

FIRESTOP 101:

An Introduction to Firestopping



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Role of Firestop

- What is Firestopping?

“A process whereby certain materials, some of them specially manufactured, are used to resist (or stop) the spread of fire and its byproducts through openings made to accommodate penetrations in fire-rated walls, floors and floor/ceiling assemblies.”

... International Firestop Council

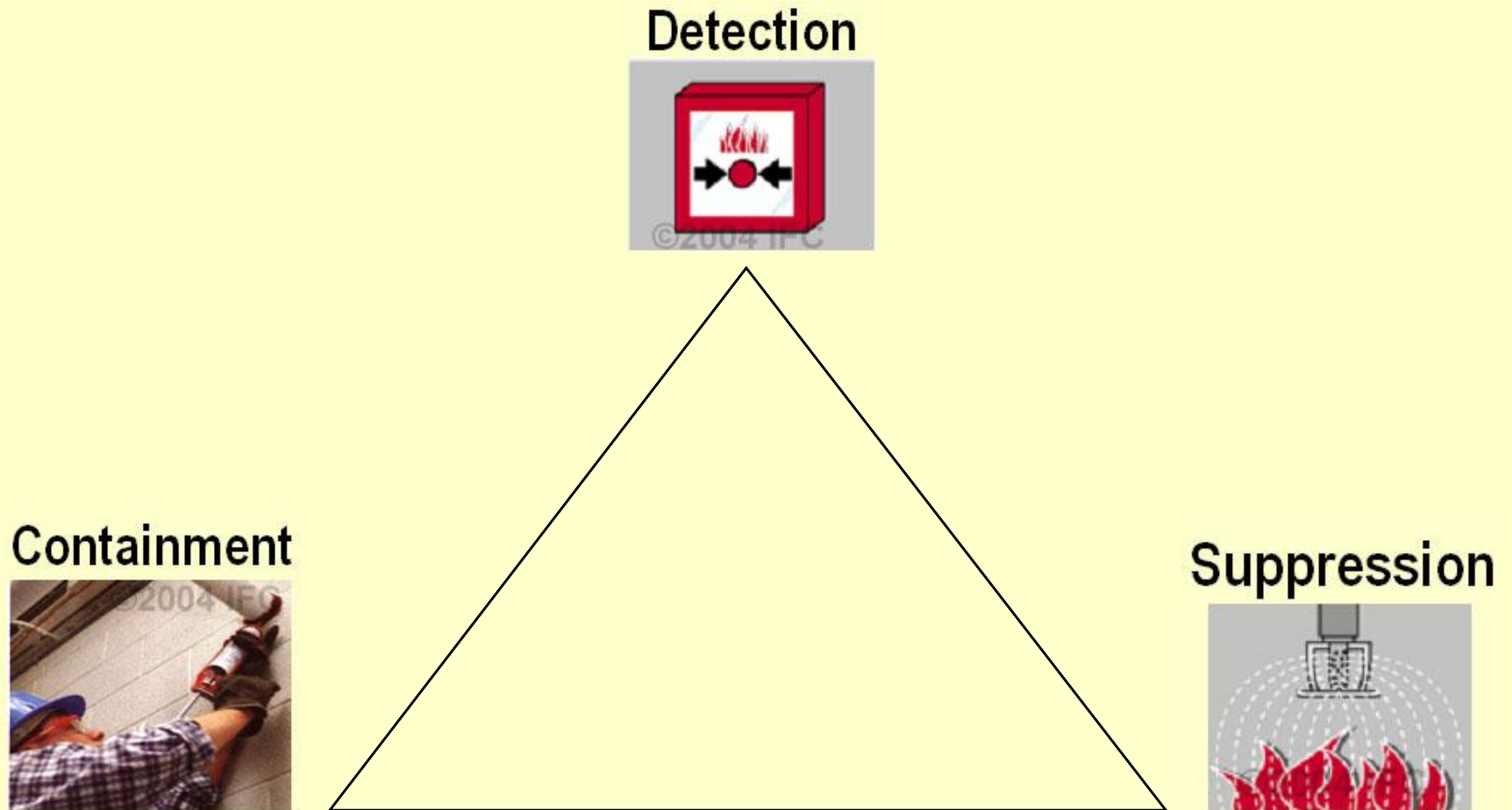


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The Balanced Approach to Fire Protection



