

Firestopping & Compartmentation



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MeriCon
Resilient Fire Protection Services, LLC

Inspections/Consulting

- Firestopping
- Fire/Smoke Barriers
- Barrier Remediation
- SOC surveys
- Project Management
- Quality Control/Assurance
- Installation Training
- Codes
- Plan/spec review



FREEMAN AIR
HOSPITAL FIRE SAFETY

Inspections/Repairs

- Fire/Smoke Dampers
- Door/Hardware

Vetted Contractors

- Firestop Installation
- Firestop Remediation
- Barrier Remediation

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ASTM 2174/2393 Inspection Standards
Fully divested from & not a competitor of:
Manufacturer, distributor, installer

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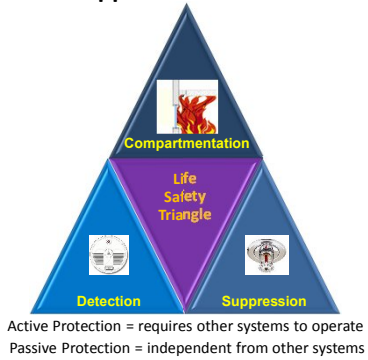
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2011 United States Fire Loss Clock



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A Balanced Approach



Active Protection = requires other systems to operate
Passive Protection = independent from other systems

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Passive Fire Protection Components

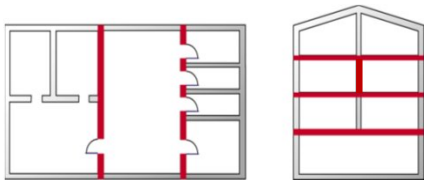


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Compartmentation = containment of flame, heat, smoke, toxic gas



Fire resistive assemblies = F-rating of 1 to 4 hours
Fire Walls
Fire Barriers – 1 to 4 hours
Smoke Barriers – 1 hour
Smoke Partitions – no rating

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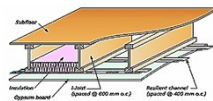
Compartmentation starts with the Assembly



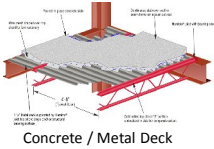
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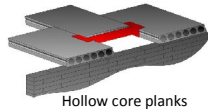
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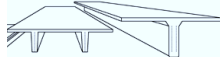
Wood frame



Concrete / Metal Deck



Hollow core planks



Pre-cast planks

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Where ratings come from



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Post burn & temperature rise



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Hose stream = structural integrity



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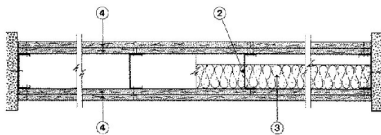
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Pass ALL tests, get a UL

Design No. U411

Rev. 05/2012

Nonbearing Wall Rating - 2 HR.



- 1. Floor and Ceiling Runners - (Not shown) - Min. 25 MGD galv steel 1 in. return legs, 2 1/2 in. deep (min), attached to floor and ceiling with fasteners 24 in. OC max.
- 2. Framing Members - Floor and Ceiling Runners - (Not shown) - As an alternate to Item 1 - For use with 24 in. OC, min. spaced, min. 2 1/2 in. deep, attached to floor and ceiling with fasteners 24 in. OC, max.
- 3. ALLSTEEL & GYPSUM PRODUCTS INC. - Type III SFR fire finished Gypsum.

CALIFORNIA EXPANDED METAL PRODUCTS CO. - Viper 20" Truss

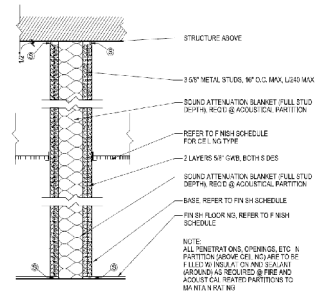
CONSOLIDATED FABRICATIONS CORP., BUILDING PRODUCTS DIV. - Type S/P/HPV Framing System

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Only LISTED designs are useable



| | | |
|-----|--|--------|
| 18 | 2 HOUR RATED PARTITION WALL DESIGN (A71) | 48 ETC |
| 19A | 1 1/2 HOUR RATED PARTITION WALL DESIGN (A71) | 48 ETC |

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All passive components are tested similarly



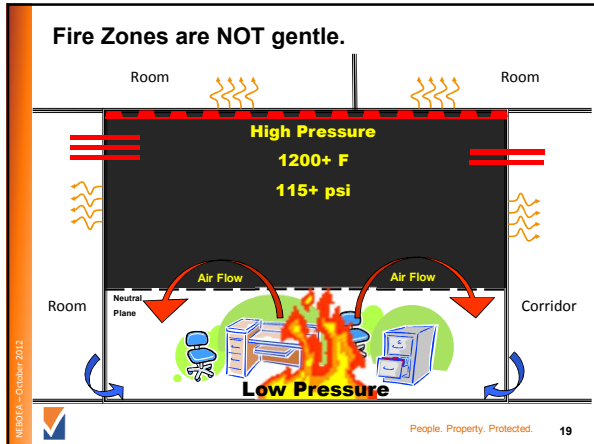
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Why do we need all of this testing?

