Objectives

• At the end of this presentation, you will:
  • Understand the intent and purpose behind fire resistive construction
  • Understand the 2015 IBC Chapter 7 code requirements, testing procedures, plan review requirements and inspection practices relating to fire resistive construction
Objectives Cont.

• Understand the code requirements, testing procedures, plan review requirements and inspection practices relating to the protection of penetrations
• Understand the 2015 IBC Chapter 7 requirements for protecting penetrations (firestop systems)

Objectives Cont.

• Be able to navigate UL’s Product Spec™ and Installation Code Link in order to identify listed products and assemblies which demonstrate compliance with the requirements of the 2015 International Building Code.
  ➢ Fire resistance-rated Building Elements
  ➢ Fire protection-rated Firestop Systems

Agenda

• A brief IBC Basics Review
• Fire-Resistance-Rated Construction
  • Definitions
  • International Building Code Requirements
• Establishing Fire-Resistance Ratings
• Permitted Changes to UL Designs
Agenda Cont.

• Through and Membrane-Penetration Firestop Systems
• Plan Review and Inspection Process
• Methods of Showing Code Compliance
• Engineering Judgments
• Navigating the UL Directories & UL’s Online Resources for Code Compliance
• Summary and Closing

Questions / Comments

IBC Basics

Some Fundamentals
Use of the IBC

• Definitions – Chapter 2
• Occupancy Classification
• Use of Tables – Scoping Section
• Table Footnotes
• Code Exceptions
• Reference Standards
• Index and Glossary
• Identifying Changes in Code Text

Identifying Changes in Code Text

Margin markings:
- Vertical lines indicate new or revised text
- Arrows indicate that an entire sentence, paragraph or Section was deleted
- * A single asterisk indicates that text or a table has been relocated within the code
- ** A double asterisk indicates that the text or table immediately following it has been relocated there from elsewhere in the code

Identifying Changes and the Responsibility of Code Development

Margin markings:
- Letters in brackets indicate the Section is maintained by another code development committee
  [B] is the Building Code Development Committee
  [M] is Mechanical Code
- Terms set forth in Chapter 2 – Definitions are italicized
  If not italicized, then the definition in Chapter 2 does not impart the intended meaning
Passive Fire Protection

The IBC takes a systematic approach to building fire protection, including:

1. Passive Fire Protection
   Fire Area = The aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or horizontal assemblies of a building.

2. Active Fire Protection
   Fire Protection System = Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.

3. Reasonable level of redundancy; inspection, testing & maintenance
More Definitions

- **Fire-resistance** - That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use. (IBC)

Definitions Cont.

- **Fire-resistance rating** - The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.3 (IBC)
  - Passage of Flames
  - Heat Transmission
  - Structural Integrity

Definitions Cont.

- **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 715. Ratings are stated in hours or minutes. (IBC)
  - Passage of Flames
  - Structural Integrity
Standards Writing Organizations

American National Standards Institute (ANSI)
- ASTM International (ASTM)
- FM Global (FM)
- National Fire Protection Association (NFPA)
- Underwriters Laboratories (UL)

Questions / Comments

Fire-Resistance-Rated Construction

International Building Code Requirements for Fire-Resistance-Rated Construction
**Code Requirements**

- Chapters 3, 4, 5, 6, 7 and 10 of the IBC
- Chapters 3 and 4 – Defines Occupancies
- Chapter 5 – General Building Heights and Areas
  - Permitted building area based on four factors:
    - Type of construction
    - Occupancy
    - Available frontage
    - Use of sprinklers

**Code Requirements Cont.**

- Section 508 – Covers mixed use considerations
- Chapter 6 – Types of Construction
  - Table 601 – Establishes hourly rating required for building elements based on Type of Construction
- Chapter 7 – Fire and Smoke Protection Features

**Code Requirements Cont.**

- 703.2 – Fire-resistance ratings shall be determined in accordance with ASTM E 119 or UL 263
- 703.2.1 – Nonsymmetrical walls shall be tested from both faces
- 703.2.3 – Assemblies considered restrained unless registered design professional provides evidence satisfactory to AHJ that construction qualifies for restrained classification per ASTM E 119 or UL 263
Code Requirements Cont.

• 703.3 – Methods for determining fire resistance shall be based on fire exposure and acceptance criteria of ASTM E 119 or UL 263

Code Requirements Cont.

