Development Services

From Concept to Construction

Phone: 503-823-7300 Email: bds@portlandoregon.gov 1900 SW 4th Ave, Portland, OR 97201
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APPEAL SUMMARY

Status: Hold for Additional Information

Appeal ID: 20521	**Project Address:** 810 N Fremont St
Hearing Date: 6/19/19	**Appellant Name:** Aaron Wigod
Case No.: B-002	**Appellant Phone:** 5035828442
Appeal Type: Building	**Plans Examiner/Inspector:** Unknown
Project Type: commercial	**Stories:** 4 **Occupancy:** A-2, B, R-2, S-2 **Construction Type:** I-A, V-A
Building/Business Name: Mississippi Ave Mixed Use	**Fire Sprinklers:** Yes - Throughout
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:** 15-132860-CO
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4]	**Proposed use:** Mixed-Use

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	703.2 Fire-resistance ratings, 703.3 Alternative methods for determining fire resistance.
Requires	Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.
Proposed Design	A 3-hour rated assembly is required at the bottom of shafts that penetrate the horizontal assembly between the construction types. The design team proposes to construct the 3-hour assembly using multiple layers of gypsum wallboard. See the attached engineering judgment.
Reason for alternative	The membrane assembly can be reviewed as a non-loaded ceiling assembly. The ceiling assembly is equivalent or superior to ICC Legacy Report NER-258, when the comparison includes the additional layers of gypsum board on the lower face and an air gap with heavier gauge of the steel studs included. In addition, a secondary assembly has been added which exceed a 60-minute rating. As documented in the EJ, the complete assembly meets the minimum requirements of the OSSC for a non-load bearing 3-hr ceiling assembly.

The proposed design uses analysis from an Oregon registered Fire Protection Engineer to provide equivalent life safety and fire protection to code requirements. Therefore, we request approval of this appeal.

APPEAL DECISION

Alternate 3 hour horizontal assembly: Hold for additional information.
Appellant may contact John Butler (503 823-7339) with questions.

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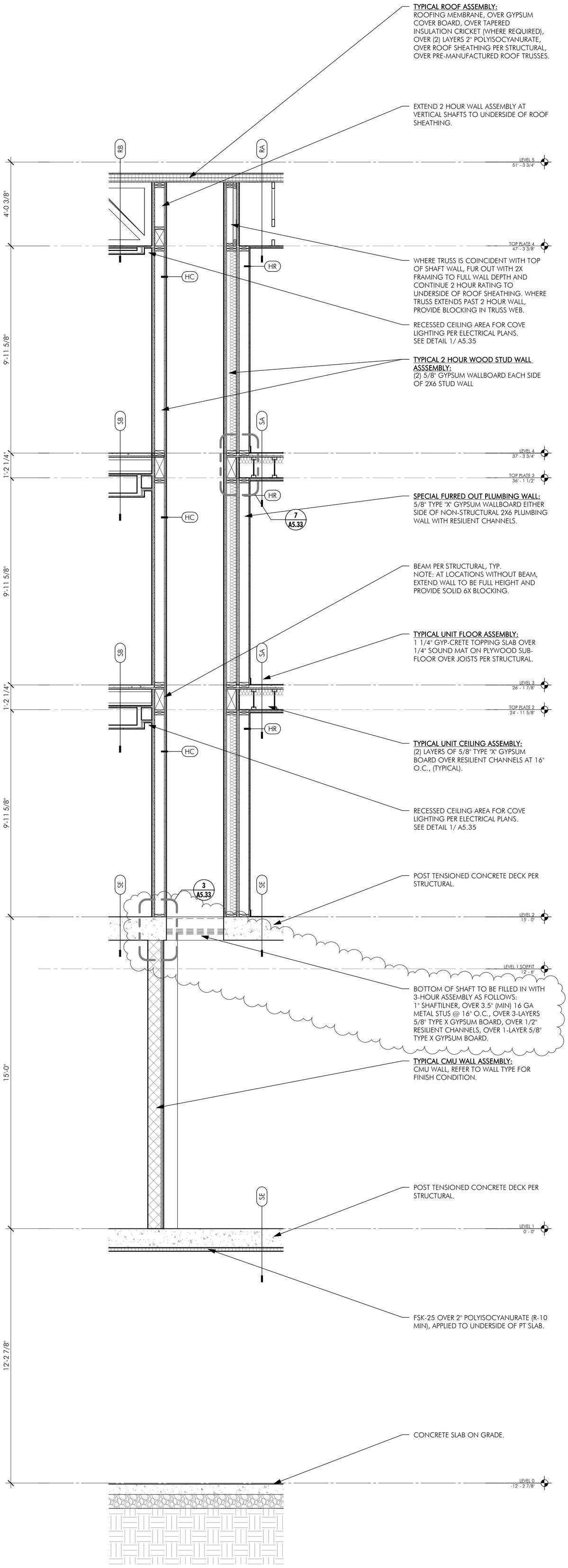
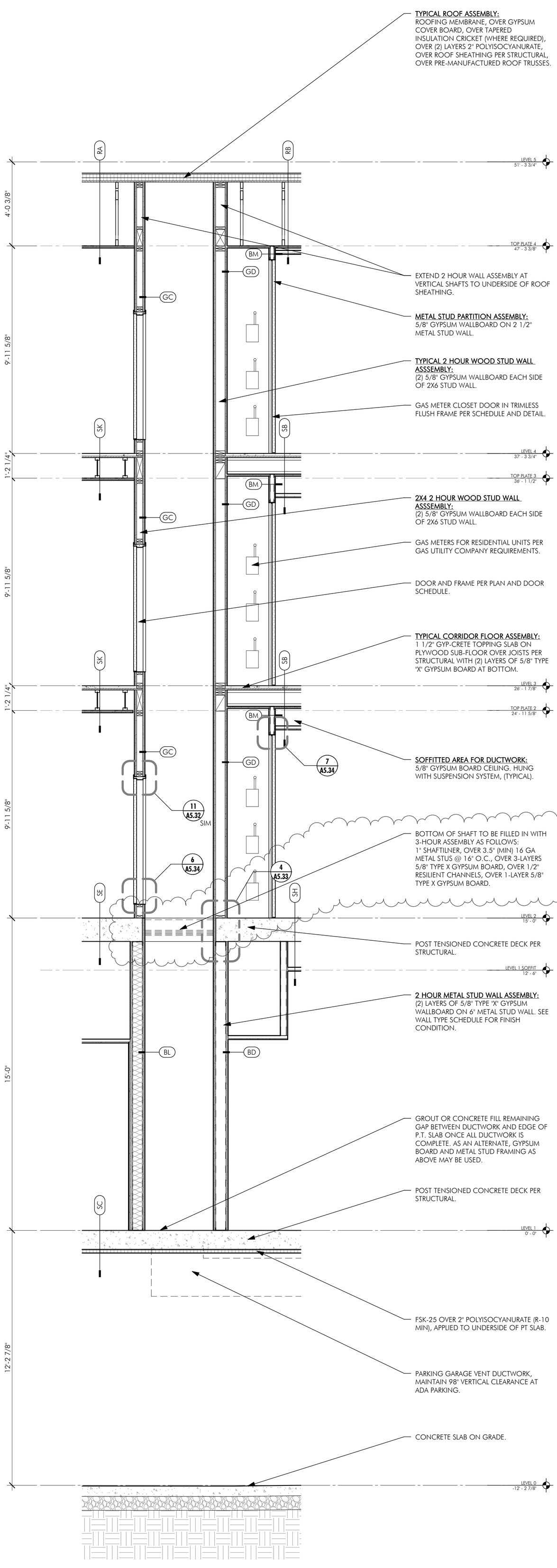