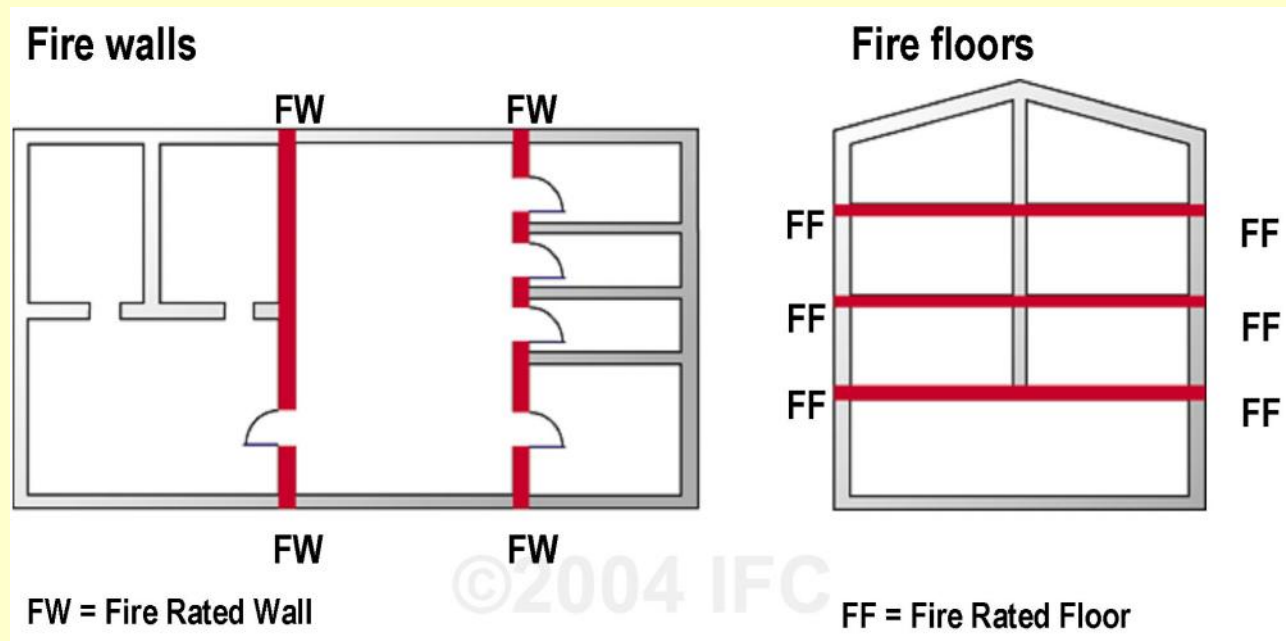
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One Globally Applied Principle for Fire Safety: **Compartmentation (Fire Compartments)**

The spread of fire can be restricted by dividing a building into separate compartments with fire-resisting walls and floors, thereby:

- increasing the availability of escape routes for occupants



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Fire Statistics

What is the leading killer in fires?

SMOKE & TOXIC GASES



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Fire Statistics

Why Must We Contain Smoke, Toxic Gases and Fire?

