# *Maintaining Protection of Gypsum Assemblies*

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FCIA
Firestop Contractors International Association



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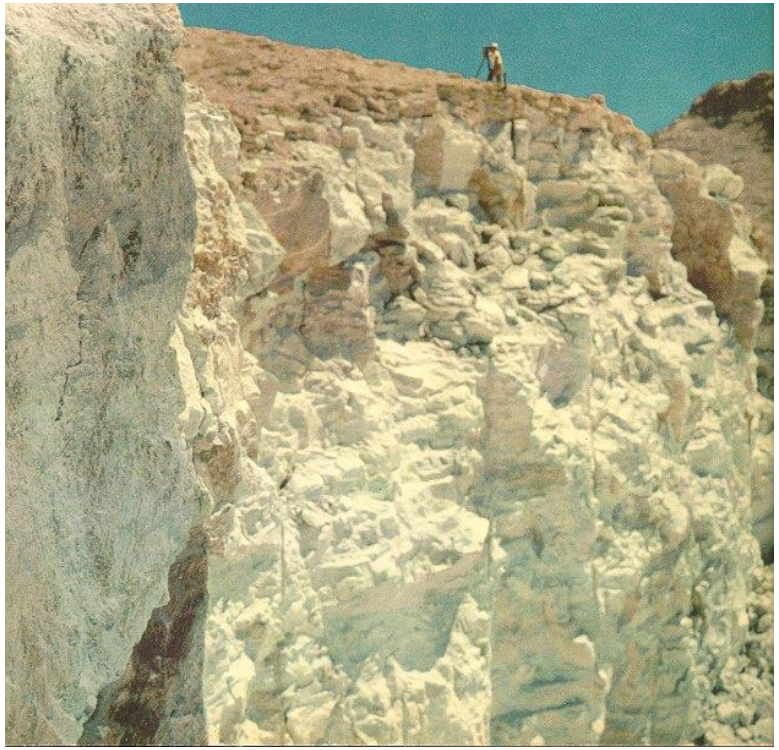
# Agenda

- Gypsum Mineral
- Types of Gypsum Cores and Their Applications
- Test Standards for Wall and Ceilings
- Common UL Designs and Acceptable Variations
- Repairs of Gypsum Wallboard

# Gypsum Mineral

- Calcium Sulfate Dihydrate
  - $CaSO_4 \cdot 2H_2O$
- 20% water by weight
- Two forms
  - Natural
  - Synthetic (Recycled)

# Natural Gypsum



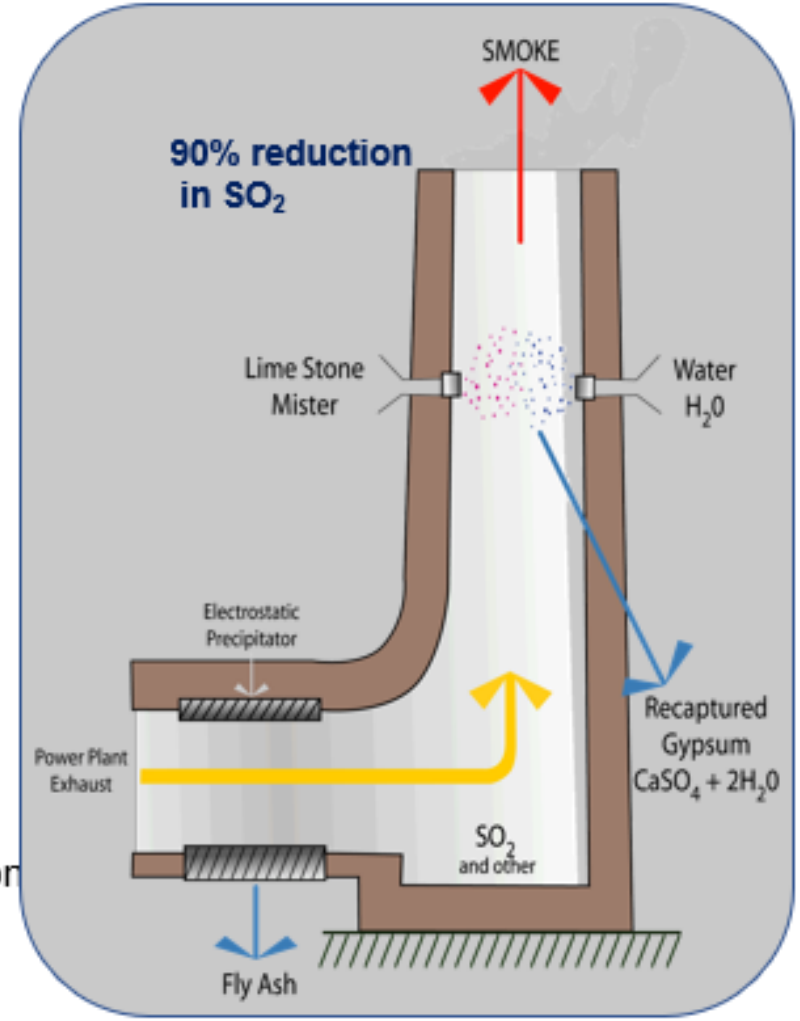
# Synthetic (Recycled) Gypsum

- Recaptured Gypsum from Flue Gas Desulphurization

$CaCO_3 + 2SO_2$ Add $2H_2O$ =
$CaSO_4$ $2H_2O + CO_2$

- ➢Reduced Acidification ($SO_2$)
- ➢Reduced Transportation
- ➢Renewable raw material
- ➢Reduce Extraction (Energy, Pollution

- ➢Increased GHG ($CO_2$)



# Gypsum Calcination

**Dihydrate (Rock)**

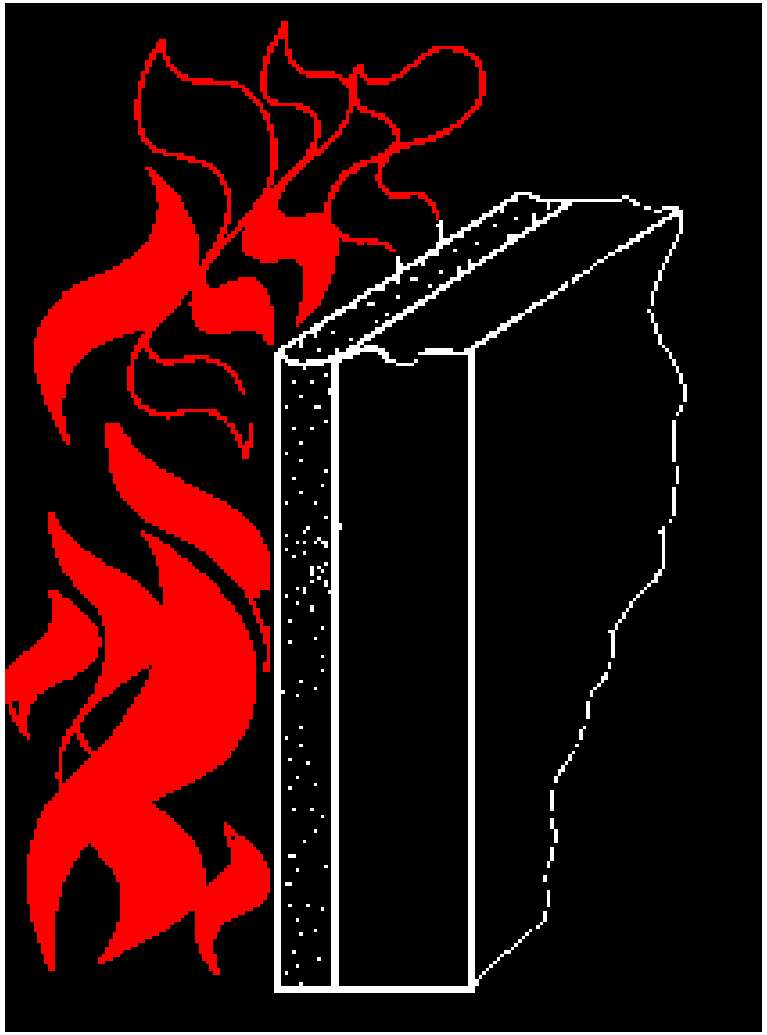
**$CaSO_4$- $2H_2O$**

**Heat** ↓ ↑ **Water**

**Hemi-hydrate (Plaster)**

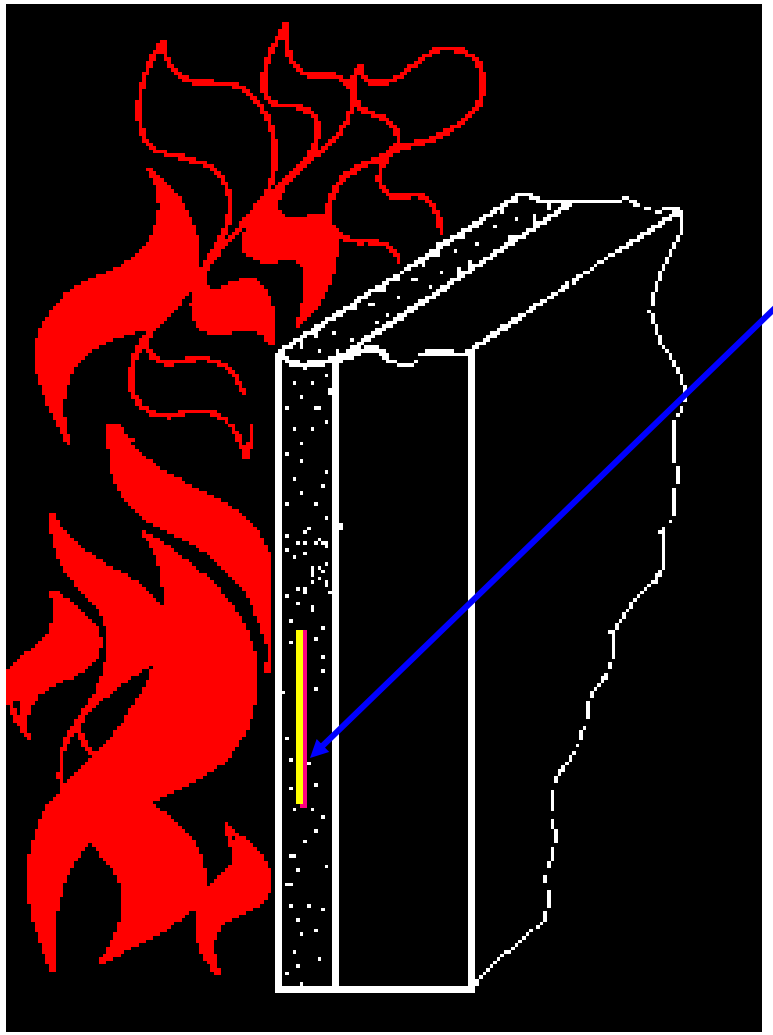
**$CaSO_4$- $1/2H_2O$**

# Gypsum Properties



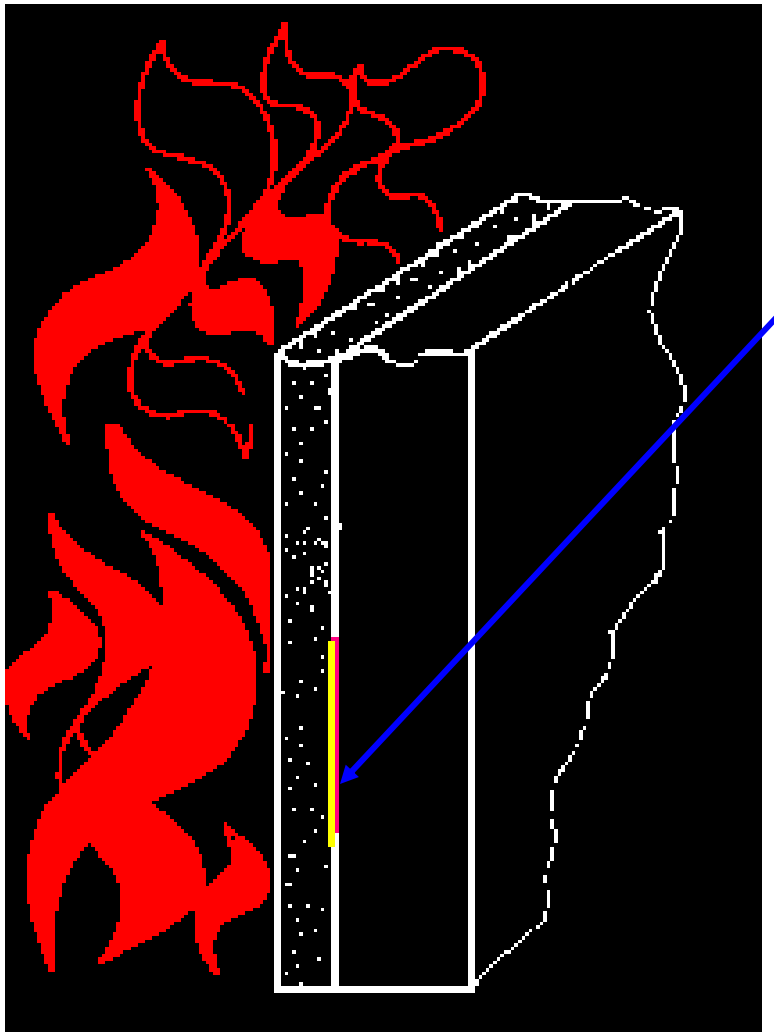
- ASTM E 119
- 2hours of exposure equals 1850$^{o}$ F