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Sprinklers suppress flames, NOT smoke

75%

Source: Hall, J., John R. NFPA Fire Analysis & Research, Quincy, MA. "Burns, Toxic Gases, and other Hazards".

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Smoke can kill almost immediately

Over 100 toxins gasses, aerosol or attached to soot.

- Carbon Monoxide
- Hydrogen Cyanide
- Phosgene
- Hydrogen Chloride
- Acrolein
- Sulphur
- Nitrogen Dioxide...

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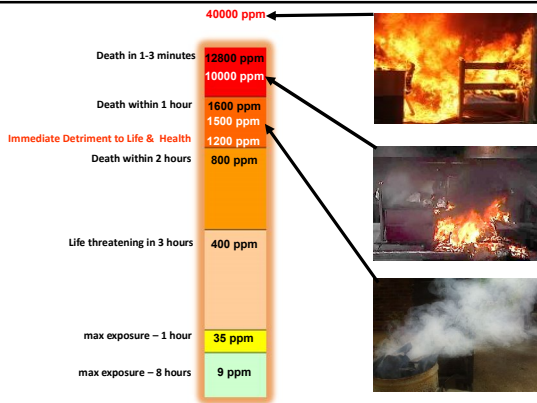
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Carbon Monoxide = Hypoxia = death



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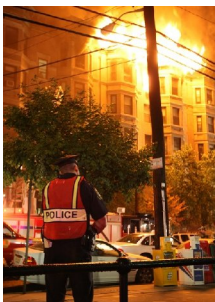




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Smoke Does Not Always Rise



Fire's origin on 5th floor, 80-yr.-old lived on third
 Thursday, October 02, 2008
 By CAROL BALDWIN
 JOURNAL STAFF WRITER

HOBOKEN - An 80-year-old woman died and many families are homeless after a four-alarm fire tore through an Applied Housing apartment complex at 20th and Hudson streets yesterday.

Julia Orso was found by rescue workers in bed in her third-floor apartment, said 6 a.m., officials said. It is not clear how she died, but there was smoke in her apartment, said Hudson County Prosecutor Edward DeFazio.

The fire started in a fifth-floor apartment at 1000 Hudson St. shortly after 3 a.m., officials said.

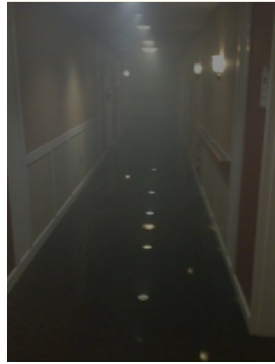
None of the block is still under investigation, but two young men were seen at that apartment and officials planned to speak to them, DeFazio said.

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Visibility

- 50% of survivors could not see more than 12 feet.
- Walking speed drops
 - Men 3.5 to 1.7 mph
 - Women 3.2 to 1.6 mph



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Speed

Smoke & toxic gases travel up to 420 ft. /minute at temperatures of 1500 degrees or more.

Hallway - 100' long, 10' wide, 8' high
Top of Wall joint = 5/8" high x 20 feet long
Hallway will fill with smoke in 4-5 minutes