• 703.3 Cont. – Required fire resistance permitted to be established based on any of the following:
  1. Designs documented from approved sources
  2. Prescriptive requirements from Section 721
  3. Calculations in accordance with Section 722
  4. Engineering analysis based on ASTM E 119 or UL 263
  5. Alternative protection methods as allowed in Section 104.11
  6. Fire-resistance designs certified by an approved agency.

Code Requirements Cont.

• Breaches of assemblies shall be protected in accordance with Sections 712, 713, 714, 715 and 716

• Chapter 10 – Means of Egress
  • Table 1020.1 – Establishes hourly rating required for corridors based on Occupancy Group
Fire Resistance

- Expressed as an Hourly Time Period
- Ratings range from 1/2 to 4 hours
- Containment of fire to room or floor of origin (horizontal and vertical compartmentalization)

Questions / Comments

Fire-Resistance-Rated Construction

Establishing Fire-Resistance Ratings
Standards

- ANSI / UL 263
- ASTM E 119
- NFPA 251 (Withdrawn)

Building Components

- Columns
- Beams
- Floor/Ceilings (F/C) or Roof/Ceilings (R/C)
- Walls

Time - Temperature Curve
Columns

- Sample size – Minimum 9 ft
- Tested unloaded
Conditions of Acceptance – Columns

• 1000ºF / 1200ºF
Beams

- Sample size – Minimum 12 ft
- Load applied – Per design
Conditions of Acceptance – Beams

• Support load
• 1100ºF / 1300ºF

Floor/Ceiling or Roof/Ceilings

• Sample size – 180 sq ft / 12 ft
• Load applied – Per design
Conditions of Acceptance
Floor/Ceilings or Roof/Ceilings

- Support load
- Flame passage
- 250°F / 325°F
- Support temperatures (beams) 1100°F / 1300°F
Walls

- Sample size - 100 sq ft / 9 ft
- Load applied - Per design
Conditions of Acceptance – Walls

- Flame passage
- 250°F / 325°F
- Support load
- Hose stream (2 ½ minutes at 30 psi)

Questions / Comments
Fire-Resistance-Rated Construction

Methods of Showing Code Compliance

- 703.2 – Fire-resistance ratings shall be determined in accordance with ASTM E 119 or UL 263
- 703.3 – Methods for determining fire resistance shall be based on fire exposure and acceptance criteria of ASTM E 119 or UL 263

Methods of Showing Compliance with the Fire Resistance Requirements of the IBC

- 703.3 Cont. – Required fire resistance permitted to be established based on any of the following:
  - Designs documented from approved sources
  - Prescriptive requirements from Section 721
  - Calculations in accordance with Section 722
  - Engineering analysis based on ASTM E 119 or UL 263
  - Alternative protection methods as allowed in Section 104.11
  - Fire-resistance designs certified by an approved agency
Designs Documented From Approved Sources

• Product Directories of Nationally Recognized Testing Laboratories
  • Intertek – Intertek Directories of Certified Products
  • FM Global - Factory Mutual Approval Guide

Designs Documented From Approved Sources Cont.

• Gypsum Association - Fire Resistance Design Manual
• American Insurance Services Group, Inc. (210) 469 – 3922 - Fire Resistance Ratings
• BOCA - Guidelines for Determining Fire Resistance Ratings of Building Elements

Designs Documented From Approved Sources Cont.

• ASCE / SFPE 29 – Standard Calculation Methods for Structural Fireproofing
• ACI 261.1 / TMS 0216.1 – Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies
Fire-Resistance Rating of Structural Members

Covered in IBC Section 704

- Comply with IBC 601 based on Construction Type
- Column and primary structural frame protection
- Secondary structural member protection (new)
  - Light-frame construction
  - Horizontal assemblies
- Truss protection

Fire-Resistance Rating of Structural Members

Continuation of IBC Section 704 Requirements

- Attachments to structural members
- Connections (CT addition 704.6.1)
- Impact protection
- Exterior load-bearing structural members
- Seismic isolation systems

Fire-Resistance Rating of Structural Members

Continuation of IBC Section 704 Requirements

- Sprayed fire-resistant materials (SFRM)
  - Application and manufacturer's instructions
  - Surface conditions
  - Primers, paints and encapsulants
  - Temperature
  - Finished condition
Prescriptive Fire Resistance
Section 721 of the IBC

Calculated Fire Resistance
Section 722 of the IBC

Engineering Analysis Based on ASTM E 119 or UL 263

- Engineering judgments
  - Product manufacturer
  - Testing laboratory
  - Fire protection engineer
  - Professional engineer
Alternate Materials, Design and Methods of Construction and Equipment