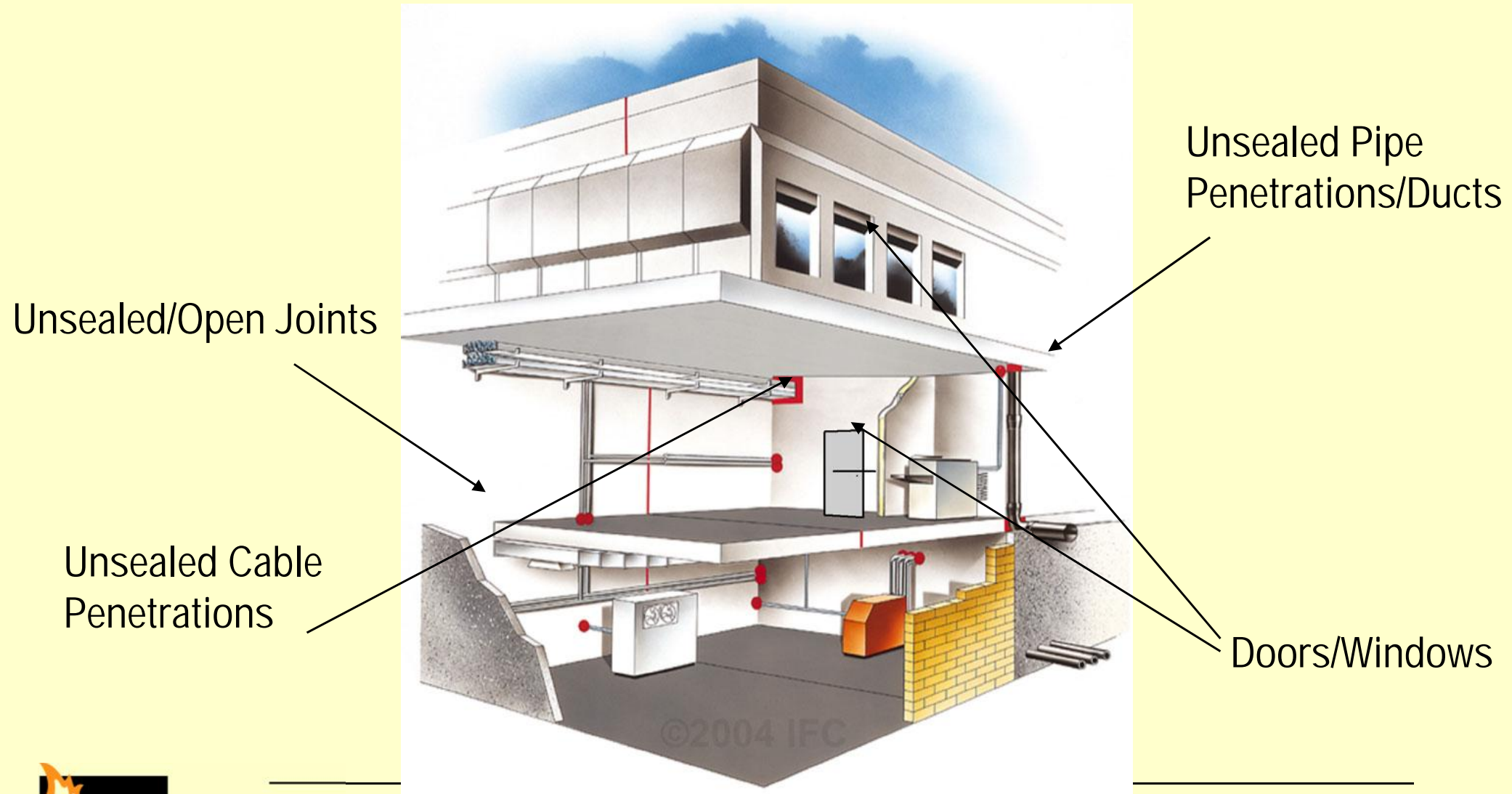
- **3/4 of all fire deaths are caused by smoke inhalation.**
Source: Hall, Jr. John R. NFPA Fire Analysis & Research, Quincy, MA. "Burns, Toxic Gases, and other Hazards".
- **Approximately 57% of people killed in fires are not in the room of the fire's origin.**
Source: NFPA Fire Protection Handbook, 18th Ed. Table 1-1P. Pg. 1-15.
- **Visibility - 47% of survivors caught in a fire could not see more than 12 feet.**
Source: NFPA Fire Protection Handbook, 18th Ed. Table 8-1P. Pg. 8-17.
- **Smoke travels 120-420 feet per minute under fire conditions**
Source: Estimate based upon ceiling jet velocity calculations for typical ceiling heights and heat release rates.



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Areas that allow for fire/smoke spread



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How Do Firestop Products Work?

- Through-penetration firestop products work by filling the voids around penetrating items in fire rated walls and floors.
- Some firestop products intumesce or expand in the presence of heat.
- The intumescent action seals and stops the spread of flames and smoke to other floors and rooms for penetrations that melt or change shape in a fire (eg. Plastic pipe)



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Typical Firestop Products

- ONE-PART SEALANTS (CAULKS)
- PUTTY
- CEMENTITIOUS MORTARS and GROUTS
- SPRAYS (COATINGS)
- INTUMESCENT WRAPS
- PILLOWS, BAGS or BLOCKS
- MECHANICAL DEVICES



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Types of Firestop Systems

- Through Penetrations
- Membrane Penetrations
- Fire Resistive Construction Joints
- Perimeter Joints

