel/concrete composite systems

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Horizontal assemblies

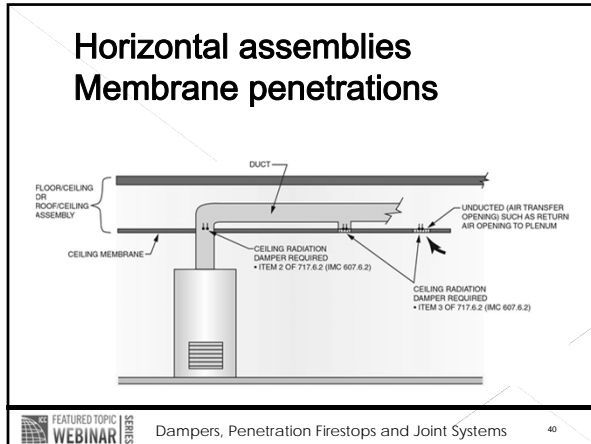
Membrane penetrations

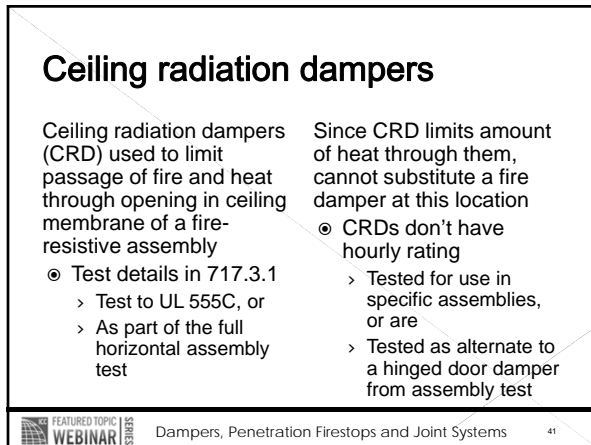
Section 717.6.2 regulates duct and air transfer openings through the ceiling membrane of an assembly

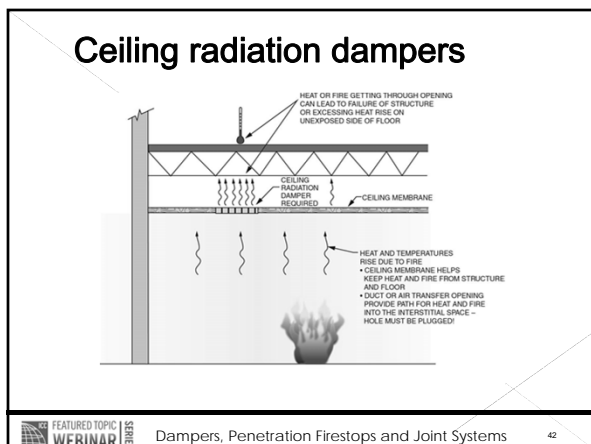
- ⦿ Provides three possible means of protection

1. Shaft enclosure complying with 713
2. Ceiling radiation damper at ceiling with duct penetration
3. Ceiling radiation damper at ceiling where diffuser with no duct penetrates

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Additional damper information

Sections 717.2 and 717.3.1 require dampers be tested, listed and labeled in accordance with the UL standards and installed in accordance with the manufacturer's installation instructions

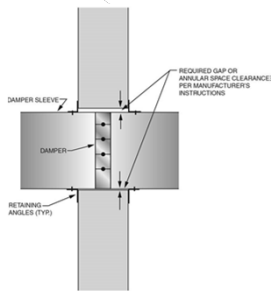
- ⦿ IBC and IMC tell where dampers are required
- ⦿ Listing and manufacturer's requirements provide most installation details
- ⦿ Products vary, so check details for that specific damper – don't rely on general rules

Damper installation

Four aspects usually only addressed within the installation instructions are:

1. The space around a damper when it is installed in the opening.
2. The requirement for a sleeve if the damper is installed within a duct.
3. The attachment and potential break-away feature for any duct attached to the damper or sleeve.
4. Whether the opening through the assembly must be lined with some material such as gypsum board or may leave the framing members exposed.