- Allows authority having jurisdiction to accept other information to show compliance
  - Evaluation Services Reports
    - IAPMO Evaluation Services
    - ICC Evaluation Services
    - UL Evaluation Services

Questions / Comments

Organization Under Each Product Area

- Guide Information
- Designs, Systems or Assemblies
- Product Categories (indexed by manufacturer’s names)
Guide Information

• Equipment, materials or systems included in the Category
• Intended use, restrictions or supplemental information that apply
• Standard(s) used to evaluate products under the Category
• Listing or Classification Mark information for the Category

Designs

• Each design contains specific construction features
• Many designs contain various options and various ratings
• Must be followed exactly for rating to apply
Questions / Comments

Fire Resistance-Rated Construction

Permitted Changes to Designs

Guide Information

- Equipment, materials or systems included in the Category
- Intended use, restrictions or supplemental information that apply
- Standard(s) used to evaluate products under the Category
- Listing or Classification Mark information for the Category
Fasteners

- Cement coated box or cooler nails shall be used for securing gypsum board, unless otherwise specified in design
- Screws meeting ASTM C 1002 or C 954 may be substituted for nails providing head diameter and length are equal or larger than specified nail

Primers with SFRM

- May be applied to primed structural elements providing:
  - Beam flange width shall not exceed 12 inch
  - Column flange width shall not exceed 16 inch
  - Web depth shall not exceed 16 inch
  - Pipe diameter or tube width shall not exceed 12 inch
  - Bond tests conducted to ASTM E 736
    - Average > 80% of uncoated steel and individual > 50% of uncoated steel, or
    - Wrap member with metal lath
Concrete in Horizontal Assemblies

- Compressive strength specified may be reduced 500 psi
- Unit weight tolerance 3 pcf
- Do not substitute lightweight concrete if normal weight specified
- Do not substitute normal weight concrete if lightweight specified

Outlet Boxes in Ceilings

- Metallic boxes may be installed in F/C and R/C assemblies incorporating gypsum board protection providing:
  - Clearance not to exceed 1/8 in.
  - Area of each box not to exceed 16 sq in.
  - Total area of boxes not to exceed 100 sq in. per 100 sq ft of ceiling area
- Nonmetallic boxes tested and listed (CEYY)

Steel Joists

- Specified joist is minimum depth
- Specified joist is minimum weight/foot
- K-Series Joist may often substitute for older series joists specified
- Spacing between joists may be increased to 4 ft OC providing:
  - Structural integrity of floor is maintained
  - Hanger wire spacing is not increased
- Bridging bar size is minimum
Gypsum Board on Horizontal Assemblies

- Thickness may be increased providing fastener length is also increased
- Additional layers may be added

Gypsum Ceiling Control Joints

- Ceiling suspended below floor assembly
- Guide describes control joints when gypsum board is parallel to wood joists
- Guide describes control joints when gypsum board is perpendicular to wood joists

Recessed (Can) Lighting

- Generic recessed luminaires not permitted unless covered in design
- Luminaires specifically tested and Listed for use in fire resistive construction covered in “Luminaires and Luminaire Assemblies Classified for Fire Resistance Category” (CDHW)
Restrained & Unrestrained

- Designer & AHJ must determine
- Unrestrained ratings may be used for either condition

Restrained & Unrestrained Cont.

1. Wall Framing
   A. Single span and simply supported end spans of multiple bays:
      1. Open-web steel joists or steel beams supporting concrete slab, precast units, or metal decking: Unrestrained
      2. Concrete slabs, precast units, or metal decking: Unrestrained
   B. Other types of multiple bays:
      1. Open-web steel joists, steel beams, or metal deck supported by concrete slab: Unrestrained
      2. Open-web steel joists or steel beams, supporting precast units or metal deck: Unrestrained
   C. Cast-in-place concrete slab systems: Unrestrained
   D. Flat concrete where the potential thermal expansion is resisted by adjacent construction: Unrestrained

2. Steel Framing
   A. Steel beams welded, riveted, or nailed to the framing members: Unrestrained
   B. All types of load-bearing floor and roof systems (such as trusses and diaphragms) where the framing members are secured to the framing members: Unrestrained
   C. All types of prefabricated floor or roof systems where the structural members are secured to the framing members: Unrestrained