# Gypsum Properties



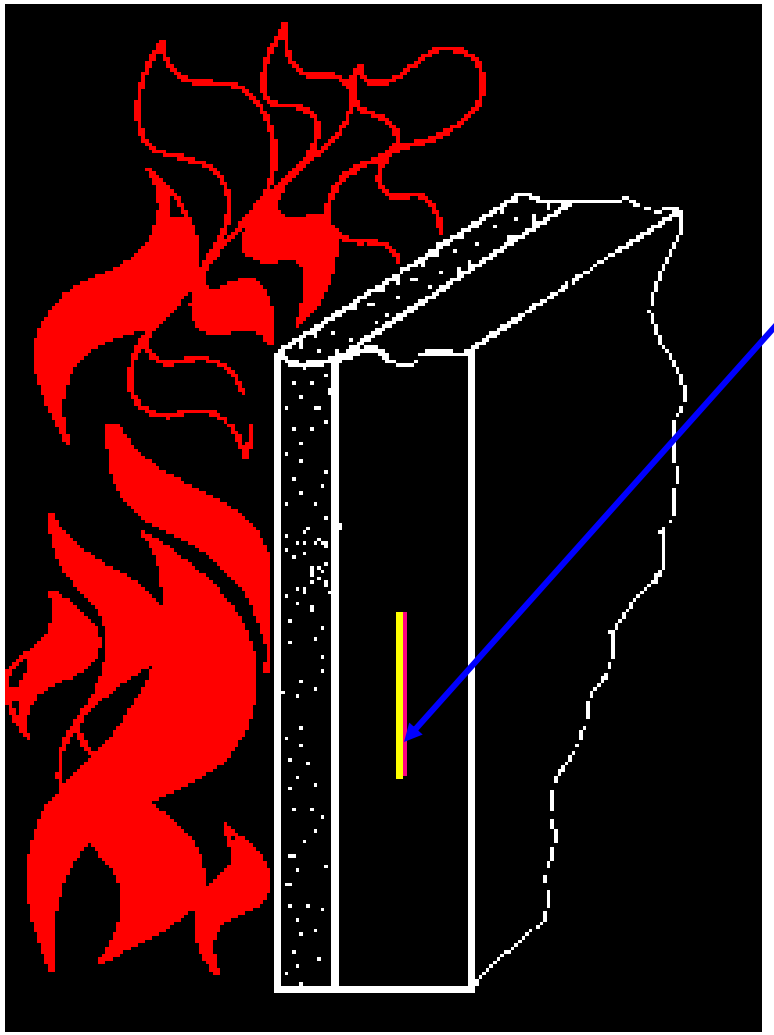
1” back  950º F

# Gypsum Properties



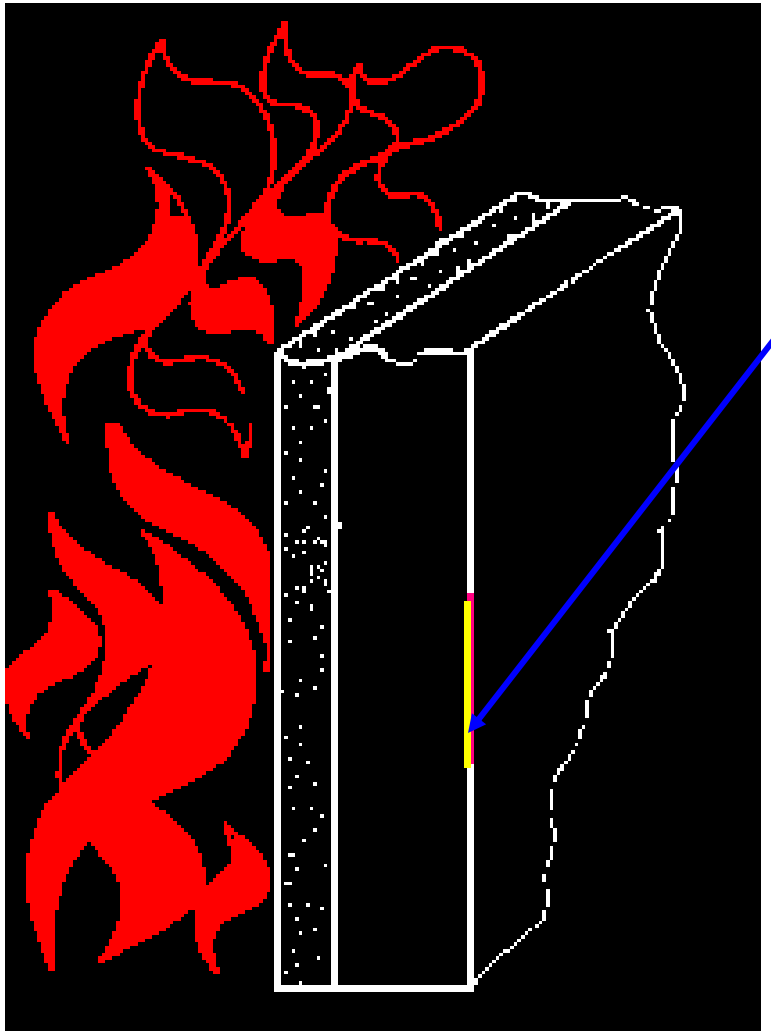
2” back  220º F

# Gypsum Properties



4” back  180º F

# Gypsum Properties

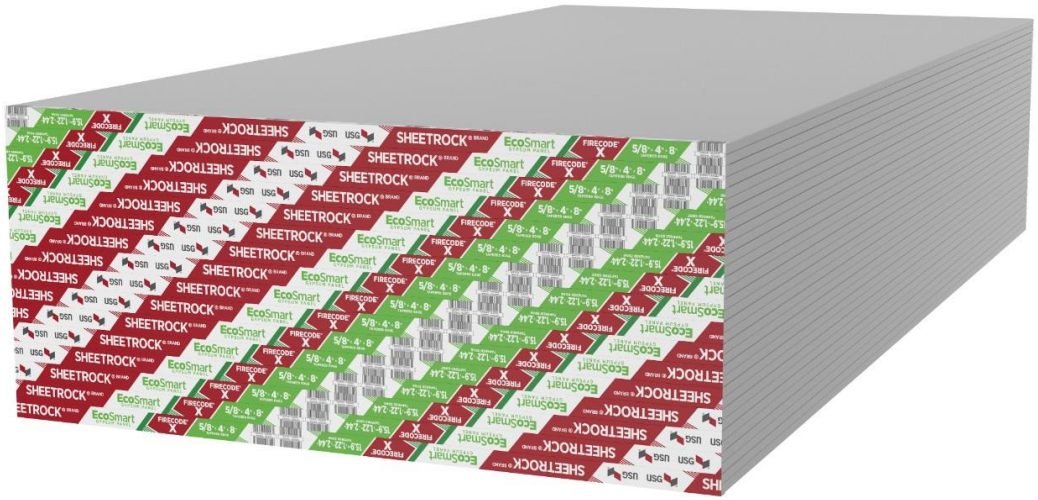


# System Fire Rating

- The system of components determines the fire rating!
- A single piece of gypsum has no rating!

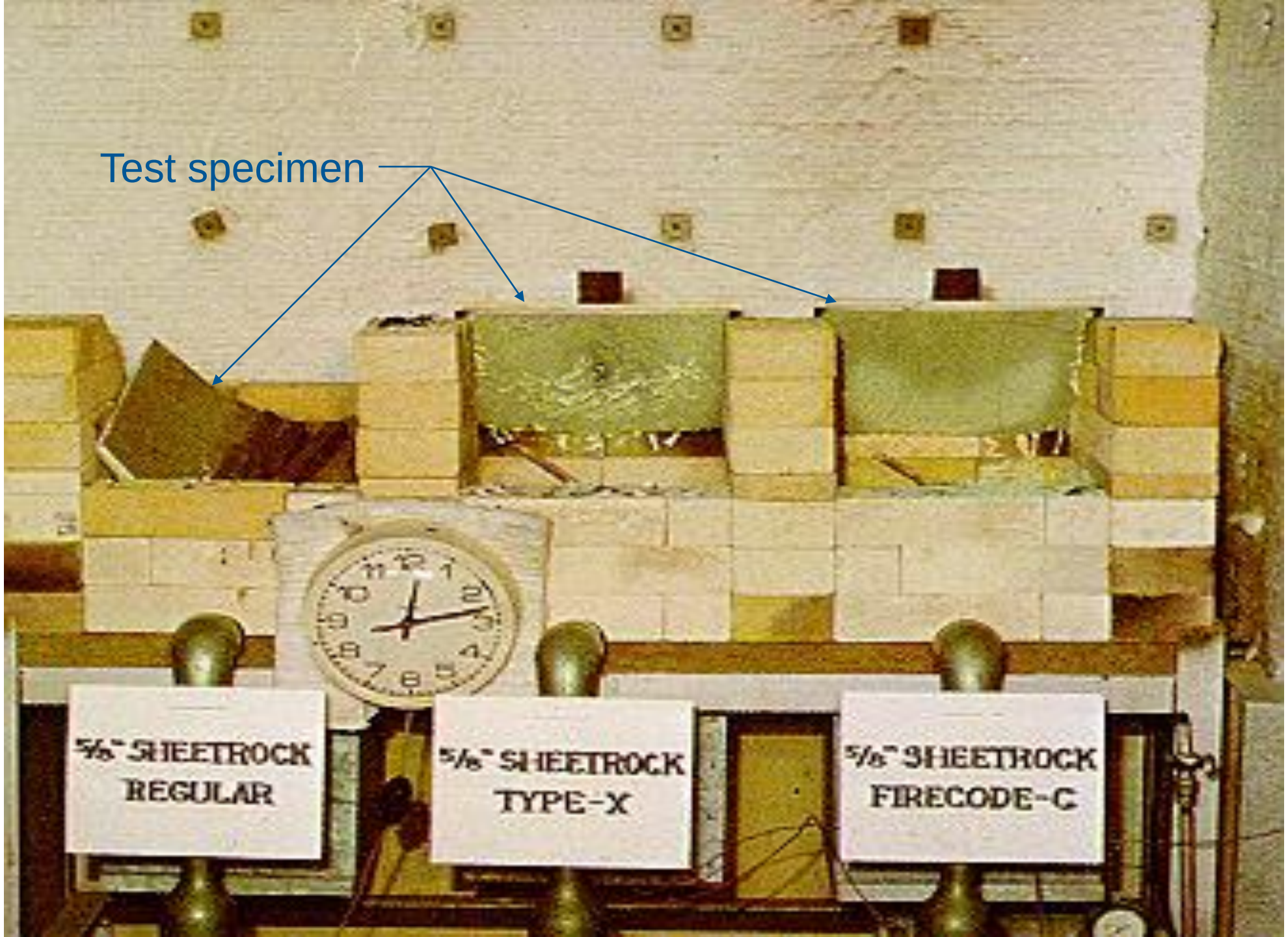
# Gypsum Core Types

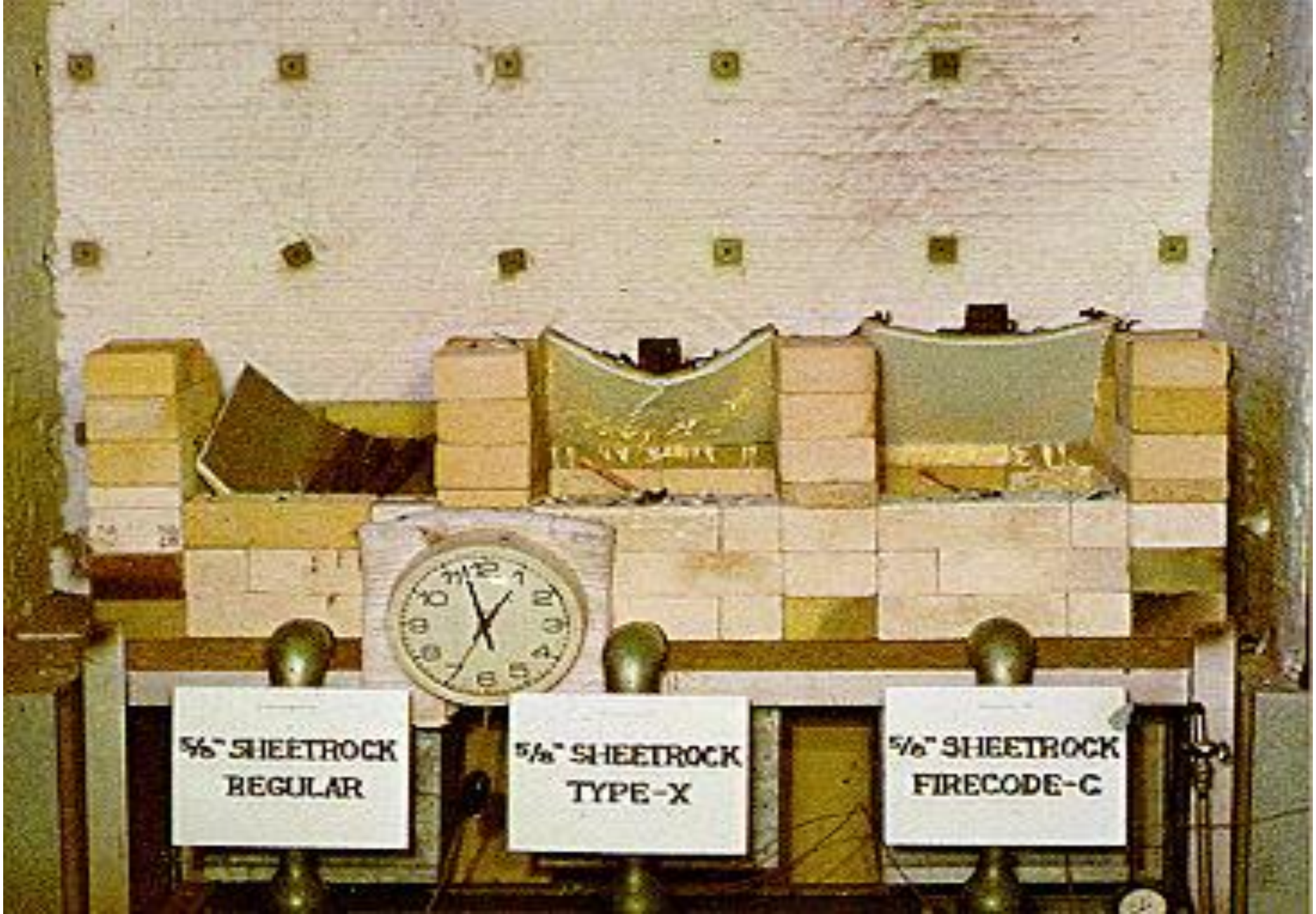
- Regular (ASTM C1396 Defined)
- Type X (ASTM C1396 Defined)
- Proprietary Enhanced (Non-defined, often called Type C)