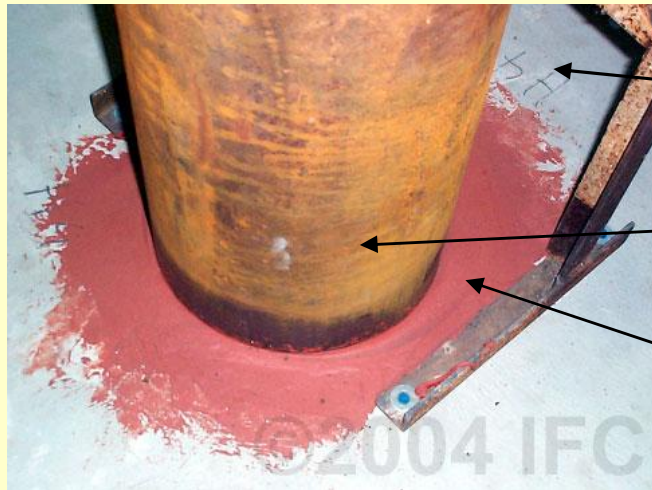


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WHAT IS A THROUGH-PENETRATION FIRESTOP SYSTEM ?

A through-penetration firestop system consists of a fire rated wall or floor, a penetrating item (pipe, cable, conduit, etc.) and the firestop material. For rated systems, the COMPLETE firestop system is tested and listed, not just the firestop material alone.



Fire rated assembly (floor/wall)

Penetrating item (pipe, cable, etc.)

Firestop material



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ASTM E814 / UL 1479

Standard Method of Fire Tests of Through-Penetration Firestops

- F-Rating - Flame does not pass through for test duration.
- T-Rating - The time by which the non-fireside reaches approximately 400 °F (325 above ambient).
 - To receive either rating the firestop *must* pass hose stream.
- L-Rating (optional) - Amount of air leakage through the FS system @ ambient & 400°F. Determines the system's ability to restrict the movement of smoke. Measured in CFM/sq. ft. The lower the number, the better.



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Factors Affecting Firestop Performance

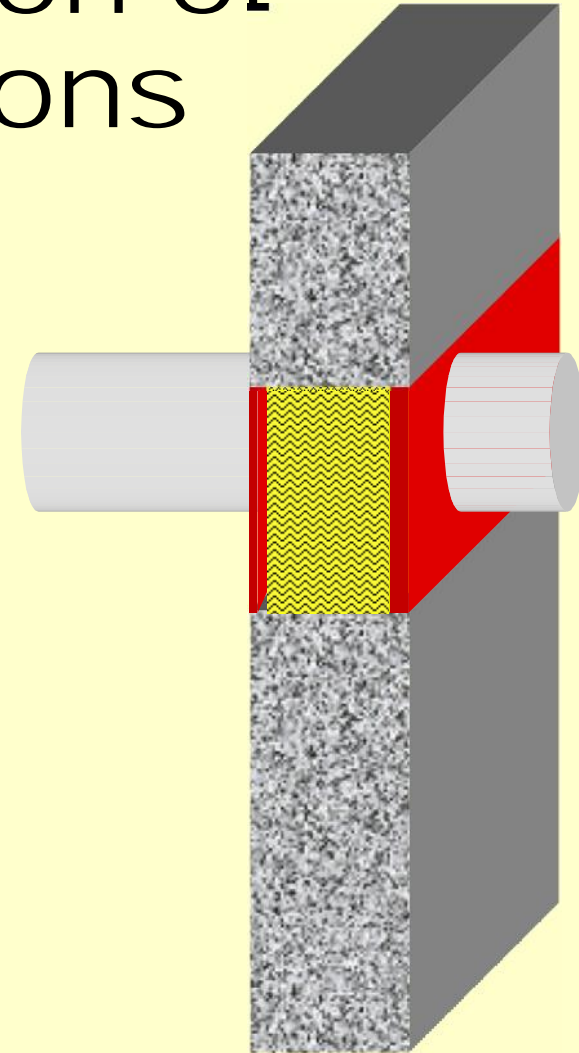
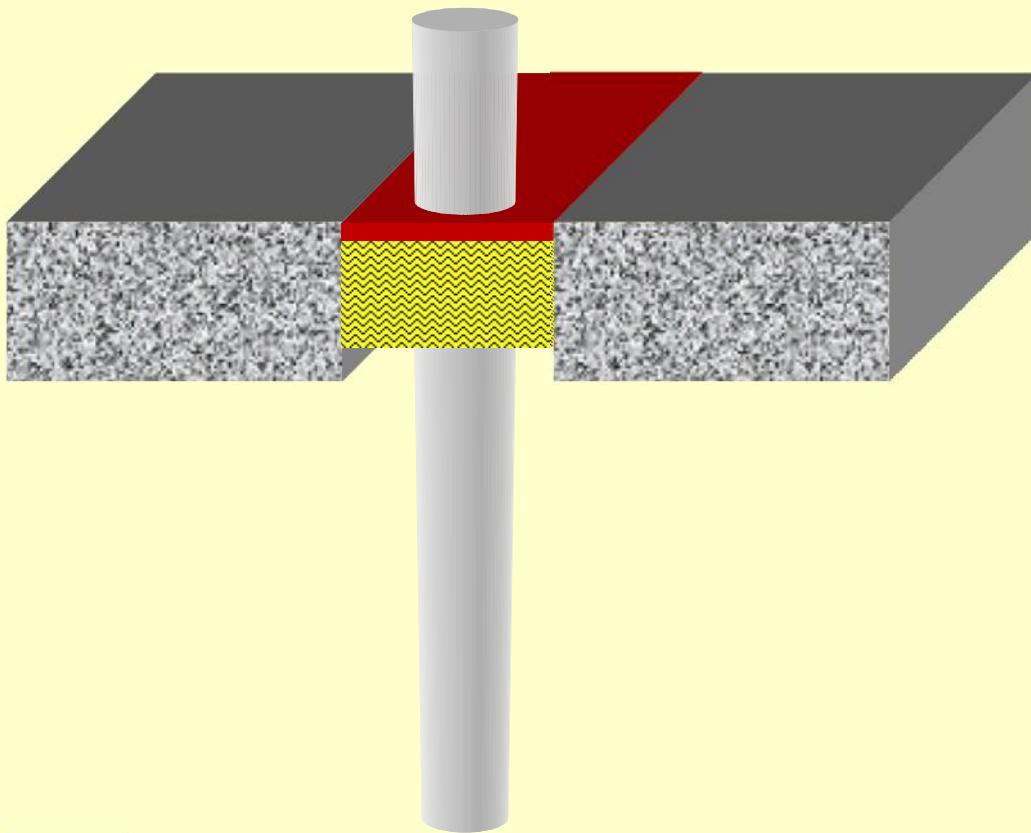
Through Penetrations