HVAC Openings in Ceilings

- Most acoustical ceilings are tested with generic hinged blade damper
- UL Classified Ceiling Damper, Ceiling Air Diffuser or Air Terminal Unit may be substituted for generic hinged blade damper
- Duct Protection Systems A and B may also be substituted per Guide Info
- Some assemblies with gypsum board ceilings have been tested with specific UL Classified Ceiling Dampers
- In assemblies with gypsum board ceilings, damper may not be utilized if not specified in design
Blanket Insulation in Horizontal Assemblies

- May cause premature disruption of ceiling membrane
- For certain assemblies, fiberglass insulation can be used with additional layer of gypsum board
- Otherwise, only permitted as specified

Beam Size

- Larger beams may be substituted without restriction
- Larger is based on W/D ratio
  - \( W/D = \) weight of unit measure divided by heated perimeter (exposed surface except top flange)
- Larger W/D yields greater fire resistance

Column Size

- Larger columns may be substituted without restriction
- Based on W/D ratio
- Larger W/D yields greater fire resistance
Walls & Partitions

- Rating applies when either face exposed to fire, unless otherwise noted
- Unsymmetrical walls tested from both sides
- Exterior walls may only require rating from inside face
- Load bearing rating applies to non load bearing applications

Walls & Partitions Cont.

- Size of studs specified is minimum
- Stud spacing specified is maximum
- Board orientation as specified in design

Walls & Partitions Cont.

- Metallic boxes may be installed in wall assemblies incorporating gypsum board protection providing:
  - Max 2 hr rated assemblies
  - Clearance not to exceed 1/8 in.
  - Area of each box not to exceed 16 sq in.
Walls & Partitions Cont.

• Total area of boxes not to exceed 100 sq in. per 100 sq ft of wall surface
• Boxes on opposite sides of wall separated by min 24 in. or provided with protection (CLIV)
• Nonmetallic boxes tested and listed (CEYY)

Permitted Changes – Summary
www.ul.com/architects

Self Service Tools and Resources
Resources to help architects quickly and easily locate code compliant fire resistance and smoke protection solutions.

Permitted Changes – Summary
www.ul.com/architects

DESIGN CRITERIA AND ALLOWABLE VARIANCES

Product category guide information can clarify construction and application requirements for the certifications and view acceptable variances allowed for the designs and systems. Click below for details.

Walls, floors, beams and columns
Firestop systems
Joint systems
Perimeter the containment systems
Architectural services FAQs
Some Definitions

• What is Firestopping?
  • Firestopping (v) is the process of restoring the integrity of a fire-resistance-rated assembly at a penetration of the assembly through the use of a properly designed, installed, inspected and maintained firestop system.
  • Firestopping (n) is a material or device installed to resist the passage of flame and heat through penetrations (i.e. a firestop).
Definitions Cont.

- **Membrane Penetration** – A breach in one side of a floor-ceiling, roof-ceiling or wall assembly to accommodate an item installed into or passing through the breach. (IBC)

- **Through Penetration** – A breach in both sides of a floor, floor-ceiling or wall assembly to accommodate an item passing through the breaches. (IBC)

Definitions Cont.

- **Membrane-Penetration Firestop** – A material, device or construction installed to resist for a prescribed time period the passage of flame and heat through openings in a protective membrane in order to accommodate cables, cable trays, conduit, tubing, pipes or similar items. (IBC)

Definitions Cont.

- **Through-Penetration Firestop System** – An assemblage consisting of a fire-resistance-rated floor, floor-ceiling, or wall assembly, one or more penetrating items passing through the breaches on both sides of the assembly and the materials or devices, or both, installed to resist the spread of fire through the assembly for a prescribed period of time. (IBC)
Definitions Cont.

• Firestop System – Membrane or through-penetration firestop system. (*BEJ*)

Three Elements of a Firestop System

• Floor or Wall Assembly
• Penetrating Item
• Firestopping Products

The Right Product for the Right Application
Steel Collars and Intumescent Wrap Strips

- Intumescent sealant expands and fills the void
- The collar expands to crush pipe

Enclosures: Valves, Controls, Speaker, Lighting

Firestop Systems

Standards
Standards

• ANSI / UL 1479
• ASTM E814

Ratings

• F - Flame Occurrence
• T - Heat Transmission
• L - Leakage (Optional)
• W - Water Leakage (Optional)

Conditions of Acceptance
F Rating

• Passage of Flame
• Hose Stream
• *IBC Definition:*

**F RATING.** The time period that the through-penetration firestop system limits the spread of fire through the penetration when tested in accordance with ASTM E 814 or UL 1479.
Conditions of Acceptance

T Rating

- Passage of Flame
- 325°F Temperature Rise
- Hose Stream
- IBC Definition:

T RATING. The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the nonfire side when tested in accordance with ASTM E 814 or UL 1479.