# Panel Core Comparison

- Simple Test @ 1850$^{o}$ F
- 13” x 13” x 5/8” Panels
- Regular, Type X & Type C Panels
- 12lb - 9oz. loading


Test specimen
5/8" SHEETROCK
REGULAR
5/8" SHEETROCK
TYPE-X
5/8" SHEETROCK
FIRECODE-C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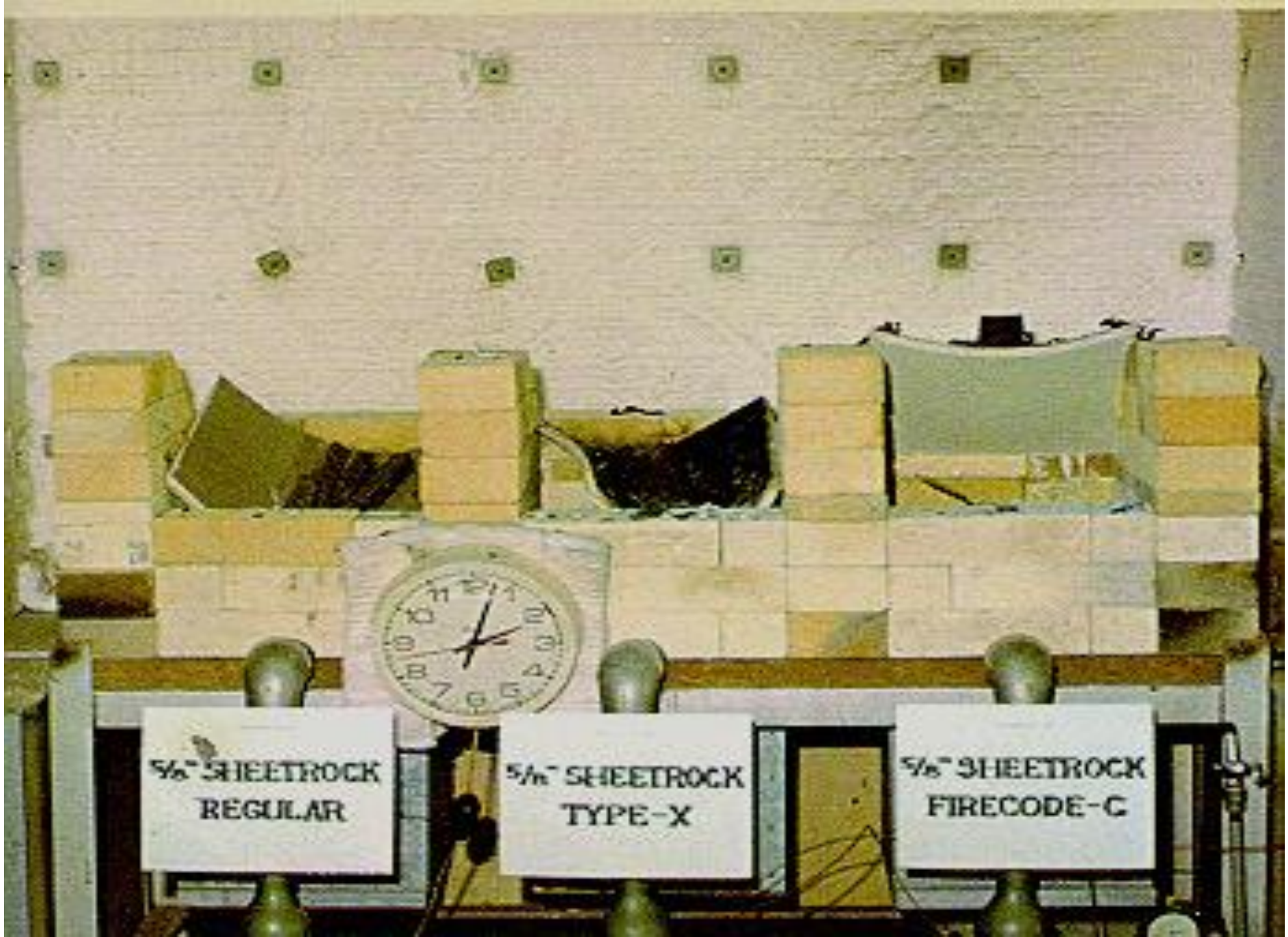

5/8" SHEETROCK
REGULAR
5/8" SHEETROCK
TYPE-X
5/8" SHEETROCK
FIRECODE-C

# Significance of Test

- Regular ≠ Type X ≠ Type C
- Specify panel type per the published design
- Panels MUST be installed per the published design

# Passive Protection - Compartmentalization

# Wall Fire Test

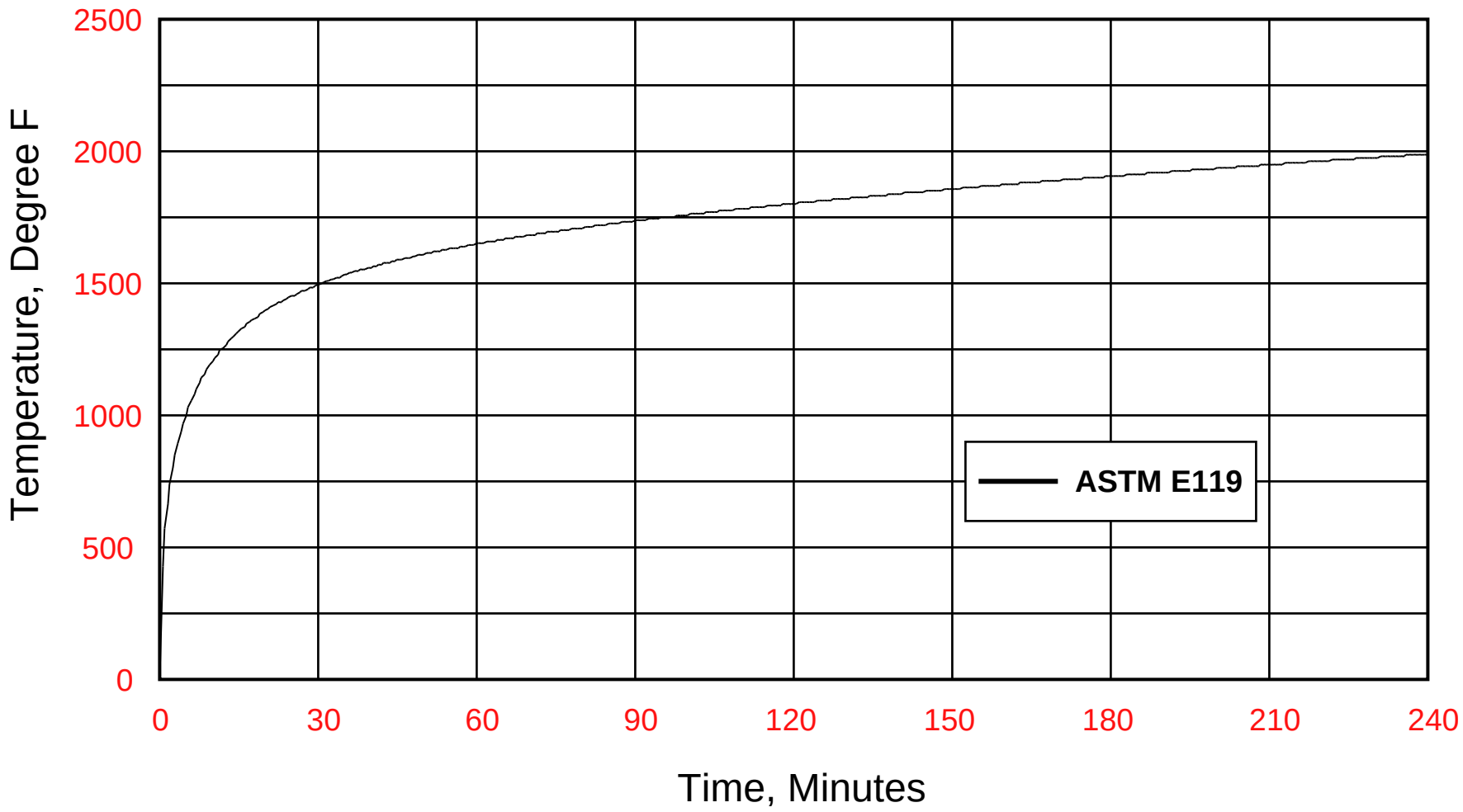
- ASTM Test Procedures (E119)

- Aspects of fire test
  1) Heat transfer
  2) Structural integrity
  3) Hose stream – structural integrity

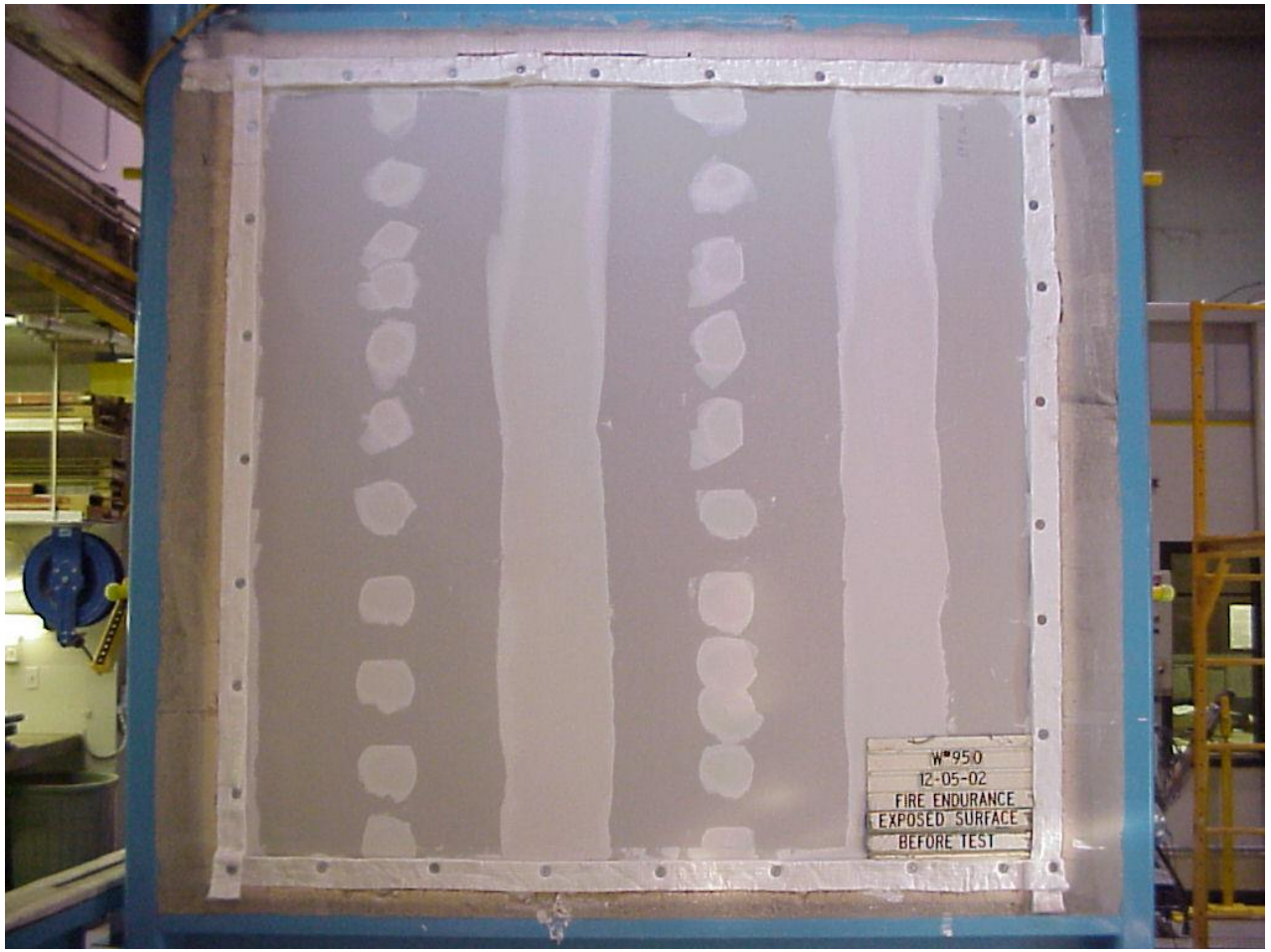
- *A single piece of gypsum has no fire rating*