Damper installation



Installation instructions will provide minimum annular space around damper

- ⦿ Space is required to allow expansion and movement
 - > Example: May require 1/8 inch per foot of damper on all sides
 - > Gap is OK. It is tested this way
 - > Filling required gap would void listing

Damper installation

Retaining angles:

- Generally cover annular space or gap
- Hold damper or sleeve in opening but allow for movement – if attached to wall they may void listing
- Generally overlap wall by 1 inch minimum
- Attachment is covered by item 7 of SMACNA table

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Damper installation

Do not place sealants around/between retaining angles and assembly or damper unless indicated in listing or installation instructions

- > Sealants could void listing
- > Could restrict damper movement
- > Always check listing if sealant is used/desired

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Breakaway connections

Connection to damper or damper sleeve must allow ductwork to breakaway and not pull damper from the opening

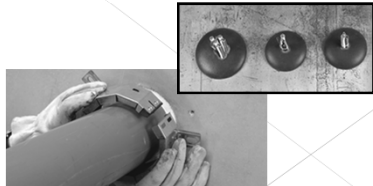
- Types of connections and locations are specified in installation instructions
- UL 555 shows various types of connections
- Test is required by UL 555

Verify with listing. For example a flat drive may not be permitted, or may only be allowed on vertical sides of duct

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Penetrations

IBC Section 714



Penetrations

No single item will work for every situation. Required systems depend on:

- > Type and rating of base assembly
- > Type, size and material of penetrant
- > Type and thickness of any insulation on penetrant
- > Material type and thickness of any sleeve
- > Type of firestopping material used in firestop system

Systems also vary between different manufacturers and within individual product lines

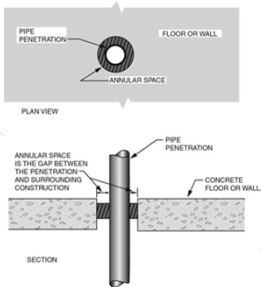
- > Size and configuration of the opening (the annular space between penetrant and periphery of opening)
- > So don't get complacent and assume all systems are equal or installed in similar manner

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Definition – Annular space

Important to understand terminology and test methods

- ◎ Annular space
 - > "The opening around the penetrating item"
 - > Many assemblies include a minimum and maximum dimension



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Annular space can vary

(A) CENTERED

(B) OFF-CENTERED

(C) POINT CONTACT

MINIMUM

ANNULAR SPACE

MAXIMUM

PENETRATION IN CONTACT WITH EDGE OF OPENING (NO POINT CONTACT WITH GAP)

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Definition

Membrane penetration

FIRE-RESISTANCE-RATED STUD WALL ASSEMBLY

MEMBRANE PENETRATION (THROUGH ONLY ONE SIDE OF ASSEMBLY)

MEMBRANE PENETRATION FIRE STOP

MEMBRANE PENETRATION FIRESTOP SYSTEM INCLUDES:

- FIRE-RESISTANCE-RATED WALL OR STRUCTURAL ASSEMBLY
- PENETRATING ITEM - PASSING THROUGH ONE SIDE OF ASSEMBLY
- MATERIALS/DEVICES INSTALLED TO RESIST SPREAD OF FIRE INTO THE ASSEMBLY

Through penetration

THROUGH PENETRATION (PASSES ENTIRELY THROUGH BOTH SIDES OF THE ASSEMBLY)

THROUGH PENETRATION FIRESTOP SYSTEM INCLUDES:

- FIRE-RESISTANCE-RATED WALL OR HORIZONTAL ASSEMBLY
- PENETRATING ITEM - PASSING COMPLETELY THROUGH THE ASSEMBLY
- MATERIALS/DEVICES INSTALLED TO RESIST SPREAD OF FIRE INTO OR THROUGH THE ASSEMBLY

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Definition

F-RATING

- PREVENT FLAME PASSAGE
- MAINTAIN STRUCTURAL INTEGRITY (HOSE STREAM TEST)