L Rating

- Air Leakage Rate at Ambient Temperature
- Air Leakage Rate at 400°F
- IBC Definition:

L RATING. The air leakage rating of a through penetration firestop system or a fire-resistant joint system when tested in accordance with UL 1479 or UL 2079, respectively.

W Rating

- Optional program*, applicable to incidental water
- 3 Ft WC Pressure Head / 72 Hr Exposure
- Firestop subjected to water exposure, followed by standard fire and hose stream tests
- Firestop systems assigned a W Rating
  * No IBC definition or requirements
Firestop Systems

International Building Code Requirements

Code Requirements

General

• Section 714 of the 2015 IBC
  • 714.3 – Penetrations into or through fire walls, fire barriers, smoke barrier walls and fire partitions shall comply with 714.3.1 through 714.3.3. Penetrations in smoke barrier walls shall also comply with 714.4
  • 714.4 – Penetrations of horizontal assemblies not required to be protected by shaft enclosure shall be protected per Section 714.4.1 through 714.4.4
Code Requirements
Wall Assemblies

• Section 714.3 of the 2015 IBC
  • 714.3.1 – Through penetrations shall be protected by one of the following:
    • As tested as part of the entire wall assembly
    • As tested to ANSI/UL 1479 / ASTM E814
  • Exceptions
    • Concrete, grout or mortar (full thickness of the wall)
    • Annular space protection material

Code Requirements
Wall Assemblies Cont.

• 714.3.1.2 – When tested to ANSI/UL 1479 / ASTM E814, through penetrations shall have an F Rating of not less than the required rating of wall penetrated

Code Requirements
Wall Assemblies Cont.

• 714.3.2 – Membrane penetration shall be protected as follows:
  • As specified in 714.3.1 (i.e. through penetrations)
  • Recessed fixtures shall be installed so as not to reduce the required fire resistance
**Code Requirements**

**Wall Assemblies Cont.**

- **Exceptions**
  - Steel electrical boxes installed per prescriptive requirements
  - Listed electrical boxes of any material installed per listing
  - Electrical boxes of any size or type installed with tested and listed protection
  - Boxes other than electrical boxes tested and listed for such use
  - Annular space created by fire sprinklers (covered by metal escutcheon plate)
  - Steel electrical boxes exceeding 16 sq. in in area or any size exceeding prescriptive requirements protected by listed putty pads or other listed material and method installed per its listing.

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**Code Requirements**

**Horizontal Assemblies**

- **Section 714.4 of the 2015 IBC**
  - **714.4.1.1** – Through penetration shall be protected by one of the following:
    - As tested as part of the entire horizontal assembly
    - As tested to ANSI/UL 1479 / ASTM E814
  - **Exceptions**
    - Annular space protection material
    - Concrete, grout or mortar
    - Listed electrical boxes of any material installed per listing

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**Code Requirements**

**Horizontal Assemblies Cont.**

- **714.4.1.2** – When tested to ANSI/UL 1479 / ASTM E814, through penetrations shall have F and T Ratings of not less than 1 hour but not less than required rating of assembly penetrated
  - **Exceptions**
    - Penetrations contained and located within the cavity of a wall above or below the floor do not require a T Rating
    - Penetrations by floor, tub or shower drains contained and located within the concealed space of a horizontal assembly do not require a T Rating
    - Penetrations a maximum of 4” in diameter penetrating directly into metal-enclosed electrical power switchgear do not require a T Rating
Code Requirements
Horizontal Assemblies Cont.

- 714.4.2 – Membrane penetration shall be protected as follows:
  - As specified in 714.4.1.1 or 714.4.1.2 (i.e. through penetrations)
  - Recessed fixtures in floor/ceiling assemblies shall be installed so as not to reduce the required fire resistance

• Exceptions
  - If less than 100 sq in. per 100 sq ft, metallic penetrants may be either firestopped or fireblocked
  - Steel electrical boxes installed per prescriptive requirements
  - Electrical boxes of any size or type installed with tested and listed protection
  - Listed electrical boxes of any material installed per listing
  - Annular space created by fire sprinklers (covered by metal escutcheon plate)
  - Interruption by a double wood top plate of a wall assembly sheathed with X-Rated gypsum; provided all penetrating items through the double top plates are protected and the ceiling membrane is tight to the top plates.