# Wall Testing Furnace

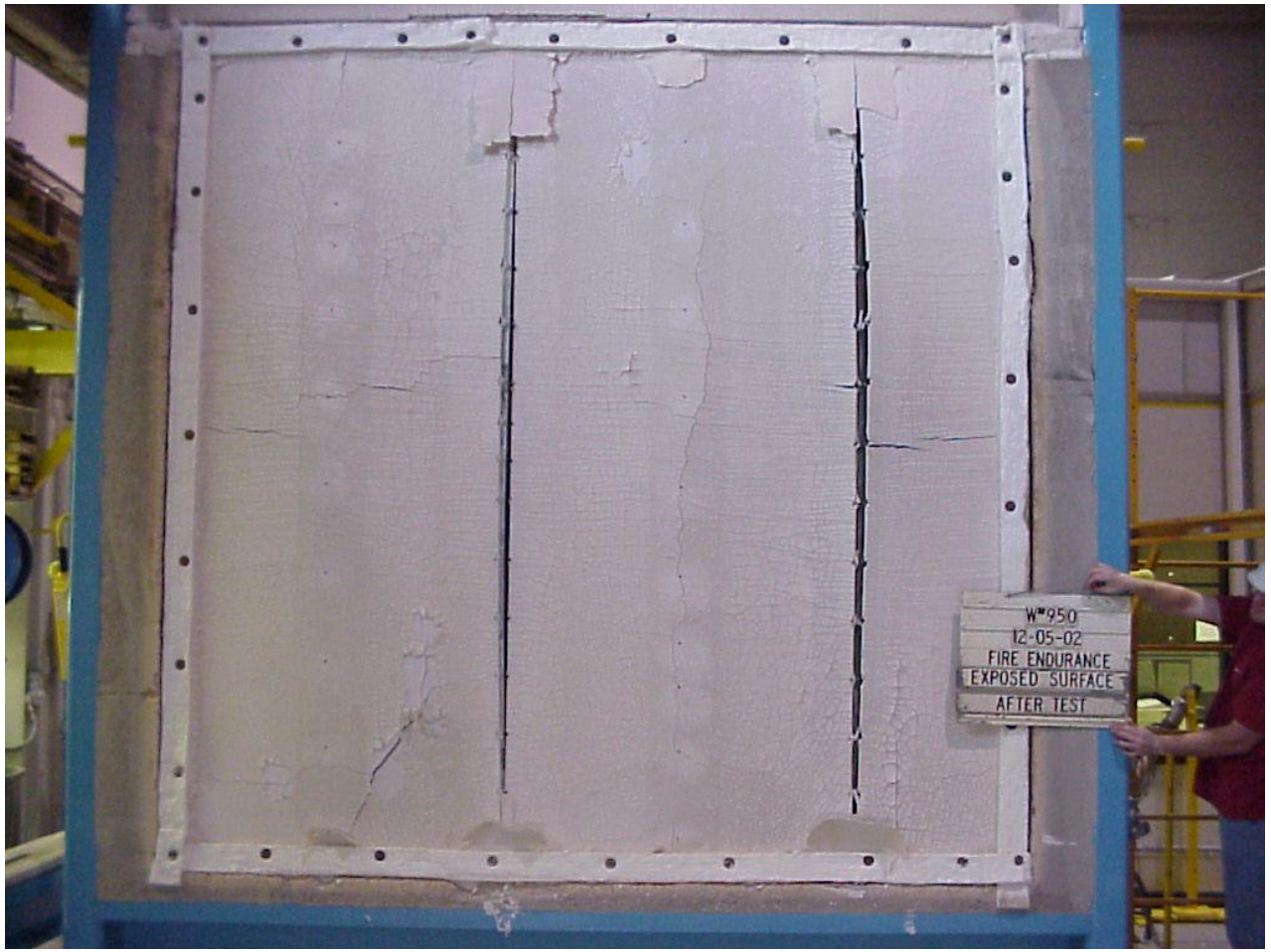
# Standard Time-Temperature Curve



# Wall Assembly Prior to Test – Fire Exposed Side



# Wall Assembly After Test – Fire Exposed Side



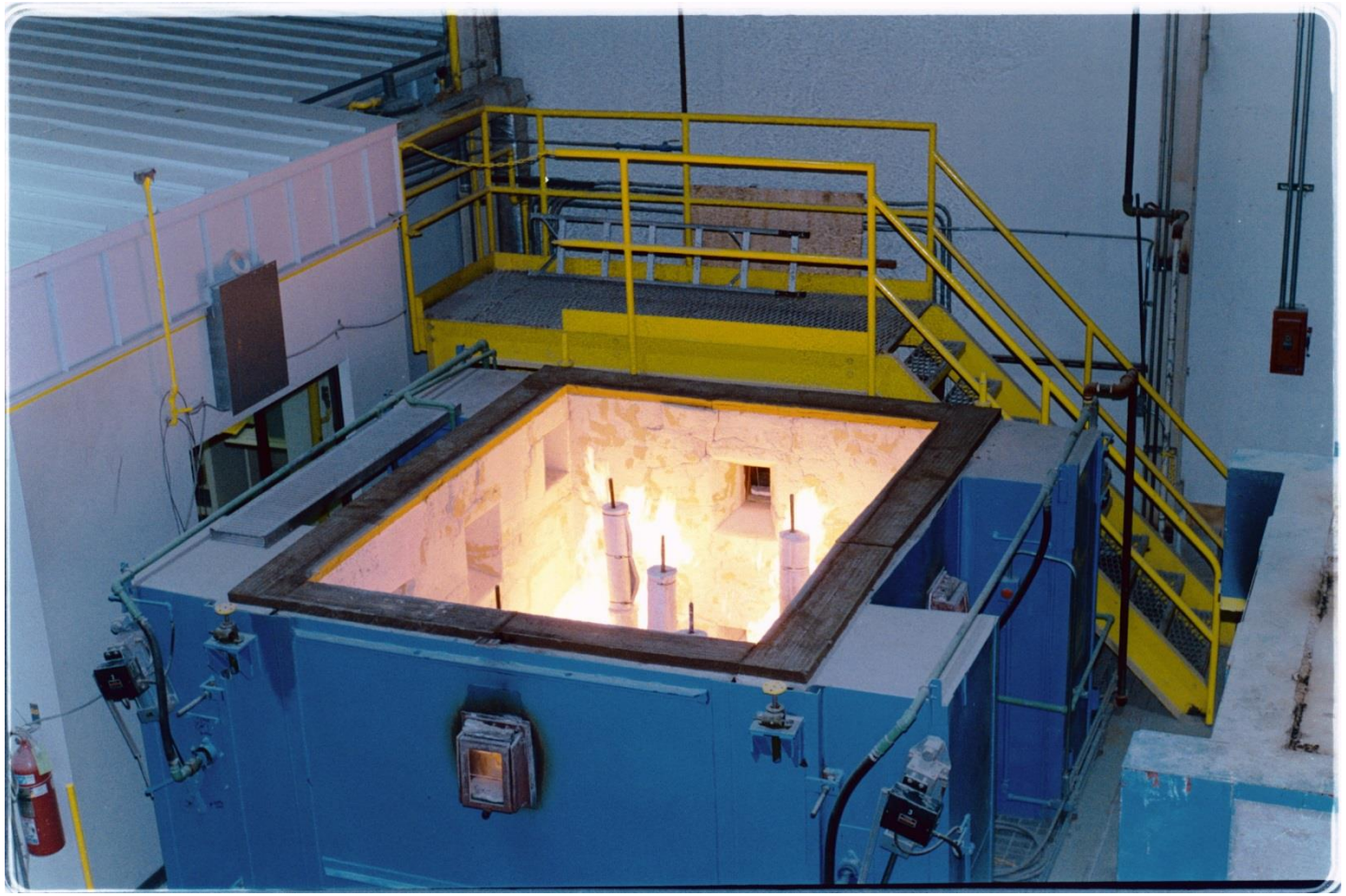
# Hose Stream Test

# Ceiling Fire Test

- ASTM Test Procedures (E119)

- Aspects of fire test
  1) heat transfer
  2) structural integrity

# Floor/Ceiling Test Furnace

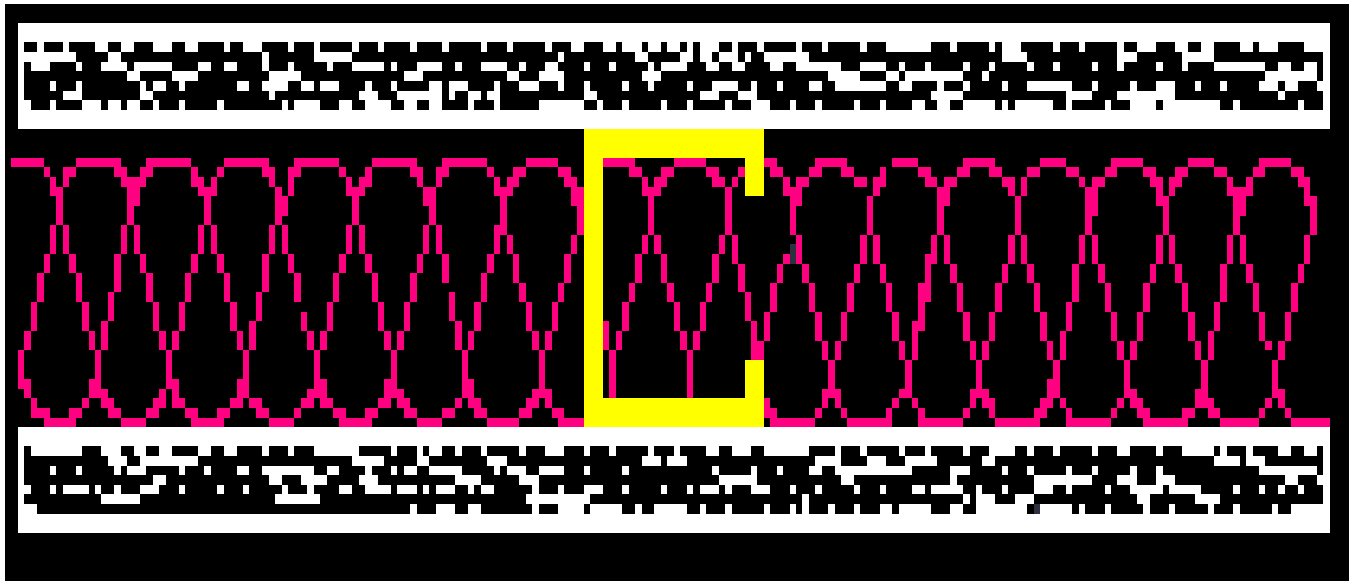


# Floor Ceiling System - Prior to Test

# Floor Ceiling System - After Test

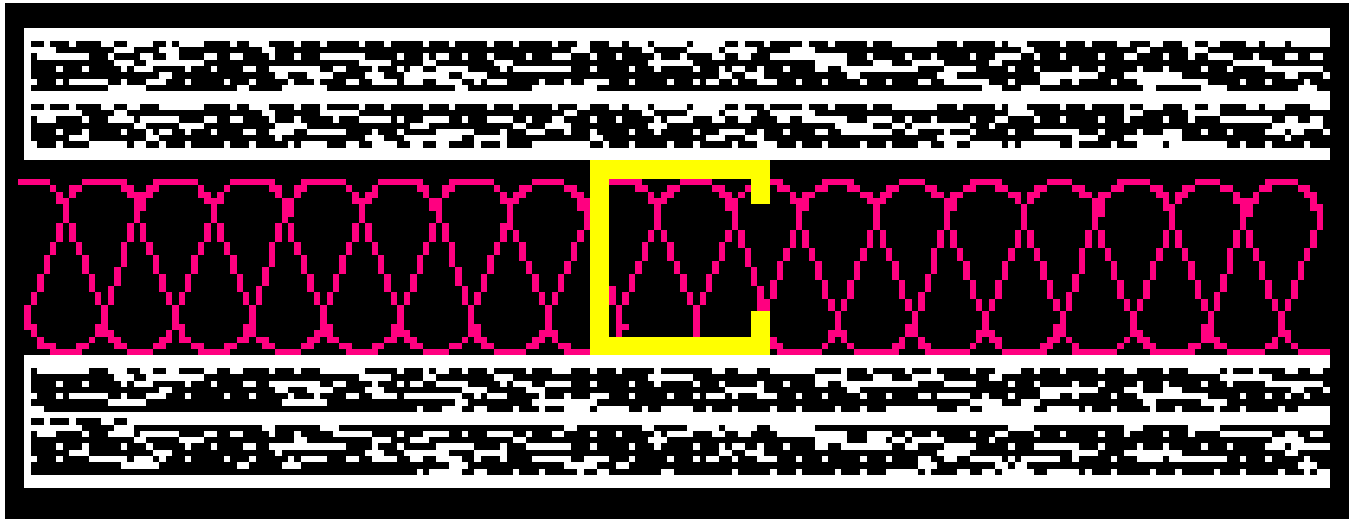
# Gypsum Assemblies

U419 - 1 Hour (U465)