- Type of penetrating item(s)
- Size of penetrating item(s)
- Percent fill (cables)
- Annular space
- Fire severity and duration
- Floor or wall construction type
- Floor or wall thickness
- Stud width for gypsum wall assemblies



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Traditional Installation of Through Penetrations



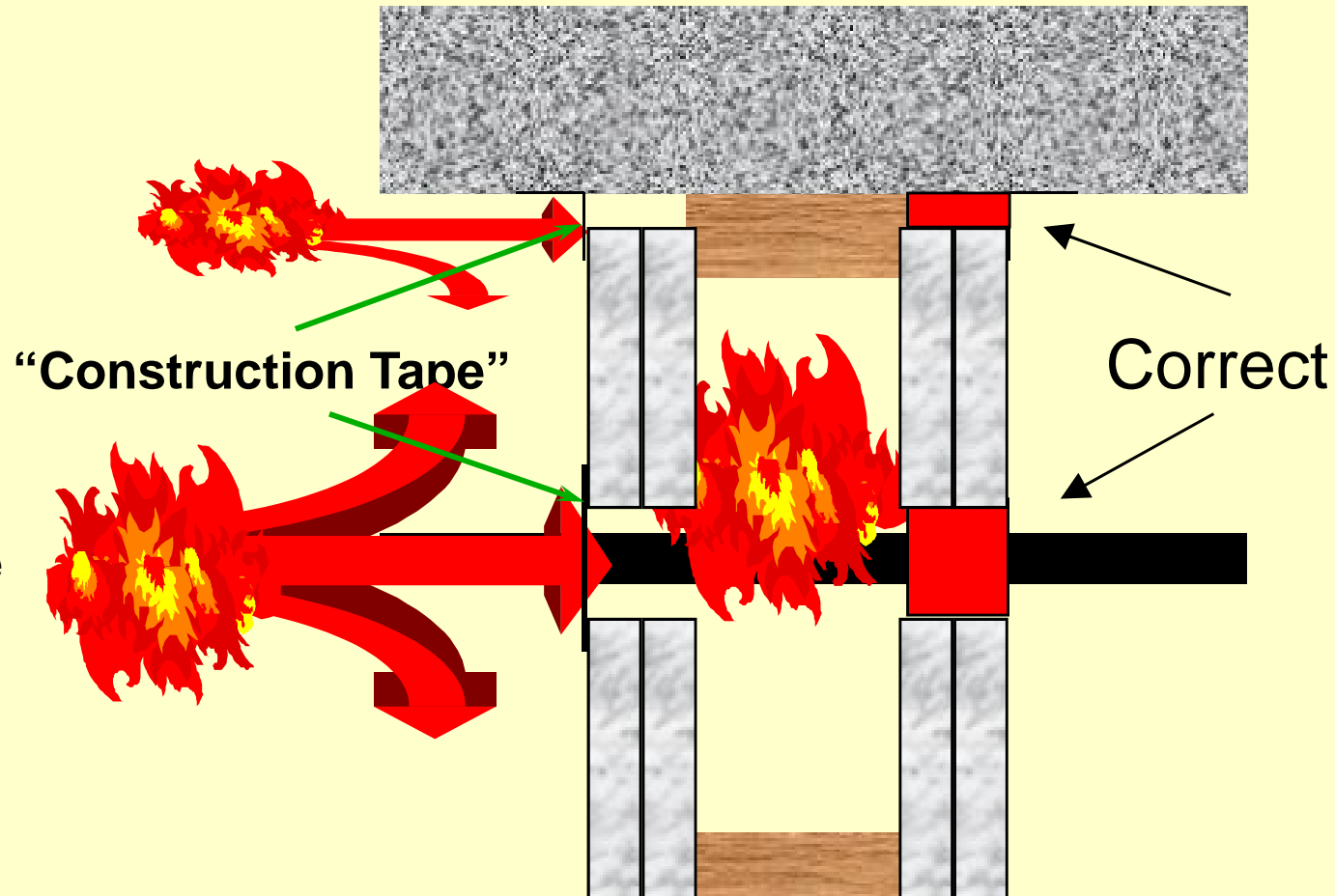
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Drywall Tape vs. Firestop Sealant