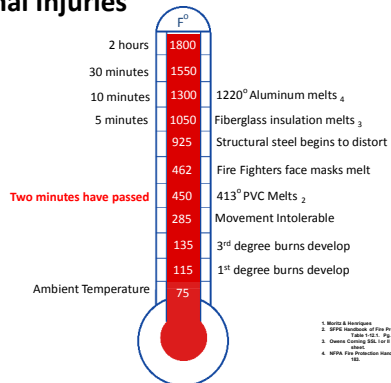
Properly firestopped = 594 minutes

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Thermal Injuries

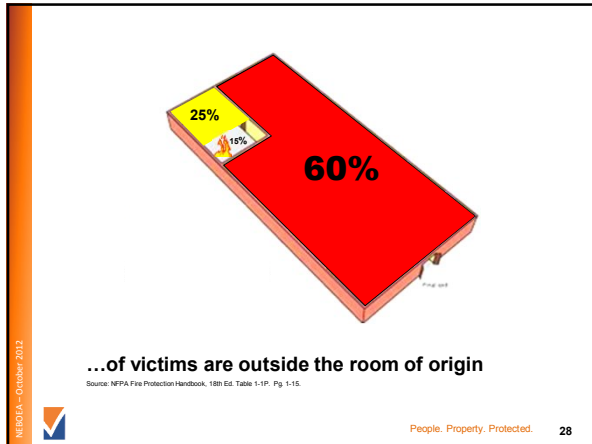


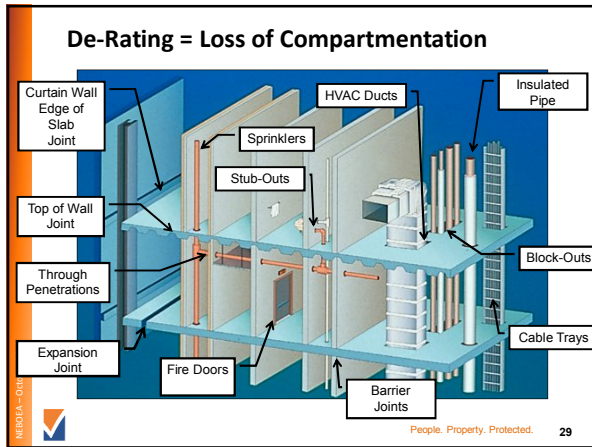
1. Morris & Henninger
 2. NFPA Handbook of Fire Protection Engineering, 1st Ed.
 3. Quincy Corning 200, 100-Fiberglass Insulation Specification
 4. NFPA Fire Protection Handbook, 19th Ed. Table 4-16A, Pg. 4-16B

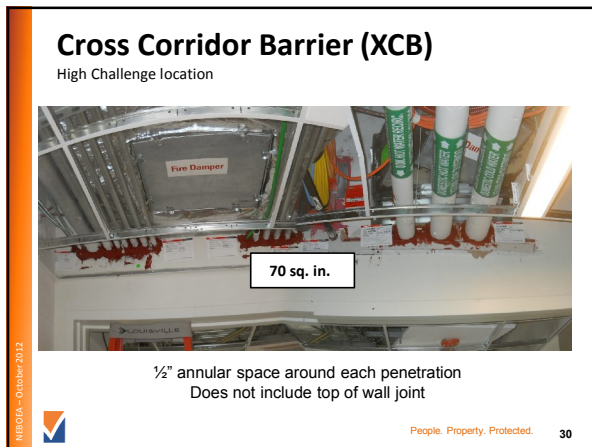
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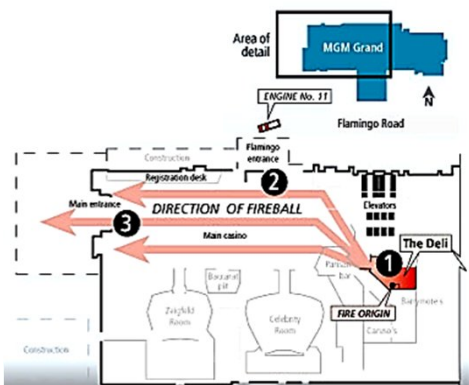


What happens when compartmentation is not established or is lost?



On November 21, 1980 a fire occurred at the MGM Grand Hotel on the 1st floor in the casino






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- Sprinklers activated on the 26th floor.
- 785 people injured
- 84 people died.
- 67 victims on the 16th floor or higher.

The flames never left the first floor



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Greenwood Manor – Hartford CT



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February 2003 - 16 deaths



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NYC - 2008



2nd floor mechanical room fire contained to room of origin

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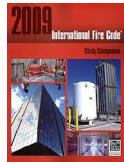
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\$19,000,000.00
Repair, clean up and lost revenue



Code Requirements



IBC 2009

- Sections 712.3.1.2 & 712.4.1.2:
 - *“Through-penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E814...”*
- Sections 712.3.2 & 712.4.2 : Membrane Penetrations
- Section 712.1: Fire Resistive Joint Systems
- Section 712.4: Exterior Wall Assemblies



Listed Systems

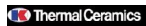
What are they and where do they come from?

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Listed Systems start with the manufacturers.



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Through-Penetration Test



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Through-Penetration Test

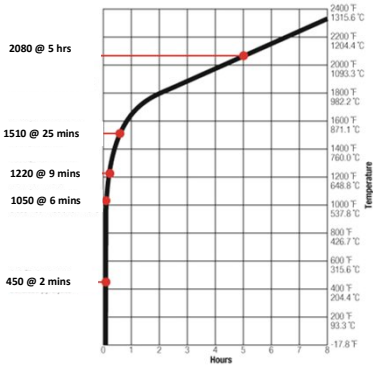


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ASTM E-814 Time Temperature Curve



Melting Points (approximate)
 PVC plastic pipe = 413 °F¹
 Fiberglass insulation = 1050 °F²
 Aluminum = 1220 °F³