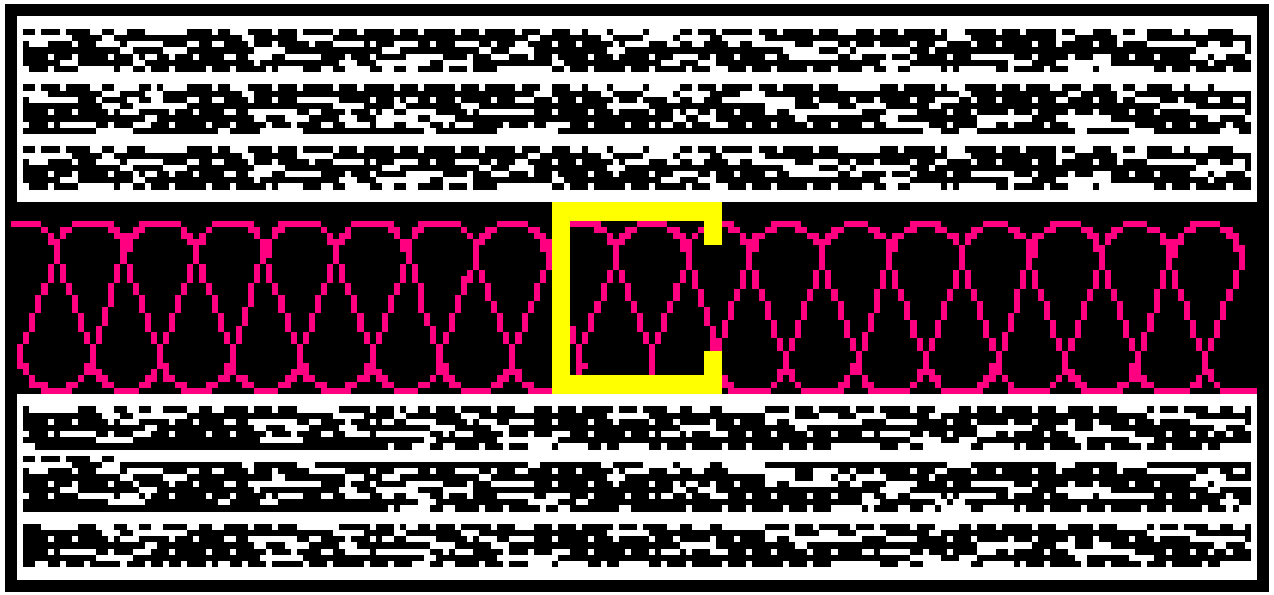
# Gypsum Assemblies

U419 - 2 Hour (U411)



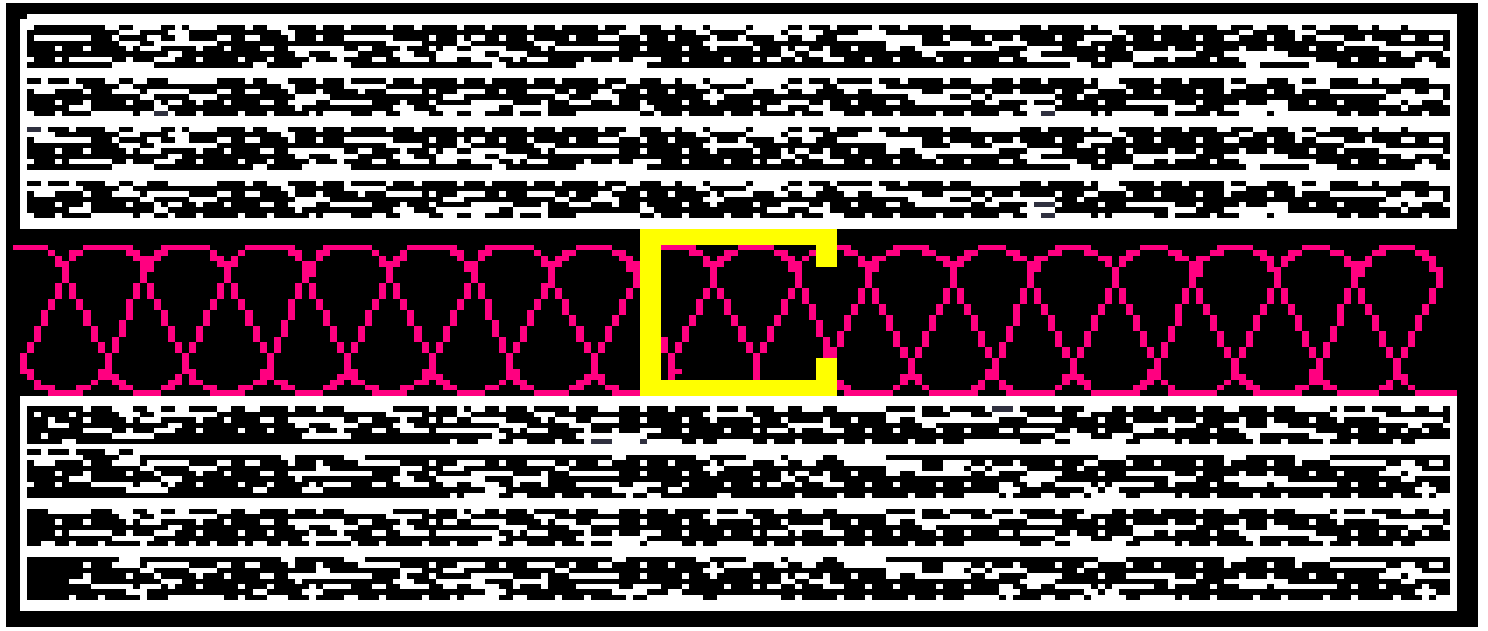
# Gypsum Assemblies

U419 - 3 Hour



# Gypsum Assemblies

U419 - 4 Hour



# UL Design No. U419

5. **Gypsum Board* —** Gypsum panels with beveled, square or tapered edges, applied vertically or horizontally. Vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Vertical joints in adjacent layers (multilayer systems) staggered one stud cavity. Horizontal joints need not be backed by steel framing. Horizontal edge joints and horizontal butt joints on opposite sides of studs need not be staggered. Horizontal edge joints and horizontal butt joints in adjacent layers (multilayer systems) staggered a min of 12 in. Horizontal edge joints and horizontal butt joints in adjacent layers (multilayer systems) with Type ULIX need not be staggered. The thickness and number of layers for the 1 hr, 2 hr, 3 hr and 4 hr ratings are as follows:

## Gypsum Board Protection on Each Side of Wall

| Rating, Hr | Min Stud Depth, in. Items 2, 2C, 2D, 2F, 2G, 2O | No. of Layers & Thkns of Panel | Min Thkns of Insulation (Item 4) |
|---|---|---|---|
| 1 | 3-1/2 | 1 layer, 5/8 in. thick | Optional |
| 1 | 2-1/2 | 1 layer, 1/2 in. thick | 1-1/2 in. |
| 1 | 1-5/8 | 1 layer, 3/4 in. thick | Optional |
| 2 | 1-5/8 | 2 layers, 1/2 in. thick | Optional |
| 2 | 1-5/8 | 2 layers, 5/8 in. thick | Optional |
| 2 | 3-1/2 | 1 layer, 3/4 in. thick | 3 in. |
| 3 | 1-5/8 | 3 layers, 1/2 in. thick | Optional |
| 3 | 1-5/8 | 2 layers, 3/4 in. thick | Optional |
| 3 | 1-5/8 | 3 layers, 5/8 in. thick | Optional |
| 4 | 1-5/8 | 4 layers, 5/8 in. thick | Optional |
| 4 | 1-5/8 | 4 layers, 1/2 in. thick | Optional |
| 4 | 2-1/2 | 2 layers, 3/4 in. thick | 2 in. |

# UL Design No. U419

4. **Batts and Blankets* —** (Required as indicated under Item 5) — Mineral wool batts, friction fitted between studs and runners. Min nom thickness as indicated under Item 5.

See **Batts and Blankets** (BKNV or BZJZ) Categories for names of Classified companies.

4A. **Batts and Blankets* —** (Optional) — Placed in stud cavities, any glass fiber or mineral wool insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance.

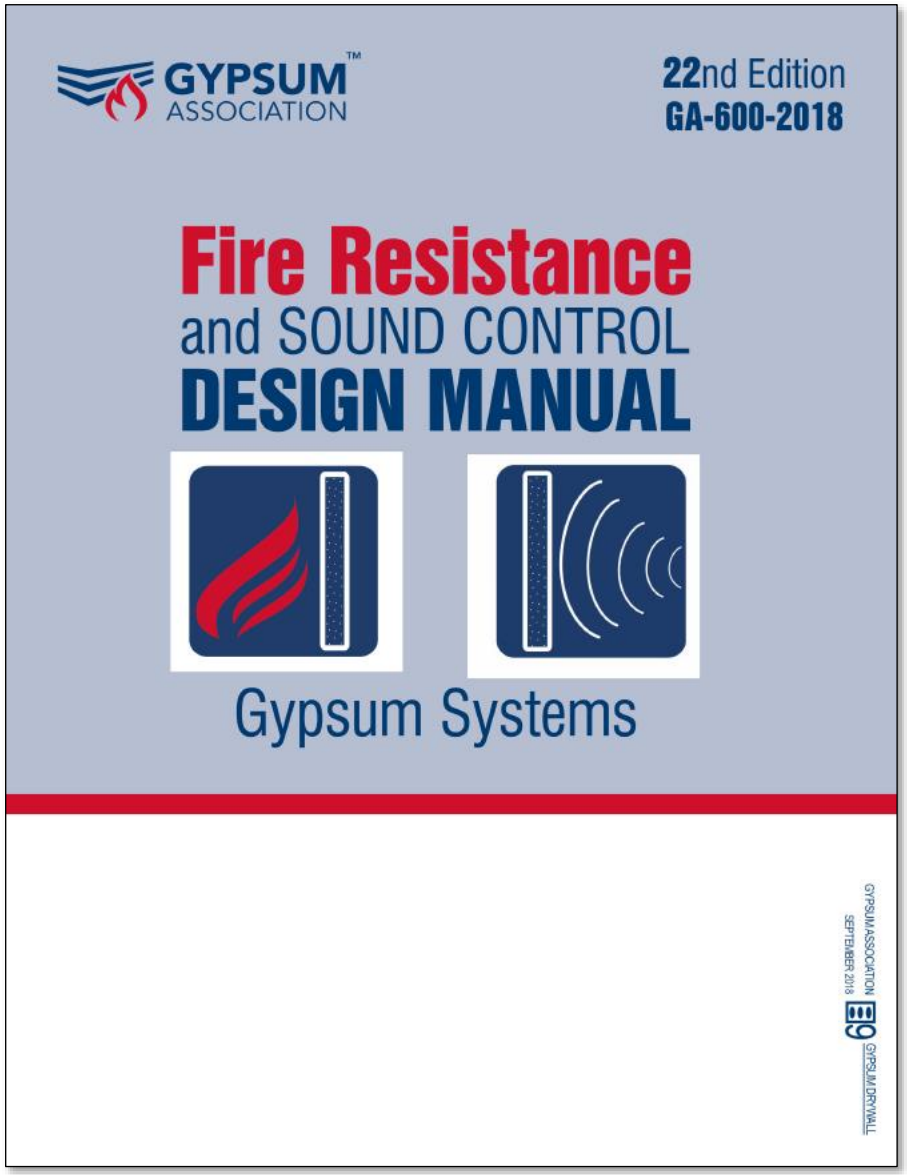
See **Batts and Blankets** (BKNV or BZJZ) Categories for names of Classified companies.

4B. **Fiber, Sprayed* —** (Optional, for use with Type ULIX) Where insulation is required - Spray applied granulated mineral fiber material. The fiber is applied with adhesive at a minimum density of 4.0 pcf to completely fill the wall cavity in accordance with the application instructions supplied with the product. See **Fiber, Sprayed** (CCAZ).

**AMERICAN ROCKWOOL MANUFACTURING, LLC** — Type Rockwool Premium Plus

6. **Fasteners —** (Not Shown) — For use with Items 2 and 2F - Type S or S-12 steel screws used to attach panels to studs (Item 2) or furring channels (Item 7). **Single layer systems:** 1 in. long for 1/2 and 5/8 in. thick panels or 1-1/4 in. long for 3/4 in. thick panels, spaced 8 in. OC when panels are applied horizontally, or 8 in. OC along vertical and bottom edges and 12 in. OC in the field when panels are applied vertically. **Single layer system with Type ULIX:** 1 in. long, spaced 12 in. OC in the field and perimeter, when panels are applied horizontally or vertically.**Two layer systems:** First layer- 1 in. long for 1/2 and 5/8 in. thick panels or 1-1/4 in. long for 3/4 in. thick panels, spaced 16 in. OC. Second layer- 1-5/8 in. long for 1/2 in., 5/8 in. thick panels or 2-1/4 in. long for 3/4 in. thick panels, spaced 16 in. OC with screws offset 8 in. from first layer.**Three-layer systems:** First layer- 1 in. long for 1/2 in., 5/8 in. thick panels, spaced 24 in. OC. Second layer- 1-5/8 in. long for 1/2 in., 5/8 in. thick panels, spaced 24 in. OC. Third layer- 2-1/4 in. long for 1/2 in., 5/8 in. thick panels or 2-5/8 in. long for 5/8 in. thick panels, spaced 12 in. OC. Screws offset min 6 in. from layer below. **Four-layer systems:** First layer- 1 in. long for 1/2 in., 5/8 in. thick panels, spaced 24 in. OC. Second layer- 1-5/8 in. long for 1/2 in., 5/8 in. thick panels, spaced 24 in. OC. Third layer- 2-1/4 in. long for 1/2 in. thick panels or 2-5/8 in. long for 5/8 in. thick panels, spaced 24 in. OC. Fourth layer- 2-5/8 in. long for 1/2 in. thick panels or 3 in. long for 5/8 in. thick panels, spaced 12 in. OC. Screws offset min 6 in. from layer below.