- Tape and Mud will not withstand the effects of Fire.
- Depending on fire conditions, the tape and mud may burn away leaving an unsealed opening in just minutes.
- A Firestop Sealant will restore an assembly to its Fire Resistance Rating.



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What is a Membrane Firestop Penetration?

- **Membrane Penetration** – An opening made through one side (wall, floor, ceiling membrane) of an assembly.
 - Example: Toilet or sink piping
- **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.



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What is a Fire Rated Joint System?

A fire rated joint system consists of specified materials designed and tested to resist the passage of flames and hot gasses sufficient to ignite cotton waste for a prescribed period of time in accordance with UL 2079.

Head of Wall

Expansion Joints

Vertical Control Joints



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ASTM E1966 / UL 2079 - Test Standard

Tests for Fire Resistance of Building Joint Systems

- Joint system is cycled (typically 500 times) through intended range of movement before fire exposure per ASTM E1399
- **Assembly Rating** - Measures both the fire and temperature ratings on the non-fireside (both required to pass test)
- Same time/temperature curve as ASTM E 814
 - Hose stream is only required for top-of-wall and wall-to-wall joints



Factors Affecting Firestop Performance

Joints

- Movement requirements
- Joint width
- Fire severity and duration
- Floor and wall construction type
- Floor and wall thickness



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Fire Resistive Joint Testing

Head of Wall Joint



Floor to Floor Joint



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Goal of Building Codes and Regulations

The goal is:

**Life Safety of
Occupants
and Protection of
Property**

**All regulations are based
on this objective**



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Building Codes

Model Codes That Require Firestop

- **International Building Code (IBC)**
- **Life Safety Code (NFPA 101)**
- **National Electrical Code (NFPA 70)**
- **NFPA 5000 (NFPA Building Code)**
- **Legacy US building codes (UBC, SBC, NBC)**



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How Do We Measure Firestop Performance?

The fore-runner and basic model for current test standards is **ASTM E119** (UL263, NFPA 251) STANDARD TEST METHODS for FIRE TESTS of BUILDING CONSTRUCTION AND MATERIALS.

The most important test for through penetration fire stop systems is **ASTM E814**, STANDARD TEST METHOD for FIRE TESTS of THROUGH-PENETRATION FIRESTOPS.

The most important test for fire resistive joint systems is **ASTM E1966**, TESTS FOR FIRE RESISTANCE OF BUILDING JOINT SYSTEMS.

In addition, UL has developed its own test standard, **UL 1479** FIRE TESTS OF THROUGH-PENETRATION FIRESTOPS, and **UL 2079** TESTS FOR FIRE RESISTANCE OF BUILDING JOINT SYSTEMS.