Sources:
 1. SP75 Handbook of Fire Protection Engineering, 1st Ed., Table 1-1.11, Pg. 1-109
 2. Owens Corning, 500, 1/4" Fiberglass Insulation, specification sheet
 3. NIST Fire Protection Handbook, 10th Ed., Table 4-10a, Pg. 4-10

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What Failure Looks Like



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Post Burn Test



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Hose Stream Test



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Hose Stream Failure



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... then submit to Third Party Testing Labs for testing and **Listing**



Labs Test the **Systems** to Exact Standards

American Society of Testing and Materials (ASTM)

E814 – Through penetrations

E1966 - Joints

Underwriters Laboratories Inc. (UL)

1429 – Through penetrations

2079 - Joints

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ASTM E 814 / UL 1479 Test Standards for Through Penetration Firestop **Systems**

F-Rating

The duration of time in which **flames** must not pass through the **system**

T-Rating

The time it takes for the **non-fire** side to reach 400°F



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ASTM E 814 / UL 1479 Test Standards for Through Penetration Firestop Systems

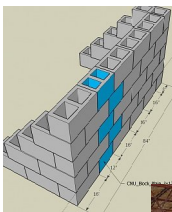
- **L-Rating** (currently optional)
- Amount of air leakage through the system at ambient and 400°F
- Measured in CFM/sq. ft. The lower the number, the better.
- **W-rating** (currently optional)
- the ability of a system to restrict the flow of water
- Class 1-rated systems resist a 3 foot water column for 72 hours

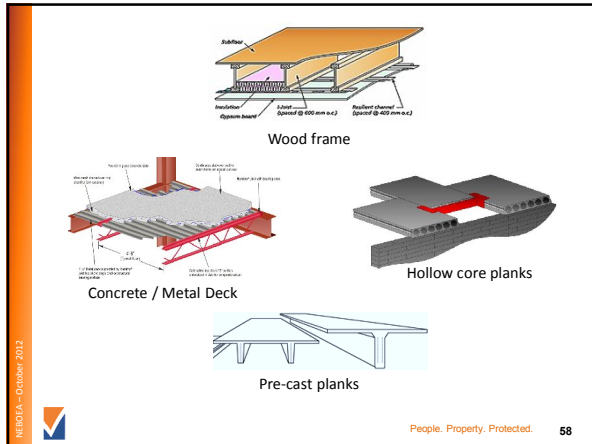


There are 3 parts to a Listed Firestop System



1st Part of a Listed System:

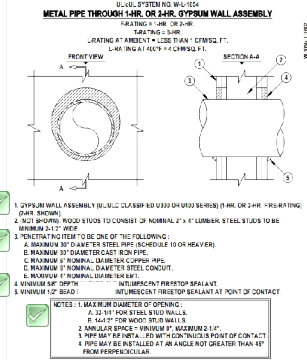








Listed System, Listed System, Listed System...

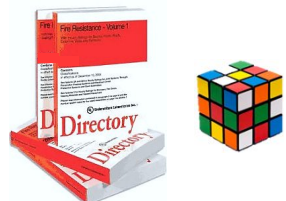


- 1 COPPER WALL ASSEMBLY (UL LISTED CLASSIFIED TO LISTED SYSTEMS) (2 HR. OR 2-HR. F-RATING, (CLASS. SHOWN))
- 2 METAL COLLAR (3) SHALL BE 1/2" (12.7 MM) THICK (4) SHALL BE 1/2" (12.7 MM) HIGH (5) SHALL BE 1/2" (12.7 MM) LONG (6) SHALL BE 1/2" (12.7 MM) WIDE
- 3 SELECTED TO BE ONE OF THE FOLLOWING:
 - A. MAXIMUM 3/4" (19.0 MM) DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER)
 - B. MAXIMUM 1/2" (12.7 MM) DIAMETER CAST IRON PIPE
 - C. MAXIMUM 1/2" (12.7 MM) DIAMETER COPPER PIPE
 - D. MAXIMUM 1/2" (12.7 MM) DIAMETER STEEL CONDUIT
 - E. MAXIMUM 1/2" (12.7 MM) DIAMETER RIGID PVC CONDUIT
- 4 MINIMUM 1/2" (12.7 MM) GAP BETWEEN PIPE AND WALL
- 5 MINIMUM 1/2" (12.7 MM) GAP BETWEEN PIPE AND WALL

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Over 10,000 Listed Systems most with UL

- Specific Listed Systems categories for:
 - Walls
 - Floors
 - Floor/Wall combos
- Each category has subsets for:
 - Blank openings
 - Metallic pipe
 - Non metallic pipes
 - Insulated metallic pipe
 - Cables
 - Duct work
 - Multiple penetrants
- Joints have separate categories for:
 - 6 different joint types
 - Static vs. dynamic joint movement potential



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So, what is the F-rating of the firestop material?