THROUGH PENETRATION FIRE STOPS

T-RATING

- TEMPERATURE RISES
- F-RATING CRITERIA

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Test standards

Code provides two basic methods to evaluate the performance of penetration firestop systems:

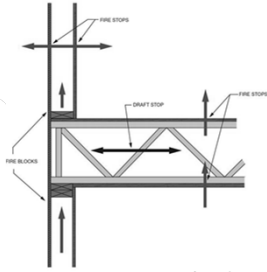
- Test as part of overall assembly (ASTM E 119 or UL 263), or
- Test penetration separately (ASTM E 814 or UL 1479)

- First option is seldom used
- Second option evaluates resistance to:
 - > Development of through openings
 - > Flaming on unexposed surface, and
 - > Ability to limit thermal transmission through the penetration
- All four tests require hose stream test

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Firestopping vs. fireblocking or draftstopping

- Section 714: firestopping for penetrations
- Section 718: fireblocking and draftstopping



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Firestopping vs. fireblocking or draftstopping

| | |
|--|---|
| <p>714 Penetration firestops</p> <ul style="list-style-type: none"> ● Protects penetrations <i>into</i> rated assemblies ● Applies to both combustible and noncombustible construction ● Typically a tested system | <p>718 fireblocking or draftstopping</p> <ul style="list-style-type: none"> ● Limits spread of fire <i>within</i> concealed spaces ● May be rated or non-rated construction ● Applies to combustible concealed locations ● Not tested, but use specific prescriptive/generic products that are deemed to be acceptable |
|--|---|


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Where penetration protection is required

Primary requirements are found in:

- > 714.3 (Fire-resistance-rated walls)
- > 714.4 (Horizontal assemblies)
- > 714.5 (Nonfire-resistance-rated horizontal assemblies)
- > 714.4.4 (Smoke barriers)

Those code sections address not only the type of penetrations required to be protected but also the acceptable methods of protection

 Dampers, Penetration Firestops and Joint Systems 58


Where penetration protection is required

Section 714 is referenced from a number of locations

- Sections 706.9 and 707.7 are examples – from fire wall and fire barrier provisions
- Section 712.1.4 – from the horizontal assembly provisions

Best to look at specific assembly section before looking at 714

- Sections 707.7.1 and 710.6 are examples
 - > 707.7 does reference 714 but 707.7.1 prohibits certain penetrations or allows them in specific locations
 - > 710.6 does not reference 714 for penetrations in smoke partitions

 Dampers, Penetration Firestops and Joint Systems 59

Penetration of fire-resistance-rated walls


Section 714.3 is the starting point

- Primary sections are
 - > 714.3.1 (through penetrations)
 - > 714.3.2 (membrane penetrations)
- Both contain exceptions
- Both ultimately point back to 714.3.1.1 and 714.3.1.2

Sections 714.3.1.1 and 714.3.1.2 allow:

- > Test penetration as part of overall assembly (ASTM E 119 or UL 263), or
- > Test penetration separately (ASTM E 814 or UL 1479)

- An F rating is required for systems

 Dampers, Penetration Firestops and Joint Systems 60

Penetration firestop systems

Are tested and listed systems

- > Should be installed as tested and described in product directory and manufacturer's instructions
- > Deviations can impact performance

Tested systems help

- > Demonstrate compliance with code requirements
- > Provide installer with detailed installation requirements
- > Provide inspector with document to use for inspection of the installation



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Penetrations of horizontal assemblies

IBC looks at horizontal assemblies as a means of compartmenting a building to minimize vertical spread of smoke or fire

Penetration protection requirements apply to:

- ⦿ Fire-resistance-rated assemblies (714.4)
- ⦿ Nonfire-resistance-rated assemblies (714.5)



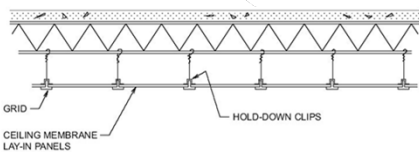
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Fire-resistance-rated assemblies Scoping

Section 714.4 is horizontal assembly's equivalent of Section 714.3 for walls

- > Due to exclusions in Sections 714.4 and 712.1.15, it does not include the roof of a roof/ceiling assembly or to a roof which is rated by itself