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TESTING LABORATORIES



Underwriters Laboratories Inc.
Northbrook, Illinois



Underwriters Laboratories of Canada
Scarborough, Ontario



Intertek Testing Services
Pittsburg, California



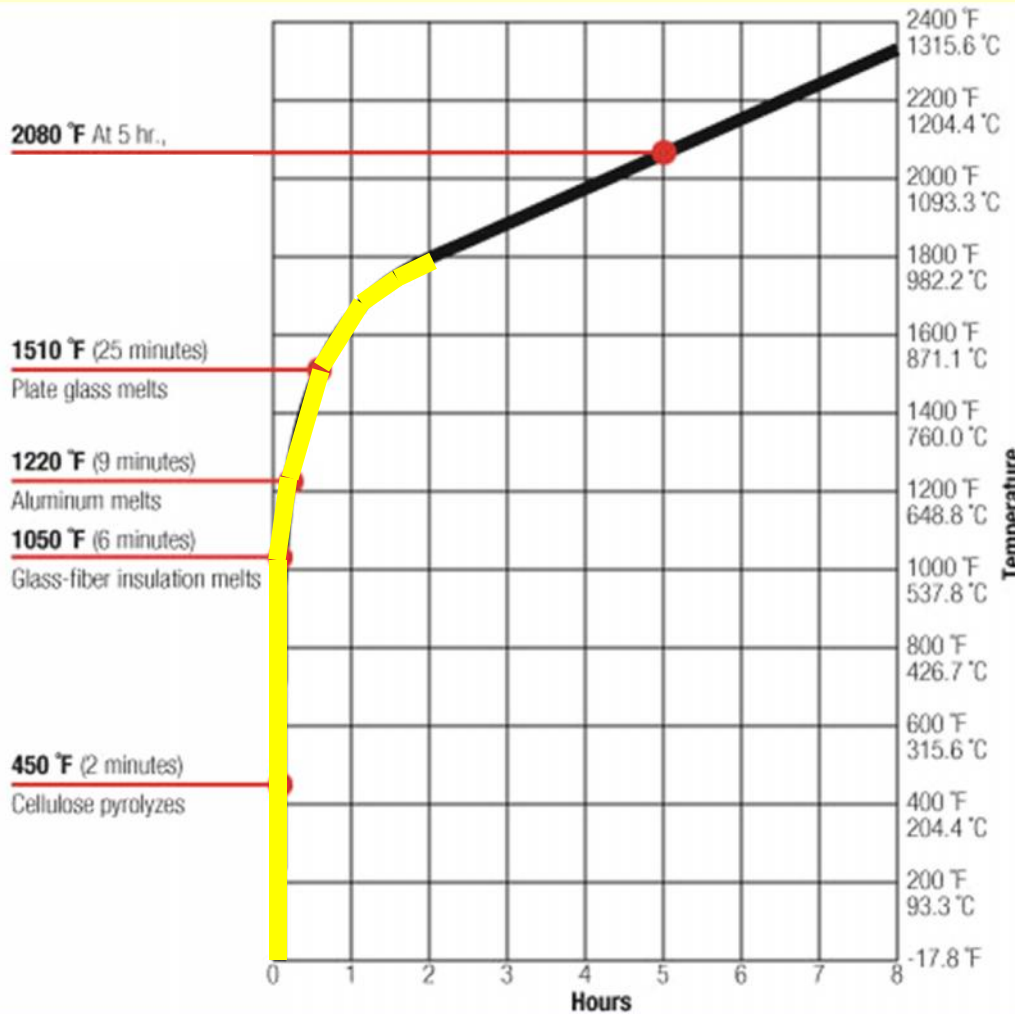
Omega Point Laboratories
San Antonio, Texas



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ASTM E-814 Time Temperature Curve



Temperature at 10 minutes = 1300 °F

Melting Points (approximate):

- PVC plastic pipe - 413 °F ¹
- Fiberglass insulation - 1050 °F ²
- Aluminum - 1220 °F ³

Sources:

1. SFPE Handbook of Fire Protection Engineering, 1st Ed. Table 1-12.1. Pg. 1-166.
2. Owens Corning SSL I or II Fiberglass Insulation specification sheet.
3. NFPA Fire Protection Handbook, 18th Ed. Table 4-16A. Pg 4-183.



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Engineering Judgments

Guidelines for creating/evaluating EJ's

- **Issued by qualified technical personnel (FPE).**
- **Based upon previously tested system.**
- **Issued only for a single job and location.**
- **Based upon assumption that the recommended firestop system would pass UL 1479 (ASTM E814) or UL 2079 (ASTM E1966) for the required rated period of time.**



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Engineering Judgments (Contin.)