ZERO!

Only Listed Systems have ratings.

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Firestopping vs Fireblocking

- Fireblocking is done **inside** the stud and joists cavities of wood frame buildings. (Type V)
- Products are **NOT** tested to ASTM E814 firestop standards
- Tested to ASTM E136 "Non-combustibility" test
- No UL Systems are involved.
- Fireblock products **CANNOT** be used in firestop applications



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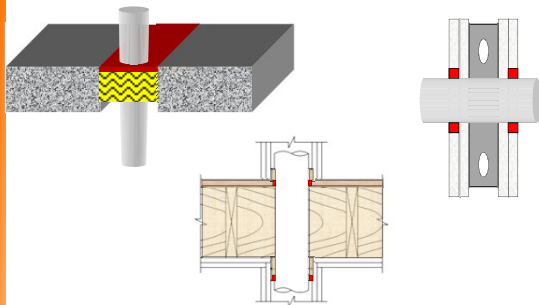


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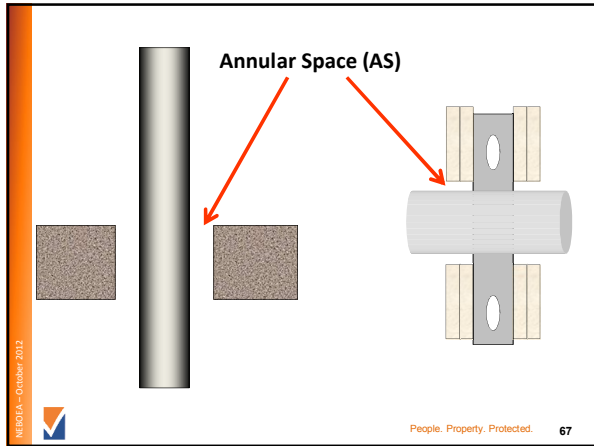
Through Penetrations Basics

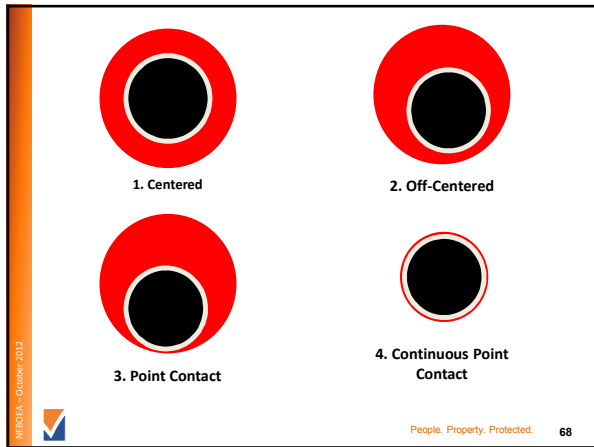


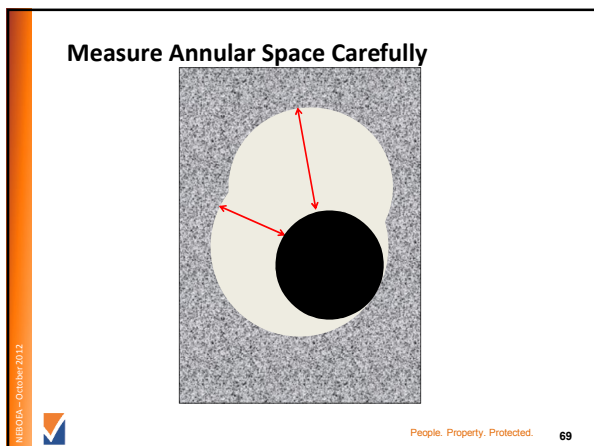
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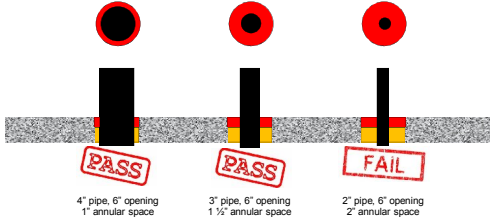






Installs must meet Annular Space limits

UL System CAJ-1380
Annular space = 0" to 1 7/8"



4" pipe, 6" opening
1" annular space

3" pipe, 6" opening
1 1/2" annular space

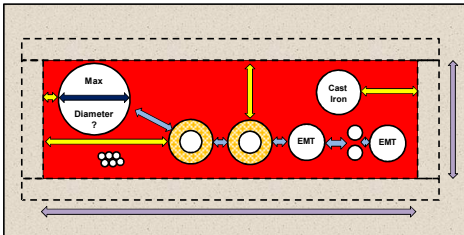
2" pipe, 6" opening
2" annular space

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Check all parameters carefully



1. Type of penetrants allowed.
2. Max size penetrants allowed.
3. Min/max distance to edge of opening
4. Min/max distance between penetrants
5. Max dimension of opening
6. Max total area of opening
7. Must be framed out??