Code Requirements
Miscellaneous

- 714.4.3 – Noncombustible penetrants shall not be connected to combustible penetrants beyond point of firestop system
- 714.4.4 – Penetrations in smoke barriers shall have an L Rating at ambient and 400°F
  - Max 5.0 CFM / sq ft of opening
  - Aggregate 50 CFM / 100 sq ft of barrier
Firestop Systems

Establishing F and T Ratings

Full-Scale Wall Assembly

Small-Scale Wood Floor Assembly
Cables Through Wood Floor

Top View of A Slab (Pre-Test)

Time - Temperature Curve
Fire-Resistance-Rated Construction

Plan Review

For the Architect / Contractor

UL Designs serve two roles:

1) Evidence of compliance

2) A set of build-instructions

For the Building Official

UL Designs serve two roles:

1) Evidence of compliance

2) Document by which to inspect
Plan Review

• 107.2.1 - Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code …

Plan Review Cont.

• Details showing compliance with the fire-resistive requirements of the IBC shall be included on the plans and specifications
• (IPC/IMC) For buildings more than 2 stories, details showing materials and methods for protecting penetrations of pipes and mechanical systems to maintain required structural safety, fire resistance rating and fireblocking shall be included

Plan Review Cont

• Recommended that the UL designs (or others) be imported into the plans
• Importing designs into plans does NOT violate UL copyright requirements, provided:
  ✓ Presented in their entirety in a non-misleading manner and without manipulation (data & drawings)
  ✓ Include notation that they are reprinted from UL Online Certification Directory: © 2017 UL LLC
Plan Review Cont.

- Review proposed fire-resistance-rated assemblies for compliance with code
- Hourly rating requirement
  - Type of Construction
  - Details of assemblies proposed relative to actual construction
  - Consider variations identified relative to permitted substitutions stated in the UL Fire Resistance Directory

Plan Review Cont.

- Consider need for engineering judgments if permitted by department policy
- Consider need for special inspections as required by code and/or by department policy
- IBC 1705.17 (new) Statement of Special Inspections required in high-rise or structural risk category III or IV by an approved agency for:
  - Penetration firestop systems
  - Fire-resistant joint systems

Questions / Comments
Fire-Resistance-Rated Construction

Inspection Process

Inspection of Fire-Resistance-Rated Assemblies

• Inspections typically done by Code Official, but may be inspected by an approved agency or individual
• IBC 1703 requirements for approved agency:
  ▶ Independence – 1703.1.1
  ▶ Adequate equipment – 1703.1.2
  ▶ Experienced personnel – 1703.1.3

Inspection of Fire-Resistance-Rated Assemblies

• Verifies approved design is being used
• Verifies assembly is being constructed in accordance with the approved design
• May require multiple and well-timed inspections
• May require selective “destructive” inspection
For the Architect / Contractor

UL Designs serve two roles:

1) Evidence of compliance
2) A set of build-instructions

For the Certified Code Official

UL Designs serve two roles:

1) Evidence of compliance
2) Document by which to inspect

Inspection of Firestop Systems

• Section 110.3.6 of the 2015 IBC:
  • Protection of joints and penetrations in fire-resistance-rated assemblies, smoke barriers and smoke partitions shall not be concealed from view until inspected and approved
• Section 1705.17 of the 2015 IBC:
  • Special Inspections are required for fire-resistant penetrations and joints in high-rise buildings and Risk Category III or IV
Pre-Construction Meeting

- Review selected designs
- Obtain engineering judgments as needed
- Establish inspection guidelines and expectations
- Establish work and inspection schedules
- Review qualifications/experience of contractors

Pre-Inspection

- Require construction documents that detail all fire-resistance-rated assemblies
- Obtain copies of all fire-resistance-rated designs
- Develop a plan to inspect each assembly at the appropriate times during the construction process

At the Inspection Site

- Have your inspection tools such as a flashlight, coring device, depth gauge, calipers, tape measure, etc.
- Review the general layout of the assembly
- Verify the building materials being utilized match those described in the approved design
At the Inspection Site Cont.

- For board products, verify the type, manufacturer, thickness and orientation match what is described in the approved design
- Verify fastener type, size and spacing for compliance with the approved design
- For insulation products, verify the type, manufacturer, thickness and density match what is described in the approved design

At the Inspection Site Cont.

- Verify that the approved third party testing agency’s labels are on the products, empty containers or boxes
- When necessary conduct destructive evaluations on the assemblies
- During the inspection have the contractor follow along to repair assemblies after destructive testing

Reference Materials

Reference Materials Cont.