# Gypsum Association GA-600




| GA FILE NO. WP 1058 | PROPRIETARY* | 1 HOUR FIRE | 50 to 54 STC SOUND |
|---|---|---|---|

**GYPSUM PANELS, STEEL STUDS, INSULATION**

**Fire Design:**

**One** layer 5/8" proprietary type X gypsum panels applied parallel or at right angles to each side of 3-5/8", 18 mil steel studs 24" o.c. with 1" Type S screws 8" o.c. at the edges and 12" o.c. at intermediate studs when applied parallel to framing or 8" o.c. at the ends and intermediate studs when applied at right angles to framing. 3-1/2" glass fiber insulation in stud cavity.

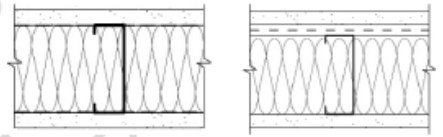
Vertical joints centered over studs and staggered one stud cavity on OPPOSITE SIDES. Horizontal joints need not be staggered or backed. **(NLB)**

**Sound Design:**

Sound tested with resilient channels 24" o.c. on ONE SIDE with the gypsum panels applied at right angles to channels.

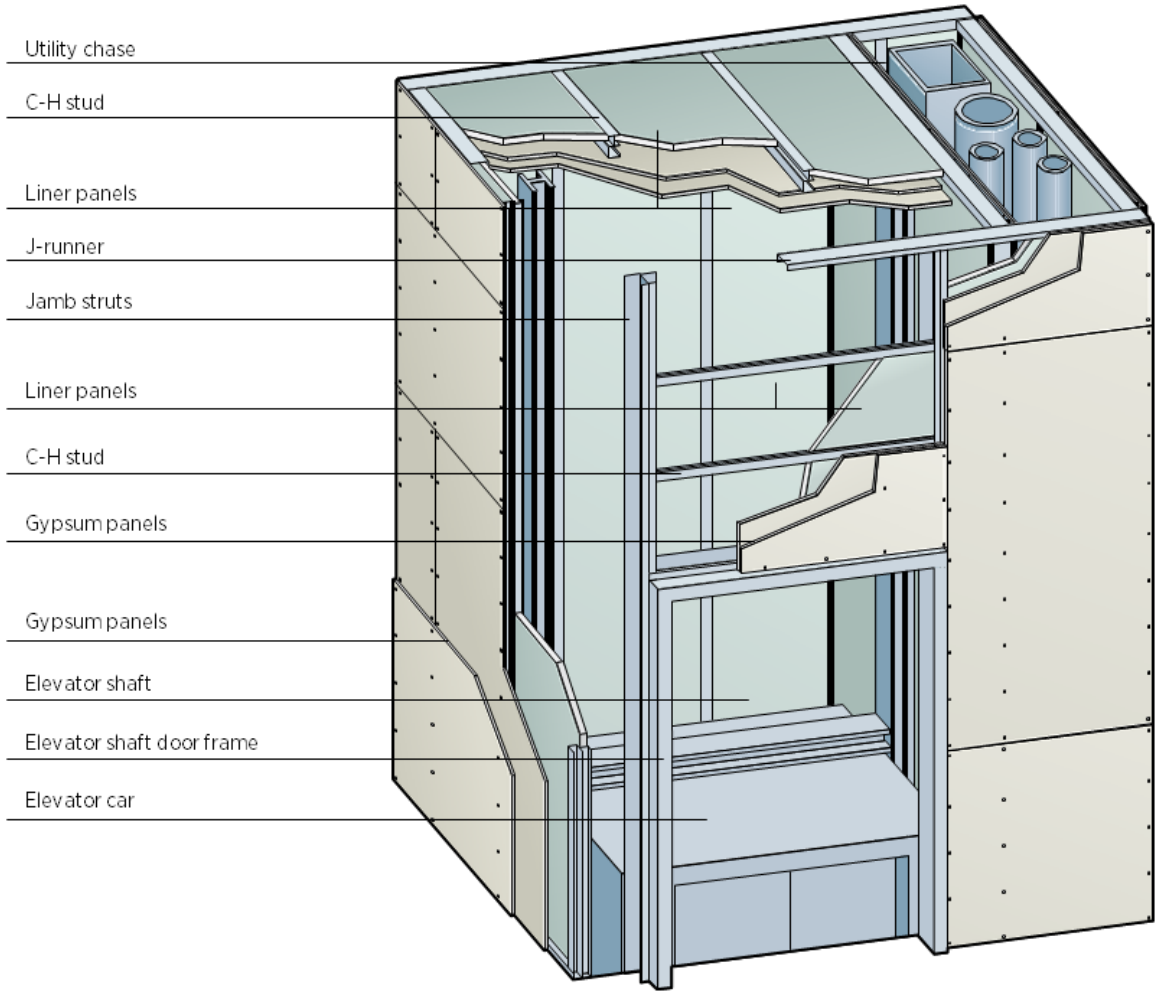
**PROPRIETARY GYPSUM PANEL**

United States Gypsum Company..... 5/8" Sheetrock® Brand EcoSmart Panels Firecode® X



| | |
|---|---|
| Thickness: | 4-7/8" (Fire)<br>5-3/8" (Sound) |
| Approx. Weight: | 3.8 psf (Fire)<br>3.9 psf (Sound) |
| Fire Test: | UL R1319, 4786834899, 4-16-15;<br>4786554784, 1-30-15;<br>4787969579, 6-22-17;<br>UL Design U419 |
| Sound Test: | USG-151202, 12-1-15 |

# Shaft Walls




Cross-Section of Elevator Shaft Assembly

## Classified by UL

- Can be used in any assembly where SLX panels are listed

## UL Assemblies

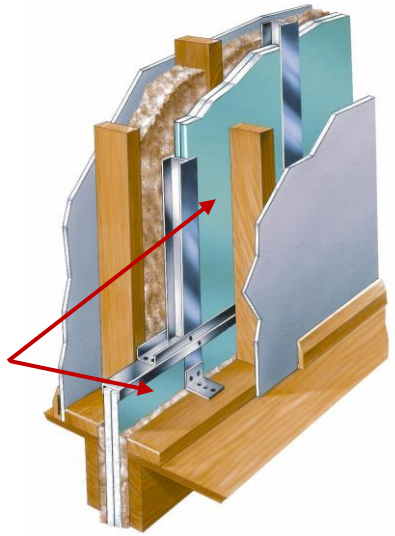
- U415 1-4 hour rated shaftwall assemblies
- Unsupported horizontal butt joints
- U336 2 hour rated area separation wall

# Area Separation Walls

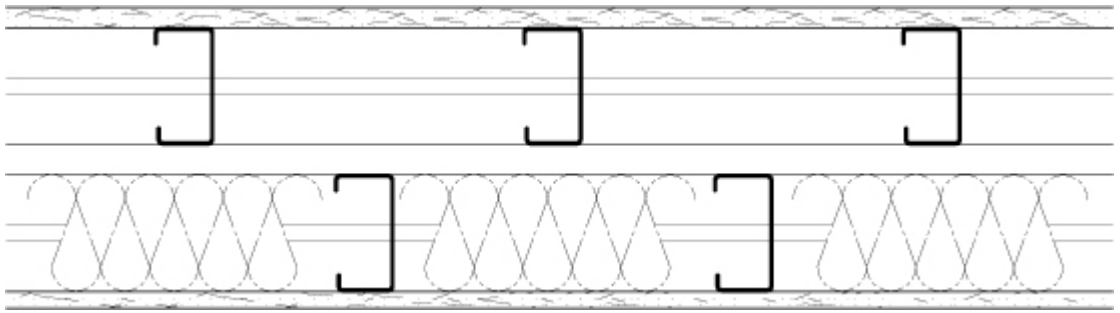
## Multi-Family Fire Resistance

- Designed for townhouses that share a common wall
- Up to 4 stories
- Allows for collapse of fire-exposed construction while maintaining integrity of unexposed side

**Area Separation Wall Cross-Section**



# UL Design No. U493

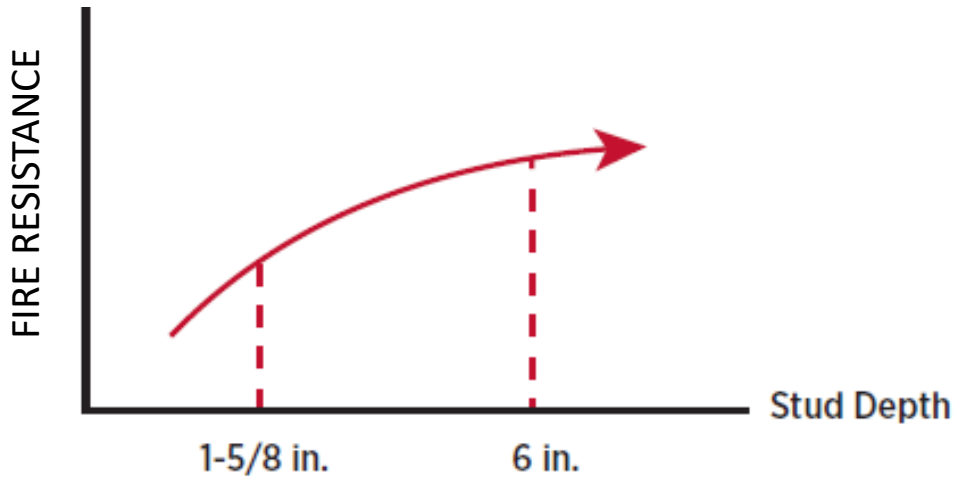


- Unique Chase Wall Design
- No connection of opposite studs
- Acoustically better