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Sealant depth & location

5/8" called for in
Listed System

1/4" installed in the
field



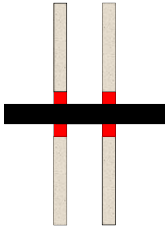
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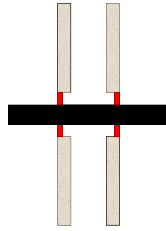
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Sealant depth & location

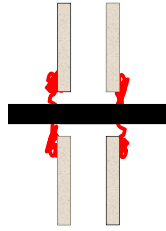
5/8" depth called for in most Listed Systems



1/4" commonly installed...



...Or worse

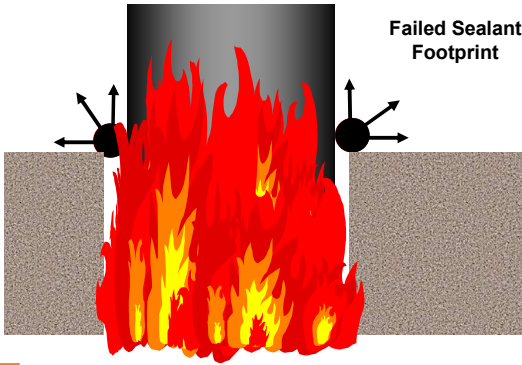


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Sealant Tooling

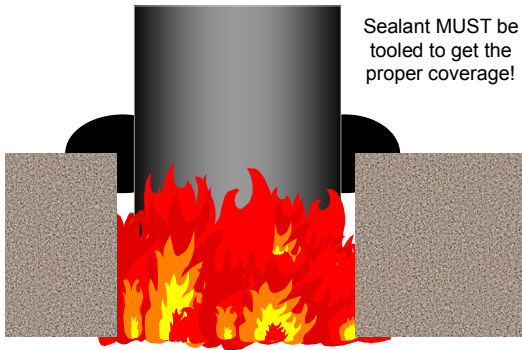


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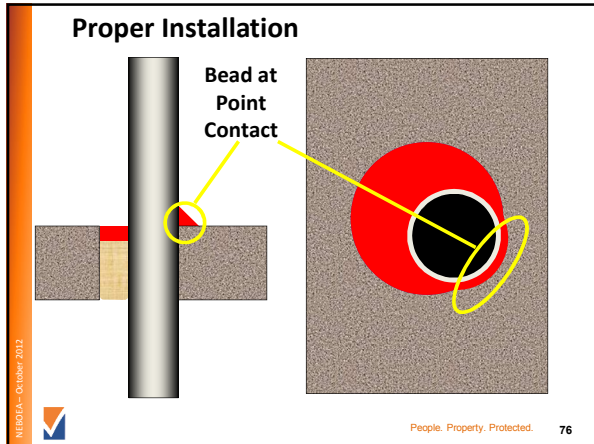
Sealant Tooling

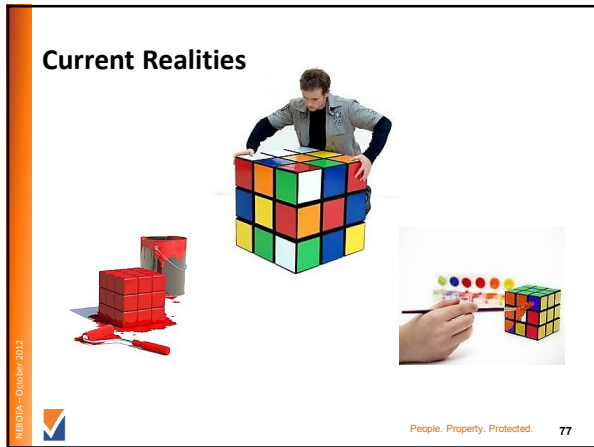


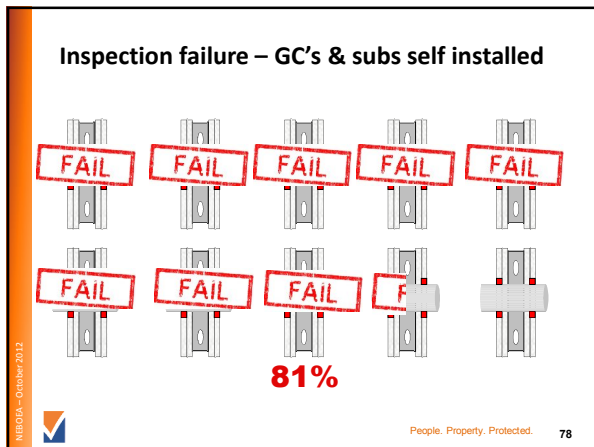
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Drywall Mud & Tape

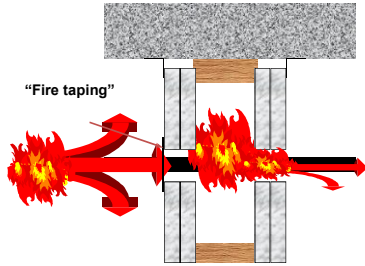


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Mud & Tape vs. Firestopping

- Tape and Mud will not withstand the effects of fire.
- Depending on fire conditions, the tape & mud may burn away leaving an unsealed opening.