- Association of Wall and Ceiling Industry – *Technical Manuals 12, 12-A and 12-B*
- Gypsum Association – *Fire Resistance Design Manual*
- International Firestop Council Video – *Inspecting Firestop for Compliance*

Available Resources

- Fire Safe North America (FSNA) – www.firesafenorthamerica.org
- Association of Wall and Ceilings Industry (AWCI) – www.awci.org
- Gypsum Association (GA) – www.gypsum.org

Questions / Comments
Engineering Judgments

• An Engineering Judgment is a letter or report issued by some knowledgeable party which evaluates the construction of some site-specific application which deviates from a tested design, system or assembly and concludes with a judgment of the applicable rating of that assembly
• Referred to as “Engineering Analysis” in IBC Section 703.3

Engineering Judgments Cont.

• Typically, an Engineering Judgment is used when a tested design, systems or assembly is unavailable
• Most often applied to fire resistive construction
Engineering Judgments Cont.

- Applications for an Engineering Judgment
  - Design and system concept where multiple components, some listed and some unlisted, are used to field construct the finished assembly (e.g. wall)
  - Typically products are not required to be listed by code
  - Must be acceptable to the Code Official

Who Issues Engineering Judgments?

- Who issues Engineering Judgments?
  - Professional engineer
  - Fire protection engineer
  - Manufacturer
  - Testing laboratory
  - Individual issuing judgment must be acceptable to the Code Official

2015 IBC References Justifying Engineering Judgments

- IBC 104.11 Alternative materials, design and methods of construction and equipment
- IBC 703.2 Fire-resistance ratings
- IBC 703.3 Alternative methods for determining fire resistance – six options are permitted
Important Points of an Engineering Judgment

• No guidance from the International Code Council or the various I-Codes
• No guidance from UL
• Best documents available are from the International Firestop Council (IFC) – www.firestop.org

IFC Guidelines

• Four Documents – *International Firestop Council* (IFC) www.firestop.org
  • Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs)
  • Covers firestops, joint systems and grease/air duct assemblies
  • Perimeter fire barrier systems
  • Fire resistant duct enclosure systems for commercial kitchen exhaust ducts
  • Fire resistant duct enclosure systems for ventilation ducts

Summary of Engineering Judgments

• Emphasizes importance of tested designs
• Not a substitute for existing designs
• Should be issued only by those who know the components
• Based on sound engineering practices and knowledge of performance of the designs
• Based on interpolation of previous testing
• Issued only for a specific jobsite
• Presented in clear detail
Questions / Comments

Fire Resistive Construction

UL's Online Search Tools

Fire-Resistance-Rated Construction

Navigating the UL Directories
UL's Online Search Tools

- Product Spec™
- Installation Code - Code Link
- Online Certifications Directory

Introducing UL Product Spec™
- Responsive Web site- Right sizes to your screen size, smartphone, tablet or PC
- Works on all web connected devices regardless of platform or OS
- Includes Electrical Construction, Fire and Building Materials and Systems

UL Product Spec™

- No charge to access
- Find, specify or verify UL certified building products, fire resistance designs, through-penetrations and more
- Updated daily
- Easy to use
  - http://www.ul.com/productspec
Searching for Information on Fire-Resistance-Rated Construction
• Sample Search - Accessing a design if design number is known
  • Design No. L501
UL Product Spec™

• Sample Search - Searching for a design based on specific parameters
• Wood stud/gypsum board wall assembly
• 2 hour rating
• Gypsum board supplied by the United States Gypsum Company
Guide Information

- Equipment, materials or systems included in the Category
- Intended use, restrictions or supplemental information that apply
- Standard(s) used to evaluate products under the Category
- Listing or Classification Mark information for the Category

Examples of Guide Information for Firestop Systems

- General Description of a Firestop System
- Standard
- Description of Ratings
- Permitted Substitutions
- Specifications of Penetrating Items
- Support of Penetrating Items
- Angle of Penetration
- Description of Numbering System
**C-A J-1000**

**First Alpha Character**

- **C** - Either Floor or Wall being Penetrated
- **F** - Floor being Penetrated
- **W** - Wall being Penetrated