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Horizontal assemblies – Through penetrations

Section 714.4.1 provides two basic methods for evaluating through penetrations

- > Test as part of overall assembly (ASTM E 119 or UL 263), or
- > Test penetration separately (ASTM E 814 or UL 1479)

These options were covered previously in Test Standard section and are the same as allowed for walls in 714.3.1

- > First option is seldom used



Through penetration firestop systems – 714.4.1.2

Testing firestop systems in horizontal assemblies to ASTM E 814 or UL 1479 differs from wall provisions since testing requires both an F and a T rating

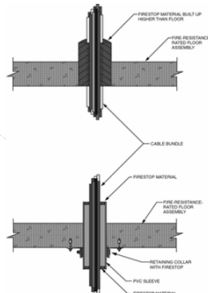
- ⦿ T rating is a higher performance criteria and more difficult to achieve than F rating
- ⦿ T rating limits temperature increase through the penetrant and the firestop system; and does not lessen original assembly performance



Through penetration firestop systems – 714.4.1.2

Obtaining T rating generally requires insulation of penetrant above and/or below to limit heat transmission

- > Details are described in listing and manufacturer's installation instructions



Through penetration firestop systems – T Rating exceptions

Two options to eliminate T rating requirement

- ⦿ Exception 1 relies on “insulation” protection that the wall provides
 - > Allowed whether wall is rated or not
 - > If wall beneath, must extend to floor – to contain penetrant

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Through penetration firestop systems – T rating exceptions

Exception 2 applies to floor drains, tub drains and shower drains

- ⦿ Must be contained and located within concealed space of horizontal assembly
- ⦿ Exceptions only eliminate T rating (Not F rating)

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Membrane penetrations

As general requirement, membrane penetrations are protected the same as through penetrations

- > Tested as part of overall assembly, or
- > Tested to ASTM E 814 or UL 1479 as firestop system
- ⦿ Seven exceptions permitted in lieu of general provisions

Code uses through penetration provisions even though these are membrane penetrations

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Membrane penetration Exception 7

- ⦿ Allows double wood top plate to interrupt ceiling protection
 - > Penetrations through top plate protected
 - > Wall sheathed with Type X Gypsum wallboard
- ⦿ Changed in 2015 code

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Nonfire-resistance-rated horizontal assemblies

IBC relies on floors to compartment buildings, even nonrated floors. Therefore requires that penetrations are protected to retard or reduce spread of smoke or fire to other levels

- ⦿ Three options to protect penetrations
 - > Shaft requirements of Section 713
 - > Noncombustible penetrants connecting 5 stories or less (714.5.1)
 - > Penetrants connecting 2 stories (714.5.2)

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Differences Section 714.5.1 vs. 714.5.2

| | |
|--|---|
| <p>Not more than 5 stories</p> <ul style="list-style-type: none"> ⦿ Limited to noncombustible penetrant ⦿ Limited to noncombustible fill material, or material listed as through penetration firestop | <p>Not more than 2 stories</p> <ul style="list-style-type: none"> ⦿ Accepts any material (combustible or noncombustible) for penetrant ⦿ Accepts any material (combustible or noncombustible) acceptable to B.O. for fill material |
|--|---|

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Nonfire-resistance-rated assemblies – Ducts penetrating

Where duct is the penetrating item, use Section 717.6.3 versus 714.5

- ⦿ Duct provisions are a “specific” requirement (102.1)
- ⦿ Requirements do differ:
 - > Duct allowed to connect two stories with noncombustible material in annular space
 - > Duct requires damper at floor line if connecting three stories – not just fill materials in annular space

Smoke barriers – 714.4.4

Smoke barrier provisions of Section 709 are referenced by a number of other code sections

- ⦿ Generally used where occupants are unable to evacuate (hospitals, jails, ambulatory care facility), or to compartment building for smoke control system
- ⦿ May be either walls or horizontal assemblies
 - Both 714.3 and 714.4 reference 714.4.4
- ⦿ Generally require a 1-hour rating for barrier