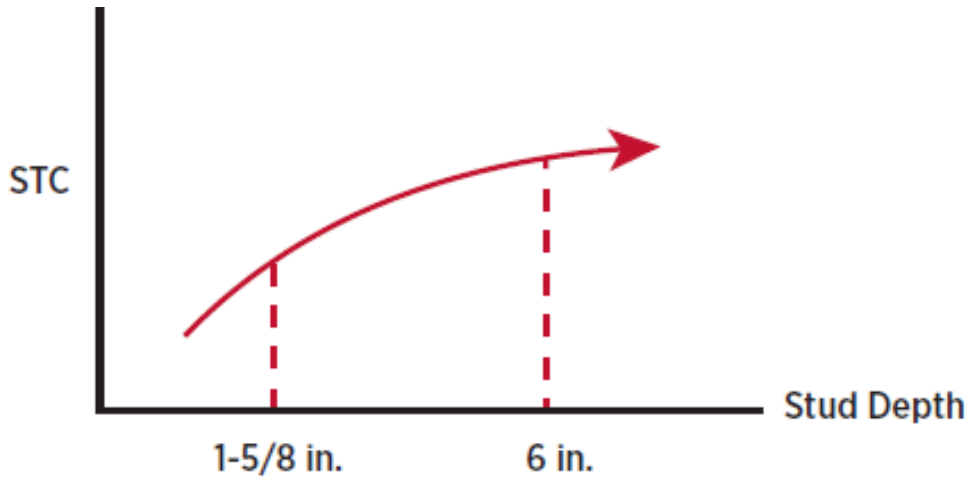
# Influencing Factors

## FRAMING MATERIAL DEPTH

### FIRE



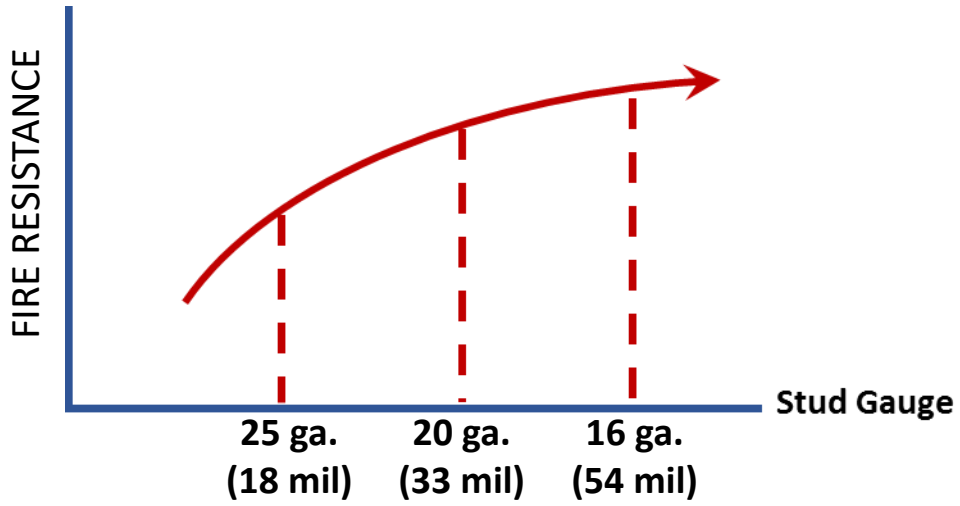

### SOUND



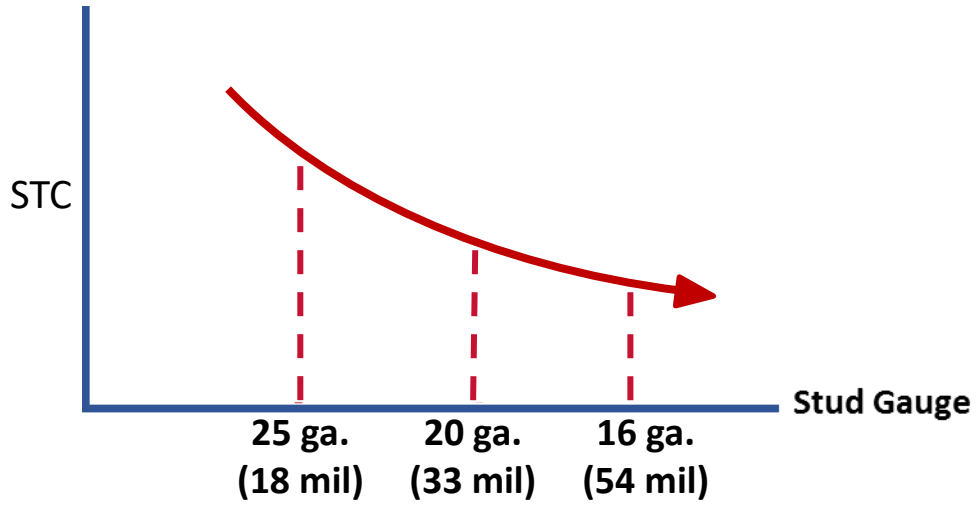
# Influencing Factors

## FRAMING MATERIAL THICKNESS

### FIRE



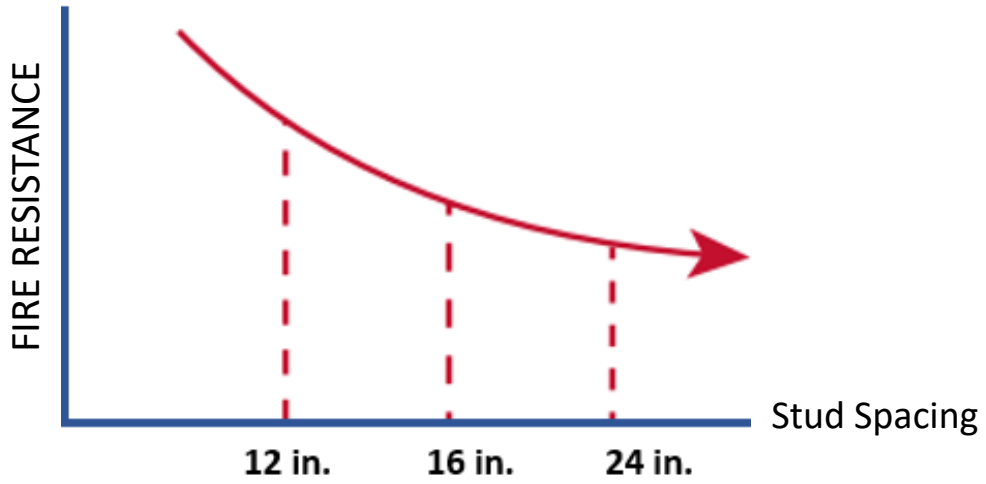

### SOUND



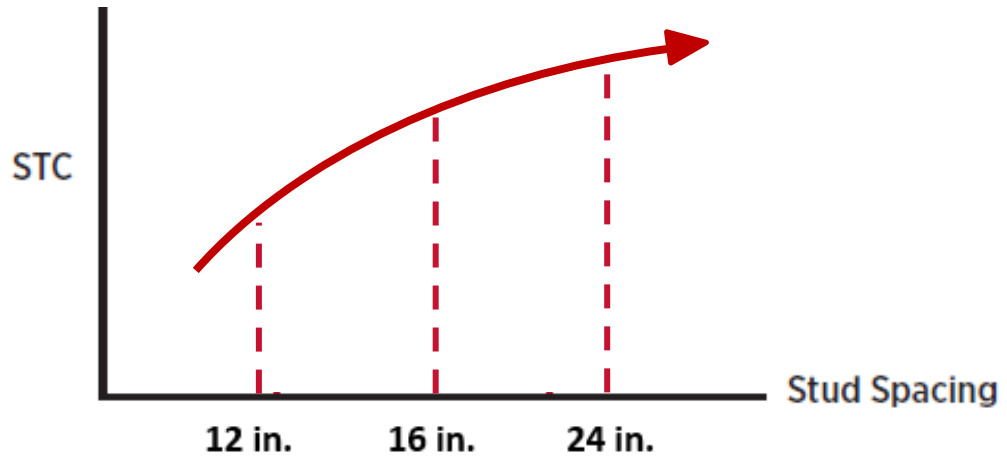
# Influencing Factors

## FRAMING SPACING

### FIRE



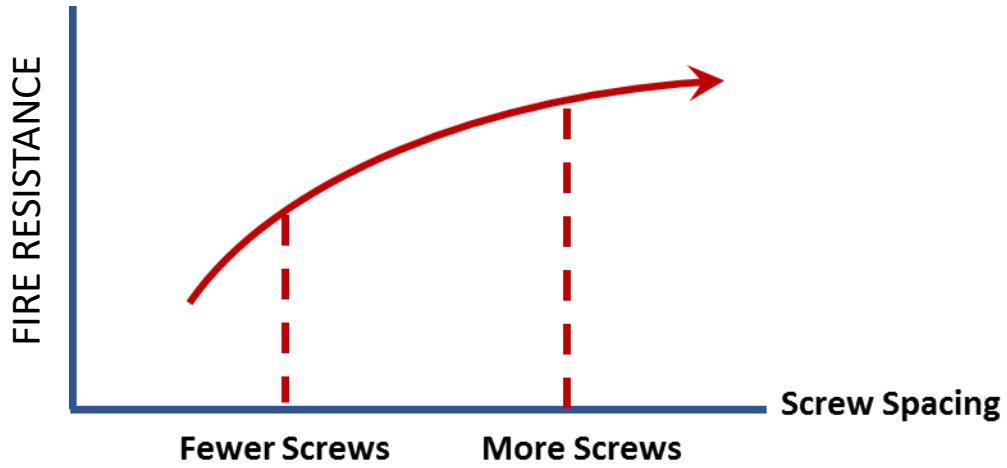

### SOUND



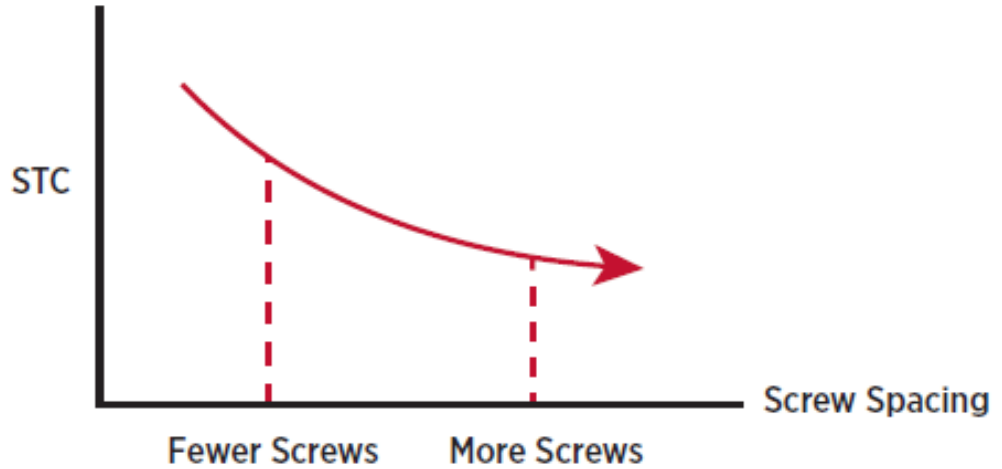
# Influencing Factors

## SCREW SPACING

### FIRE



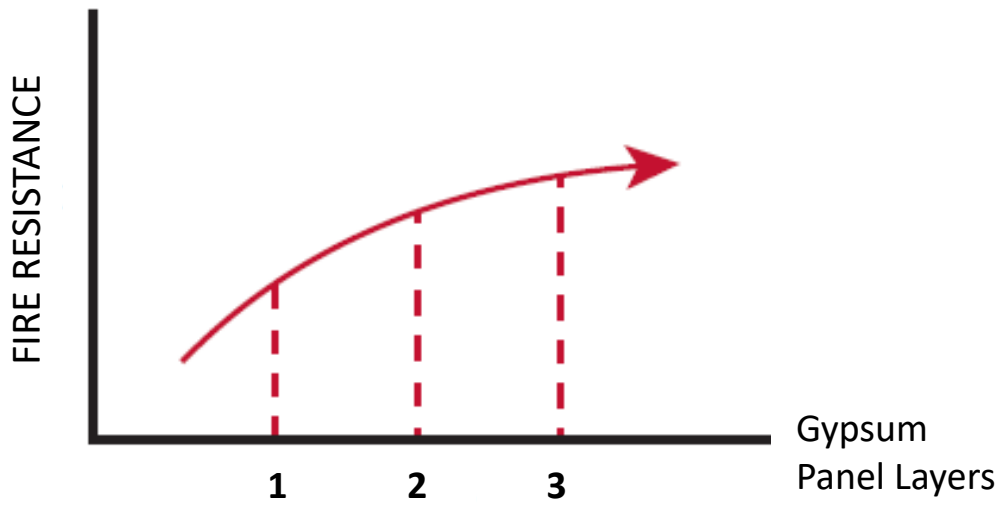

### SOUND



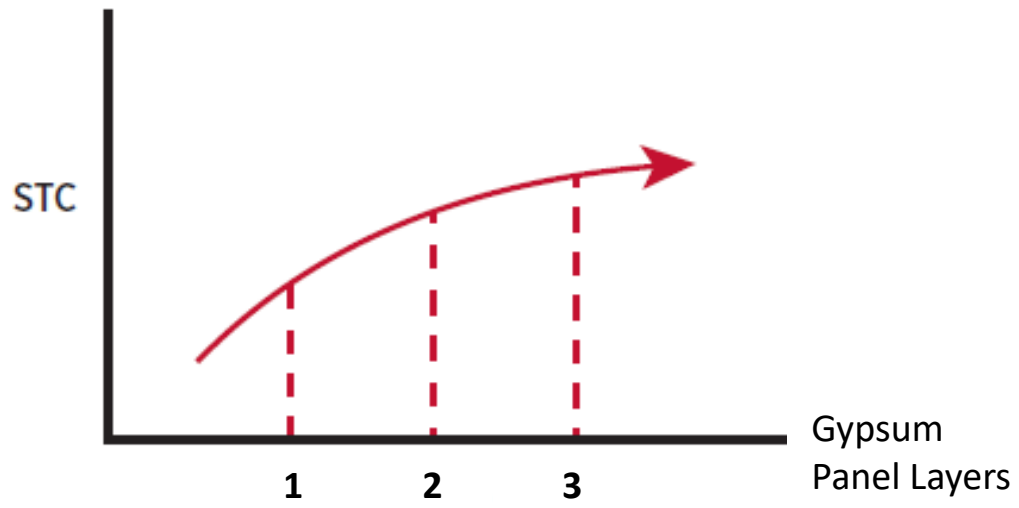
# Influencing Factors

## GYPSUM PANEL LAYERS

### FIRE




### SOUND



# Dos & Don’ts

**DO**

- Add layers of gypsum
- Add fibrous insulation to walls
- Add resilient channels to walls
- Add materials on top of the flooring system
- Add sheathing (e.g. plywood) within walls

**DON’T**

- Don’t add insulation to floor- and roof-ceilings without consulting published design
- Don’t add spray foam insulation to walls or ceilings without consulting published design
- Don’t construct steel stud chase walls with a common runner

# Repairs

- Simply covering a hole or damaged area **is not a repair**
- Repair procedure must take into consideration:
  - Size of the affected area
  - Hourly rating of assembly
  - Framing: type, size and spacing
  - Gypsum: type, number of layers and orientation
  - Accessibility: Can the repair be made from both sides?
  - Other: fastening method, location of repair, etc.
- NFPA 1:
  - 12.3.3.2 Where required, **fire-rated gypsum wallboard** walls or ceilings that are damaged to the extent that through openings exist, the damaged gypsum wallboard shall be **replaced or returned to the required level of fire resistance using a listed repair system or using materials and methods equivalent to the original construction.**
- ***Must contact manufacturer to verify listed repair method***