Guidelines for creating/evaluating EJ's

- **Clearly indicate that the system is an EJ and not a listed system.**
- **Identify the job, location and fire rating conditions.**
- **Provide descriptions of systems (products, densities, depths, annular space, etc.).**



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Key Firestop Terms and Definitions

WALL or FLOOR ASSEMBLY - A fire resistance rated wall or floor that contains through-penetrations.

THROUGH-PENETRATION - An opening (hole) that has been made through a fire rated wall or floor.

PENETRANT (or Penetrating item) - Pipes, electrical conduit, cables, cable trays, or ducts that have been placed through a fire rated assembly.

ANNULAR SPACE - The gap between the penetrating item and the edge of the opening. A point of contact or an area where no gap exists is referred to as ZERO ANNULAR SPACE.

FILL MATERIAL - The firestop sealant material that is placed in and/or around the opening.



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Key Firestop Terms and Definitions

BACKING MATERIAL or FORMING MATERIAL - Noncombustible material used to provide support for fire-rated sealant (i.e. foam backer rod or mineral wool)

INTUMESCENT - The ability of firestop to swell, inflate, or expand with heat. Some firestop sealants will intumesce when exposed to the intense heat of fire causing them to close gaps or voids in through-penetration openings.

COLLAR - A sheet metal restricting device normally used in conjunction with plastic pipe to direct and control the intumescent action of the firestop sealant with which it is filled.

F- RATING - The time in hours that a firestop system will prevent the passage of flames through an opening, remain in place, and not permit the projection of a water stream as determined by standard test methods **ASTM E814 or UL 1479**.

T- RATING - The time in minutes required for the temperature on the unexposed surface of a firestop system or any penetrating item to rise 325° F above the ambient temperature as determined by **ASTM E814 or UL 1479**.



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Why Are Firestop Products So Important?

- Simply put, firestop systems are and have been required by all model building codes.
- More importantly, firestop products play a significant role in reducing the number of lives and property lost unnecessarily due to the rapid spread of fire and smoke.
- Mandated for public safety
- Mandated for property loss management



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QUESTIONS: FIRESTOP TRAINING

1. Why are firestop products needed?

Code required

Life safety

Limit property damage



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QUESTIONS: FIRESTOP TRAINING

2. What are the components of a through-penetration firestop system?

1. Fire-rated assembly
2. Penetrating item
3. Sealant or barrier material



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QUESTIONS: FIRESTOP TRAINING

3. What basic information is needed to determine the proper firestop system?

1. Fire-rated assembly
2. Penetrating item
3. Hole size / Annular space
4. F-Rating



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QUESTIONS: FIRESTOP TRAINING

TRUE OR FALSE

4. A firestop system refers only to the firestop sealant. **False**
5. Mineral wool alone is a complete firestop system as defined by ASTM E814. **False**
6. Drywall tape/compound, mortar, grout and concrete will intumesce and form a fire rated seal. **False**



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QUESTIONS: FIRESTOP TRAINING

7. The gap between the penetrating item and the edge of the opening is the ...

- a) Char
- b) Annular Space
- c) Rating
- d) Assembly



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QUESTIONS: FIRESTOP TRAINING

8. The ability of firestop material to swell, enlarge, or expand under heat conditions is...

- a) Annulus
- b) Char
- c) Intumescence
- d) Static



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QUESTIONS: FIRESTOP TRAINING

9. The time in hours that a firestop system will prevent the passage of flames through an opening, remain in place, and not permit the projection of water is the ...

- a) F Rating
- b) I Rating
- c) L Rating
- d) All the above



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QUESTIONS: FIRESTOP TRAINING

10. The appropriate test for through-penetration firestop systems is ...

- a) ASTM E84
- b) ASTM C112
- c) UL 680
- d) ASTM E814



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About the IFC

The International Firestop Council is a not-for-profit association of manufacturers, distributors and installers of fire protective materials and systems.

IFC's mission is to promote the technology of fire containment in modern building construction through research, education and development of safety standards and code provisions.

Website - www.firestop.org

Email - Info@firestop.org



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Available educational seminars on our website include.....

- **Firestop 101 – An introduction to firestopping**
- **Perimeter Curtain Wall Fire Protection**
- **Firestop System Selection**
- **Flexible Duct Wrap Systems**
- **Fire Protection of Construction Joints**



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