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ConKey Firestop Systems LLC

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What is hidden by drywall compound?



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What is hidden by drywall compound?



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Red over white ain't right!



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Red over white ain't right!



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Not on the wall...

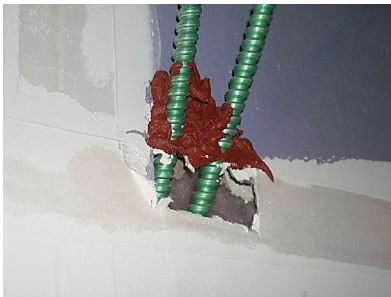


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... in the wall!



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Hodge Podge



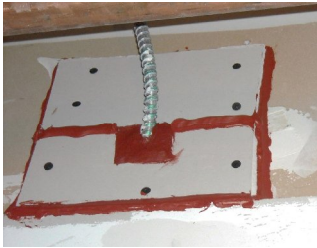
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No scab patching

- Not to Code
- Not rated
- Not Listed
- Cannot be *approved*



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Surface mount technology??



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Must Have Good AS



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Watch out for "smear attacks"...



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...and what is behind them.



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Pipe shields do!

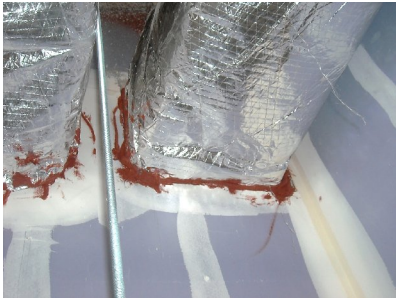


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Have to look up top



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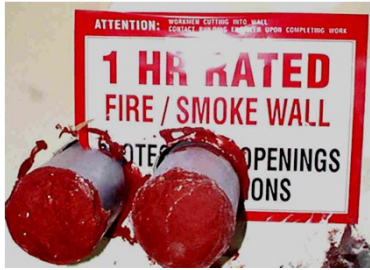


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Partial Installations



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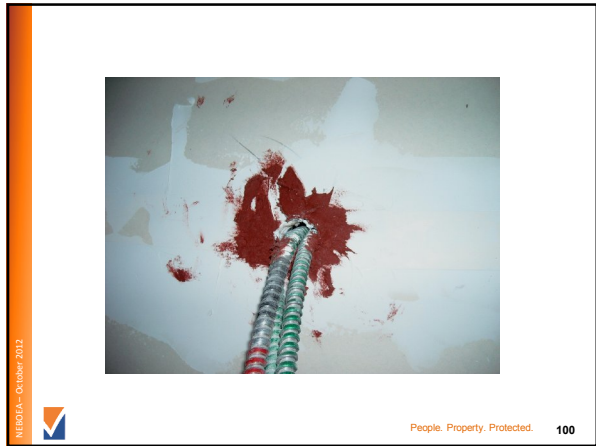
High Noon Syndrome



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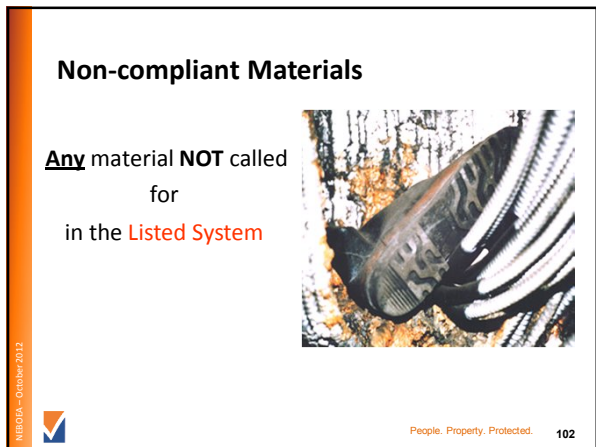
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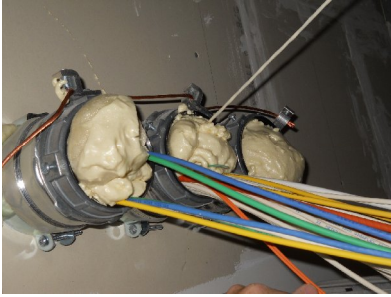




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Any Expanding Foam

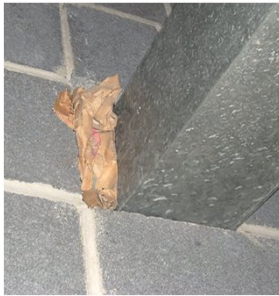


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Yagottabekiddinme!