Smoke barrier penetrations

Penetrations must be tested to UL 1479 and obtain an L rating

- ⦿ L rating provides quantitative indication of system’s ability to resist passage of smoke
- ⦿ System must be tested and listed to have an L rating – don’t assume something complies
 - Air leakage test is an optional test under UL 1479
 - ASTM E 814 test does not contain L rating test protocol

Smoke barrier penetrations

Air leakage (L rating) cannot exceed

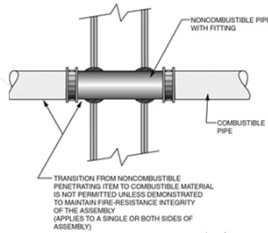
- > 5.0 cfm per square foot of penetration opening for each system, or
- > A total leakage of 50 cfm for any 100 square feet of wall or floor area.

- ⊙ L rating provides measurable criteria versus subjective provisions (limit, restrict, resist)
- ⊙ L rating determined at both ambient temperature and at elevated temperature

Dissimilar materials

Noncombustible penetrating items shall not connect to combustible materials beyond point of firestopping – unless fire-resistance integrity is maintained

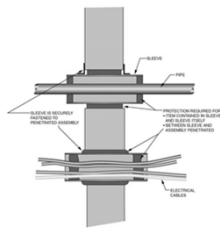
- > Walls and horizontal assemblies (714.3.3 and 714.4.3)



Sleeves – Section 714.2

Sleeves generally used for assemblies with voids or where penetrant will be removed/changed often

- Sleeve securely fastened to assembly
- Space between penetrant and sleeve firestopped
- Annular space firestopped



Ducts as penetrants

Section 714.1.1 and 717.1.2 coordinate and detail how ducts are to be protected

- ⦿ Per Section 717 where using a fire or fire/smoke damper
- ⦿ Per Section 714 as a penetration if a fire damper is not provided
 - Section 714 provisions do not apply if the duct requires a damper.
 - Installing firestopping in annular space around damper could prevent proper operation and void the listing

Installation, inspection and maintenance

No one single firestop product works for all situations

- ⦿ Look at specific details of proposed system
- ⦿ As stated throughout code, install in accordance with listing/manufacture's instructions

Code does NOT specify who is responsible for installing firestops.

- > Not important from inspection standpoint but should be decided at beginning of project to avoid errors

Installation, inspection and maintenance

Four sections that specifically relate to firestopping

- > 110.3.6 - requires joints and penetrations remain accessible until inspected
- > 1705.17 - special inspection for high-rise and Risk Category III or IV
- > 703.7 – marking and identification of assemblies requiring protected penetrations/openings
- > IFC 703.1 – addresses maintenance of fire-resistance-rated assemblies, including firestops

Marking and identification Section 703.7

MINIMUM 3 IN. LETTERING

SIGN OR STENCILING AT MAXIMUM 30-FT INTERVALS AND WITHIN 15 FEET OF EACH END

ACCESSIBLE CONCEALED SPACE

FLOOR OR ROOF DECK

CEILING

FLOOR

IDENTIFICATION SIGN FOR FIRE BARRIER

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Maintenance – IFC 703.1

Requires fire-resistance rating of construction “including...firestops...and fire-resistant joint systems” to be maintained.

- ⊙ Requires visual inspection by owner on annual basis
 - > Not required for inaccessible concealed areas
- ⊙ Repair or replaced if damaged or altered; protected if new penetration
 - > Same intent as IBC 3401.2 and 3404.1 in 2012

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Fire-resistant joint systems Section 715

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Joint - Definition

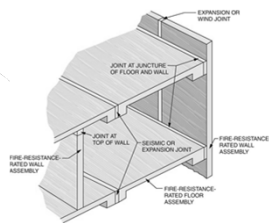
IBC defines a joint as “the opening in or between adjacent assemblies that is created due to building tolerances, or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.”