# Repairs

- GA-225 – Repair of Fire-Rated Gypsum Panel Product Systems

Figure 1: Damaged Gypsum Panel

Figure 2: Square Off Damaged Area

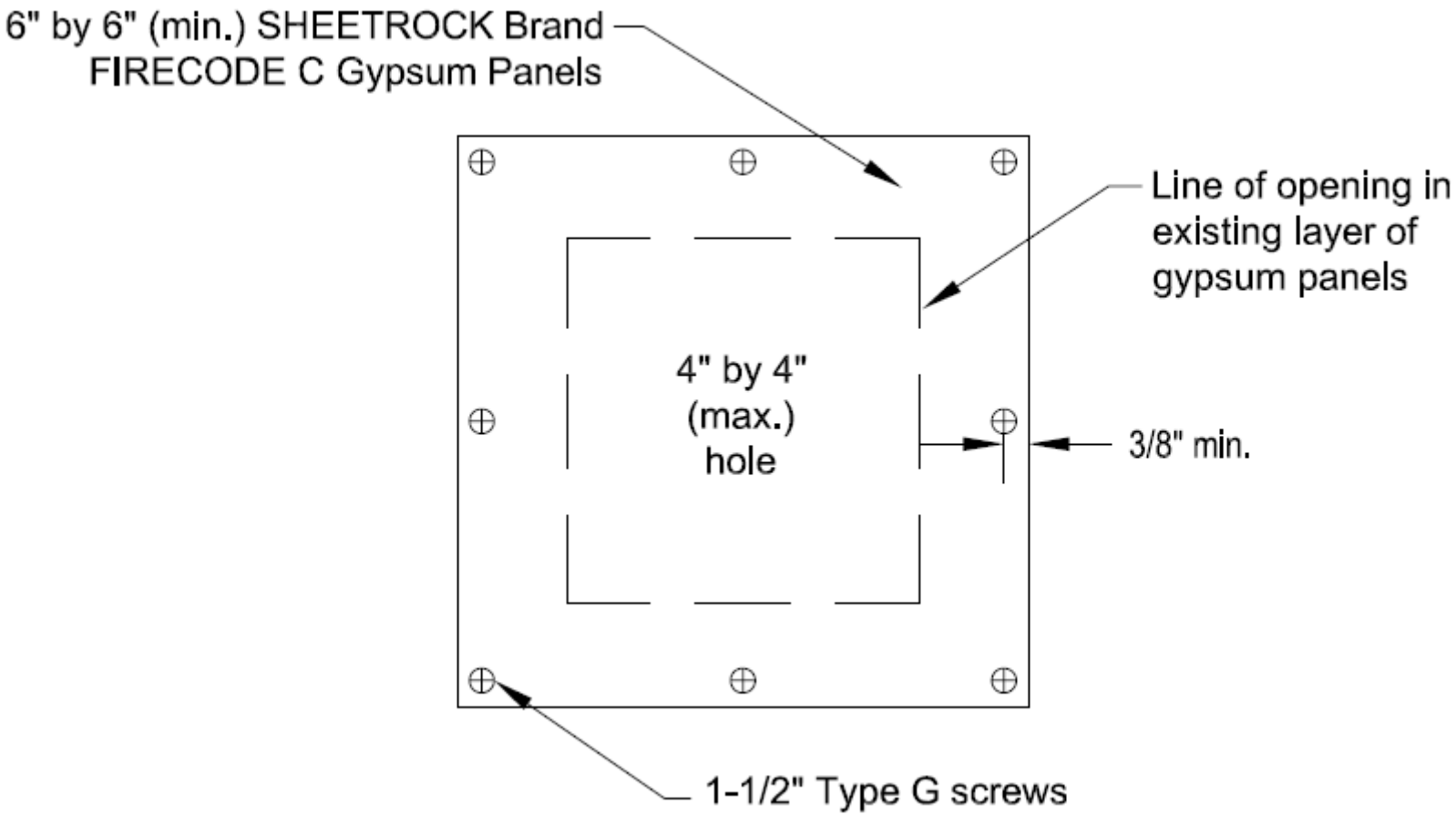
Figure 3: Frame Opening

Figure 4: Apply Gypsum Panel Patch

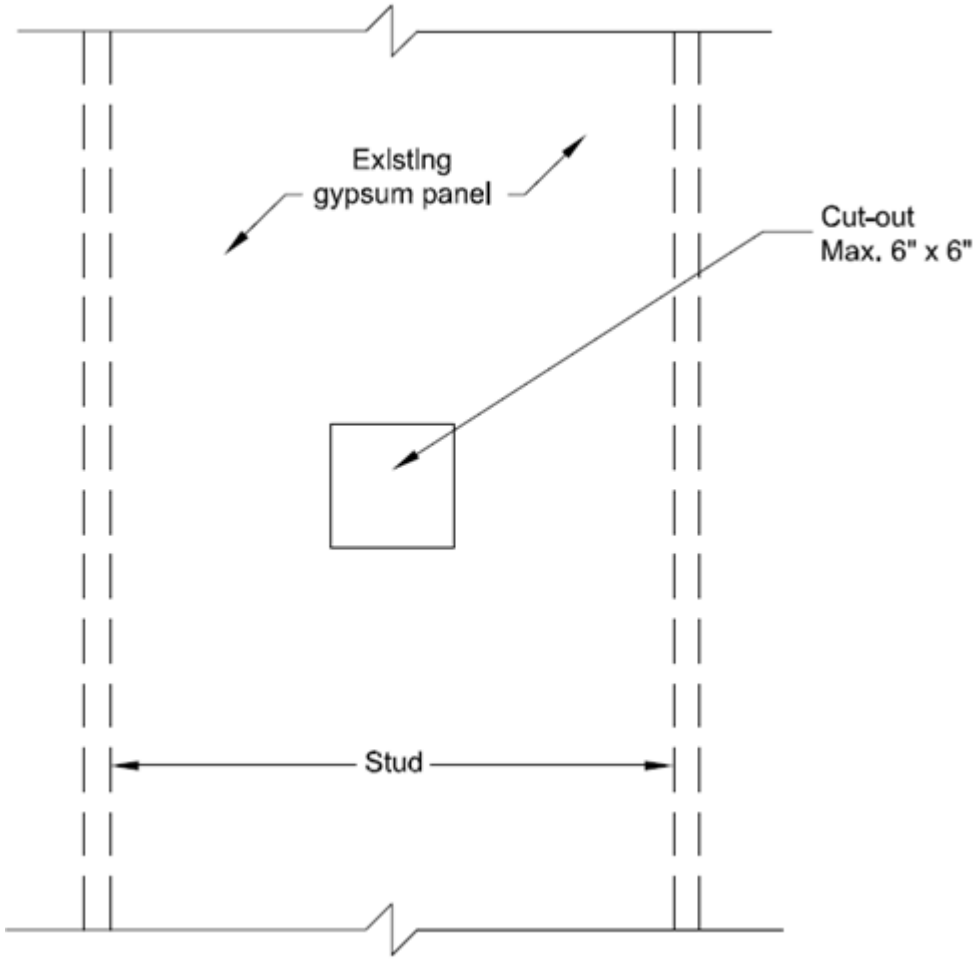
Figure 5: Tape and Finish Patched Area

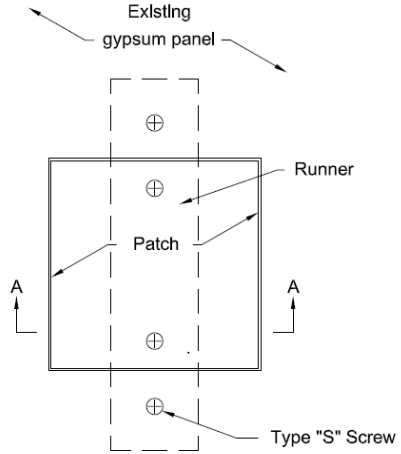
Figure 6: Redecorate Repaired Area

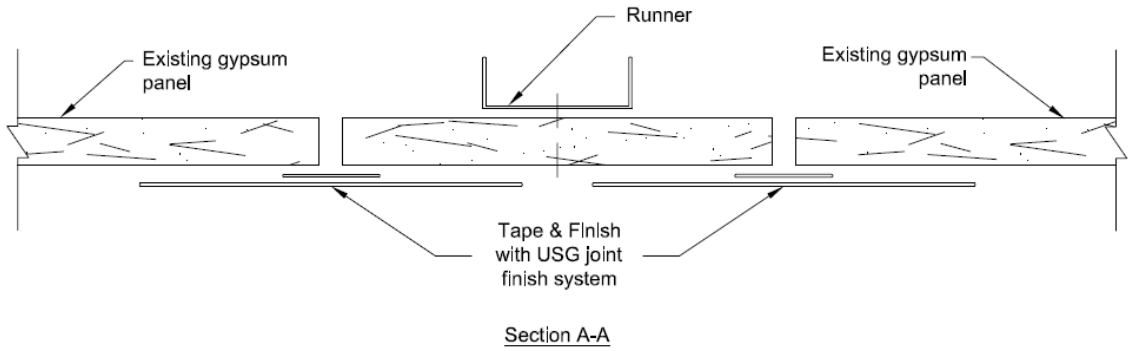
# Repairs – Small Surface Patch



# Repairs – Small Flush Patch

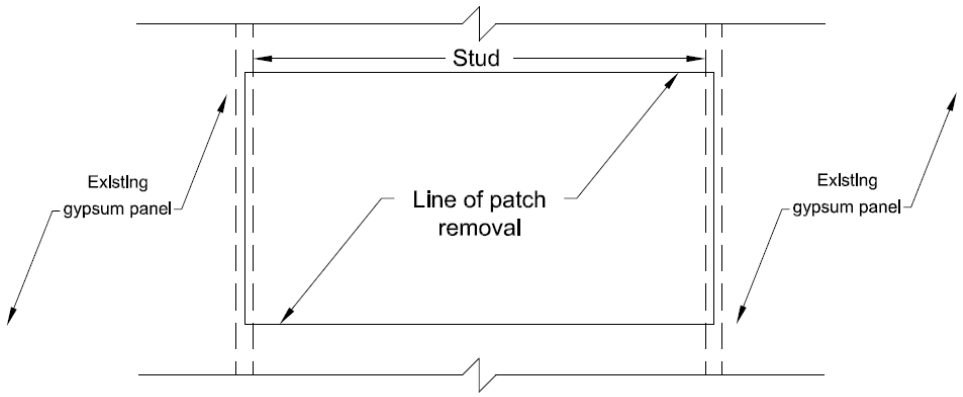


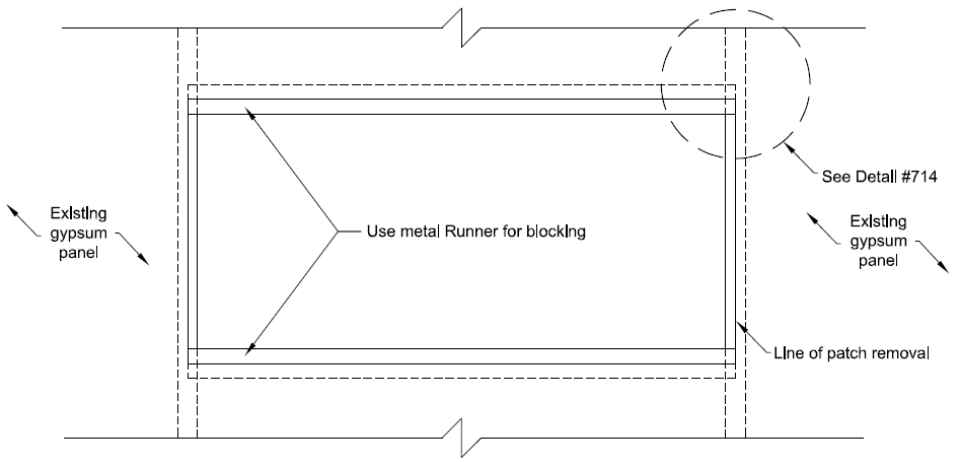



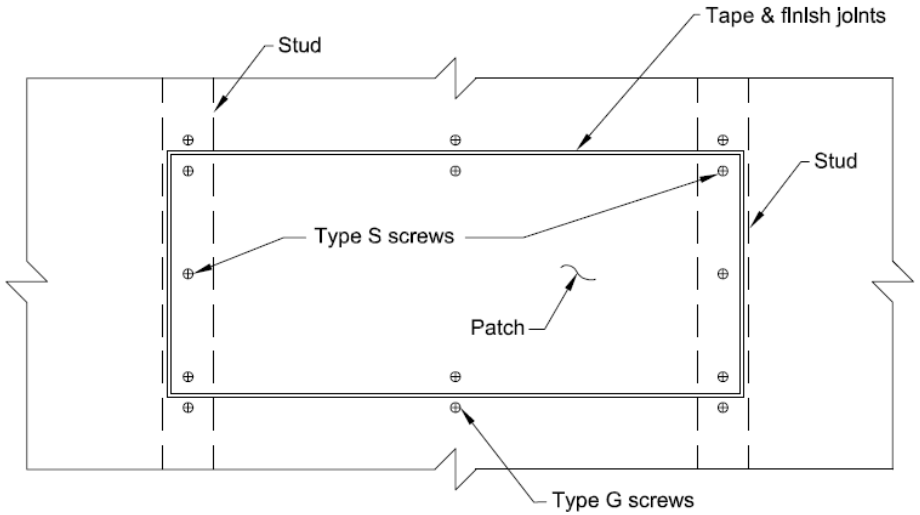



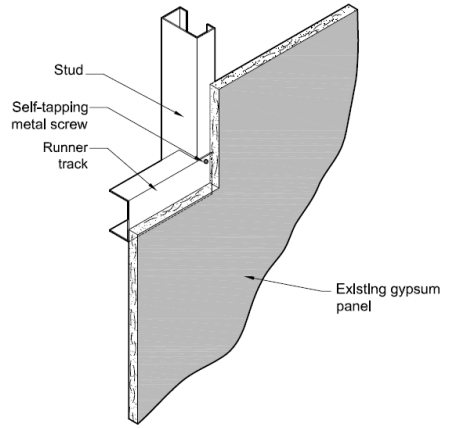

Section A-A

# Repairs – Large Flush Patch



# Questions??

# Thanks for Attending!!!

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