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Extend the wall through the flutes



NIBDIA - October 2012



People. Property. Protected. 105













... hope this does not happen



IBC 2012 code changes



- **1705.16** - Third party firestop inspections **mandated** for:
 - **Risk Category III** - Buildings and other structures that represent a substantial hazard to human life in the event of failure.
 - Hospitals
 - Public Assembly
 - Most schools
 - Some Nursing Homes, SNF, etc
 - Jails & detention centers
 - **Risk Category IV**
 - Fire, rescue and police
 - Designated earthquake, hurricane or other emergency shelters.
- **High Rises** = 75 ft or more taller

MUST be conducted in accordance with ASTM 2174 and 2393



Components



Qualified



Be acceptable to the AHJ and:

1. Minimum 2 years experience in construction field inspections
2. Education, credentials & experience acceptable to the Authorizing Authority (AA)

OR

1. Meet criteria in ASTM Practice E699 for agencies involved in quality assurance;
 - Translates to being AC291 accredited

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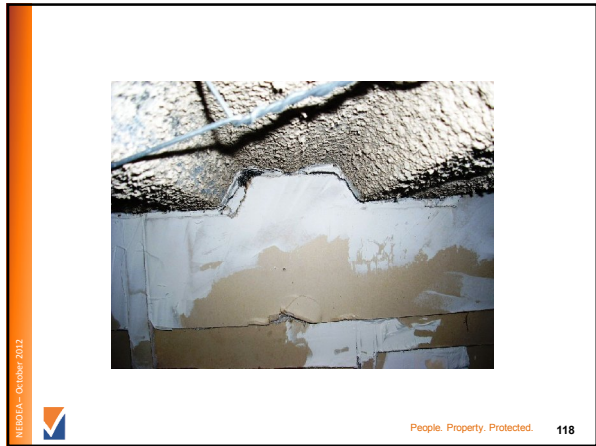
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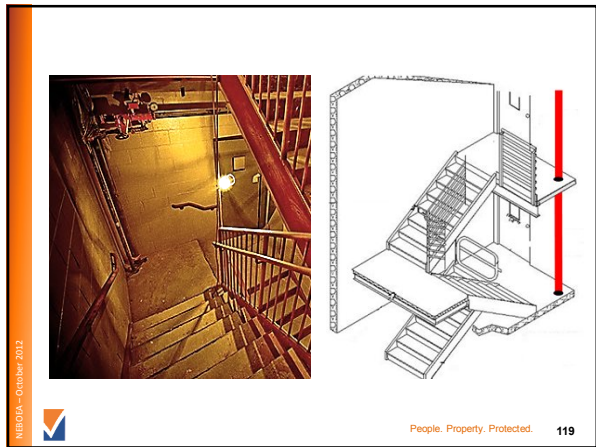




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No Conflict of Interest



- "... **shall be independent of, and divested from,**..."
- "... **shall not be a competitor of...**"
 - Installer
 - Contractor
 - Manufacturer
 - Supplier
- **FSC's and reps cannot inspect.**

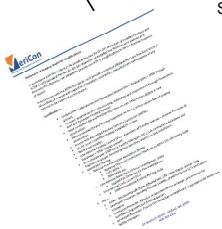
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Apply for Acceptance

Firestop Inspector Statement of Qualifications



Inspector Conflict of Interest Affidavit



Submitted before bidding

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Inspection Protocol #1



- Randomly observe 10% of each type of penetration firestop being installed per ten thousand sq. ft.
- Randomly observe 5% of total lineal feet of each type of joint firestop being installed.

...or

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Inspection Protocol #2



Destructive Testing

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Inspection Protocol #2



Through Penetrations

- Minimum 2% but not <1 of each **type**.
- Each UL System & E.I.
- Per 10,000 sq ft.
- One wrong? Do one more...up to 10% of total.

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Inspection Protocol #2



Joints

- One sample of each type for every 500 LF
- One wrong = one more...
- 10% failure, inspection stops.

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Reporting

1 page per...
% of deficiencies
per type **Deficiencies**
Executive **Within 2 days**
Summary
Within 1 day **Type & quantity**
Chronologically **of each**
Total as % of all
penetrations

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Inspection or Inspection?



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Questions???

Please complete evaluations

Wayne Barrow

603-769-4108

wbarrow@vericonpfp.com

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