- ⦿ Put another way, the joint is the breach or opening in or between adjacent assemblies
- ⦿ A joint system is used to fill the opening or breach

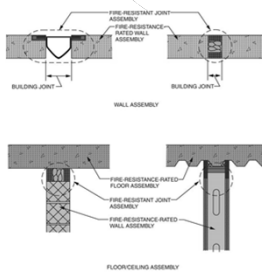
Joints – Locations & examples

Examples:

- ⦿ Gap between adjacent concrete tilt-up panels
- ⦿ Head of wall/top of wall
- ⦿ Floor and exterior curtain wall
- ⦿ Expansion joint in floor



Joints – Locations & examples



Test joint systems using ASTM E 1966 or UL 2079

- ⦿ Neither ASTM E119 nor UL 263 evaluate performance where wall and floor assemblies connect
- ⦿ ASTM E 2307 used for floor/curtain wall

Joint firestop systems

Compliant systems

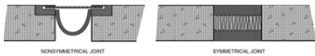
- ⦿ Accommodate cyclical movement of adjacent assemblies
- ⦿ Prevent the passage of flame and hot gases sufficient to ignited cotton waste on unexposed side of the assembly
- ⦿ Will remain in place when subjected to the hose stream test



Test criteria

ASTM E 1966 and UL 2079 are essentially equivalent

- ⦿ Both focus on joint and ability to go through movement cycles
 - > ASTM E 1966 does not evaluate smoke leakage so must use UL 2079 for L rating



Nonsymmetrical wall joint systems must be tested from both sides, or from least fire-resistant side (similar to 703.2.1 wall test)

- Exception for exterior walls with fire separation distance greater than 5 feet.



Where required

Section 715.1 states joints “in or between fire-resistance-rated” walls or horizontal assemblies are required to be protected by approved systems

- ⦿ Most locations are covered by this general requirement or the exception in 715.1
 - There are nine exempt locations in 715.1
- ⦿ Sections 715.4 through 715.6 contain specific requirements for certain locations



Exception from 715.1

The exception in 715.1 list nine locations where joint systems are not required to be installed

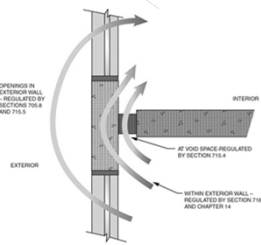
- Most eliminate joint protection due to fact that some other code provision would allow a fire to circumvent the joint system
- Therefore code cannot justify requiring a joint system where the fire can bypass it by another route

Structural integrity vs. exempt locations

Although the exception eliminates joint requirement at the nine locations, code will not allow opening to jeopardize structural integrity of the fire-resistive assembly

- Mezzanine floor (item 6) is good example
 - > While joint may not be needed to limit heat rise to unexposed side of floor (since it could go around the floor) – Still must protect against structural failure of mezzanine floor.
 - > 712.1.15 and 703.2 require structural integrity be maintained

Three paths to spread fire



- Through void:
 - Regulated by 715.4
- Through cavity:
 - Regulated by Sections 718 and 718.2.2, or perhaps Chapter 14 (e.g. 1403.5)
- Leap-frogging:
 - Regulated by 705.8.5 and 715.5

Voids at intersection of floor and exterior curtain wall

Exterior curtain wall construction and attachment to floor dictate the fire risk and protection required

- A: No voids
- B: Void includes space at curtain wall
- C: Void plus wall cavity

> Selected containment system must address actual conditions

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Exterior curtain wall/floor intersection

Provisions of Section 715.4 are split into two parts

- Section 715.4.1 applies where the floor assembly does not have a fire rating
- Section 715.4 applies to rated floor assemblies

Code expects voids to be filled whether floor is rated or not

> Primary difference is code expects tested systems for rated floors and "approved" materials or systems for nonrated floors

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General features in ASTM E 2307 systems

Perimeter fire containment systems passing ASTM E 2307 typically include:

- Some type of mineral wool insulation mechanically secured to the interior side of the spandrel panels of the exterior wall so it protects the curtain wall framing system;
- A reinforcing angle or channel mechanically secured to the curtain wall adjacent to the floor slab;
- Compressed mineral wool insulation filling the gap or void between the floor and the curtain wall, which is commonly referred to as "safing;" and
- A smoke seal applied on top of the safing insulation.