---

**C-AJ-1000**

**Second and Third Alpha Characters**

<table>
<thead>
<tr>
<th>Letter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Concrete floors with a minimum thickness less than or equal to 5 in.</td>
</tr>
<tr>
<td>B</td>
<td>Concrete floors with a minimum thickness greater than 5 in.</td>
</tr>
<tr>
<td>C</td>
<td>Framed floors</td>
</tr>
<tr>
<td>D</td>
<td>Steel decks in marine vessels</td>
</tr>
<tr>
<td>E</td>
<td>Floor-ceiling assemblies consisting of concrete with membrane protection</td>
</tr>
<tr>
<td>F</td>
<td>Not used at present time</td>
</tr>
<tr>
<td>J</td>
<td>Concrete or masonry walls with a minimum thickness less than or equal to 8 in.</td>
</tr>
<tr>
<td>K</td>
<td>Concrete or masonry walls with a minimum thickness greater than 8 in.</td>
</tr>
<tr>
<td>L</td>
<td>Framed wall</td>
</tr>
<tr>
<td>M</td>
<td>Bulkheads in marine vessels</td>
</tr>
<tr>
<td>N</td>
<td>Composite panel walls</td>
</tr>
<tr>
<td>O-Z</td>
<td>Not used at present time</td>
</tr>
</tbody>
</table>

---

**C-AJ-1000**

**Numeric Characters**

<table>
<thead>
<tr>
<th>Numeric Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 - 0999</td>
<td>No penetrating items</td>
</tr>
<tr>
<td>1000 - 1999</td>
<td>Metallic pipe, conduit or tubing</td>
</tr>
<tr>
<td>2000 - 2999</td>
<td>Nonmetallic pipe, conduit or tubing</td>
</tr>
<tr>
<td>3000 - 3999</td>
<td>Electrical cables</td>
</tr>
<tr>
<td>4000 - 4999</td>
<td>Cable trays with electrical</td>
</tr>
<tr>
<td>5000 - 5999</td>
<td>Insulated pipes</td>
</tr>
<tr>
<td>6000 - 6999</td>
<td>Misc. electrical penetrants such as busducts</td>
</tr>
<tr>
<td>7000 - 7999</td>
<td>Misc. mechanical penetrants such as air ducts</td>
</tr>
<tr>
<td>8000 - 8999</td>
<td>Groupings of penetrations including any combination of items listed above</td>
</tr>
<tr>
<td>9000 - 9999</td>
<td>Not used at present time</td>
</tr>
</tbody>
</table>
Firestop Systems

• Each firestop system contains specific construction features
• Many firestop systems contain various options and various ratings
• Must be followed exactly for rating to apply

Questions / Comments

Search by Installation Code

• Correlates model code sections to UL product categories
• Covers many model codes and editions (IBC, IFC, NEC, etc.)
• Flexible search capabilities
• Powerful tool to locate appropriate Listings
• www.ul.com/codelink
Product Spec™ Installation Code

1. HOW DO YOU WANT TO SEARCH?

2. RESULTS

|-------------------|--------------------------|--------------------------|-------------------|---------------------------|----------------------------|-------------------------------|------------|

Enter one of the following search parameters:

- Installation Code
- UL Product Category Code
- Product Spec™
- Search

Results: 1 of 47

<table>
<thead>
<tr>
<th>INSTALLATION CODE</th>
<th>UL PRODUCT CATEGORY &amp; CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5BC 2015 T2-8.3</td>
<td>Fire-extinguished Dancing Flames - GCST</td>
</tr>
<tr>
<td>5BC 2015 T2-8.3.1</td>
<td>Fire-extinguished Dancing Flames - GCST</td>
</tr>
<tr>
<td>5BC 2015 T2-8.3.1</td>
<td>Dancing Flames - KDNZ</td>
</tr>
<tr>
<td>5BC 2015 T2-8.3.2</td>
<td>Dancing Flames - KDNZ</td>
</tr>
<tr>
<td>5BC 2015 T2-8.3.3</td>
<td>Fire-extinguished Dancing Flames - GCST</td>
</tr>
<tr>
<td>5BC 2015 T2-8.3.3</td>
<td>Dancing Flames - KDNZ</td>
</tr>
</tbody>
</table>

Results: 1 of 47
Questions / Comments

Additional Resources

www.ul.com/architects

Architectural Services

Resources to help you quickly and easily locate code compliant fire resistance and smoke protection solutions.

LOCATE SPECIFIC DESIGN AND SYSTEMS

Wall, Floor, Roof, Beams and Columns
Firestop Systems
Joint Systems
Perimeter Fire Containment Systems

Additional Resources

• Firestop Contractors International Association  www.FCIA.org
• National Fireproofing Contractors Association  www.NFCA-online.org
• UL – Code Authorities Technical Library  www.ul.com/codeauthorities
Thank You for Attending!!

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www.ul.com