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General features in ASTM E 2307 systems

Labels in diagram: CURTAIN WALL FRAMING MEMBERS, VISION GLASS, FRAMING MEMBER, INSULATED FLOOR ASSEMBLY, APPROVED MATERIAL, REINFORCING ANGLE, CURTAIN WALL INSULATION, FINISHED FLOOR LEVEL.

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Section 715.4 - Exception

Curtain wall assemblies with vision glass to floor cannot pass ASTM E 2307 test

Labels in diagram: VISION GLASS EXTENDS TO FINISHED FLOOR LEVEL, APPROVED MATERIAL SECURELY INSTALLED TO SEAL JOINT, PROTECTION IS AT LEAST EQUAL TO TIME PERIOD OF FLOOR ASSEMBLY, MATERIAL CAPABLE OF RESISTING PASSAGE OF FLAME AND HOT GASES UNDER CONDITIONS OF THE TESTS AT 1193 TIME-TEMPERATURE CONDITIONS.

- > Systems were tested to the exception criteria prior to 2009 IBC
- > Accepts systems tested prior to ASTM E 2307 development
- > Reasonable protection

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Curtain wall and nonrated floor assembly intersections

Section 715.4.1 applies where curtain wall is adjacent to a nonrated floor assembly

- ⦿ Little code guidance as to level of protection required – uses term “approved”
- ⦿ Is permissible to use a tested system – even with nonrated floor
- ⦿ Material should be secured into place and compatible for floor construction and use

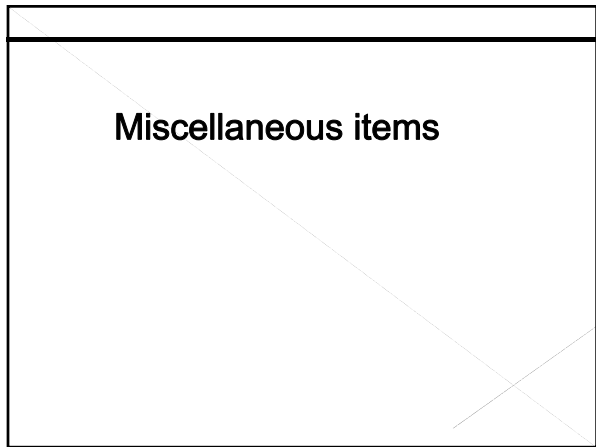
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Joint systems in smoke barriers

Joints require an L rating (air leakage) not exceeding 5 cfm per linear foot of joint

- ⦿ Applicable to joints in smoke barriers, and at the intersection of a horizontal smoke barrier to an exterior curtain wall
- ⦿ Must be tested using UL 2079 and using both ambient and elevated temperatures
 - > Verify system does have an L rating since it is an optional test under UL 2079 standard – not all systems tested to UL 2079 will have L rating

Miscellaneous items

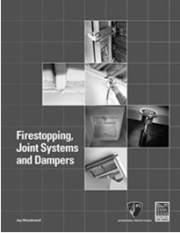


Miscellaneous items

Book addresses several items not directly related to code provisions including:

- ⦿ Mineral wool vs. mineral fiber
- ⦿ Compression and orientation of insulation
- ⦿ Top of wall joint with nonrated horizontal assembly
- ⦿ Engineering judgments
- ⦿ Inspection and installation process
- ⦿ Combustibles within plenums

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10-Minute Q & A



- Please type your questions into the Q & A portion of the Adobe Connect Box.
- The facilitator and/or the speaker will now respond to your questions.

Type your questions into here.

Then hit enter or the send button.

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Simplified Wall Bracing, Based on the 2012 IRC Webinar 10
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This webinar provides an explanation of the 2012 International Residential Code® (IRC®) simplified wall bracing requirements. The seminar will focus on basic requirements and step through the process of applying the Simplified Wall Bracing procedure.

<http://shop.iccsafe.org/education-and-certification/live-schedule/simplified-wall-bracing-based-on-the-2012-irc-webinar-043015.html>

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