1 SHAFT SECTION
0" 1' 2' 4' 8'
3/8" = 1'-0"



2 SHAFT SECTION
0" 1' 2' 4' 8'
3/8" = 1'-0"

SHEET: A3.17

MISSISSIPPI AVE MIXED USE BUILDING

810 N FREMONT ST, PORTLAND, OR 97227

PROJECT # 2014-26
DATE: 03/13/2015
REVISIONS

IN THE EVENT CONFLICTS ARE DISCOVERED BETWEEN THE ORIGINAL SIGNED AND SEALED DOCUMENTS PREPARED BY THE ARCHITECTS AND/OR THEIR CONSULTANTS, AND ANY COPY OF THE DOCUMENTS, THE ORIGINAL SIGNED AND SEALED DOCUMENTS SHALL GOVERN.

REGISTERED ARCHITECT
GENE C. BOLANTE
4449
SALEM, OREGON
STATE OF OREGON

STUDIO 3 ARCHITECTURE INCORPORATED
222 COMMERCIAL ST. NE
SALEM, OR 97301-3410
P: 503.390.6500
www.studio3architecture.com

Mixed Use Building

Engineering Judgement Report

3-hour rating of the Shaft/Ceiling Assembly

Client Name: Studio 3 Architecture Inc.

Client Address: 275 Court St NE, Salem, OR 97301

Date: 6/10/2019

Table of Contents

1. PROJECT OVERVIEW

Studio 3 is designing the new Mixed-Use podium building in Portland, OR. The building is fully protected by automatic sprinklers, fire alarm system throughout. A 3-hour rated assembly is required at the bottom of shafts that penetrate the horizontal assembly between the construction types. The design team proposes to construct the 3-hour assembly using gypsum wallboard. Code Unlimited has been asked to provide an Engineering Judgment (EJ) letter for this condition.

2. APPLICABLE CODES, STANDARDS, AND GUIDES

- 2014 Oregon Structural Specialty Code Appendix N, which refers to International Fire Code

3. DISCUSSION

3.1 Approach

- The proposed ceiling assembly has been analyzed in accordance with 2014 OSSC Section 703.3 **Alternative Methods for Determining Fire Resistance**.
- The proposed design has been evaluated by an Oregon Licensed Fire Protection Engineer.

4. PROPOSED DESIGN

Code Unlimited has been asked to provide analysis for the fire protection of this shaft membrane assembly to ensure it will provide 3-hour fire protection as required per Oregon Structural Specialty Code. These vertical shafts will be situated throughout the project and will be protected with the same assembly. The shafts will be of differing sizes but will not exceed 5 ft wide x 7 ft long. Since a compatible tested assembly does not exist for this situation, a combination of protection measures is planned.

The shaft protection will be provided at the opening of the post tension slab as detailed in fig. 1. The assembly will follow the requirements of NER-258 (Additional, clarifying evaluation is provided in AER-09038 which details the test requirements of NER-258) for 2-hour rating. Additionally, the assembly will include a secondary 1-hour assembly to meet the requirement for a 3-hour total protection detail.

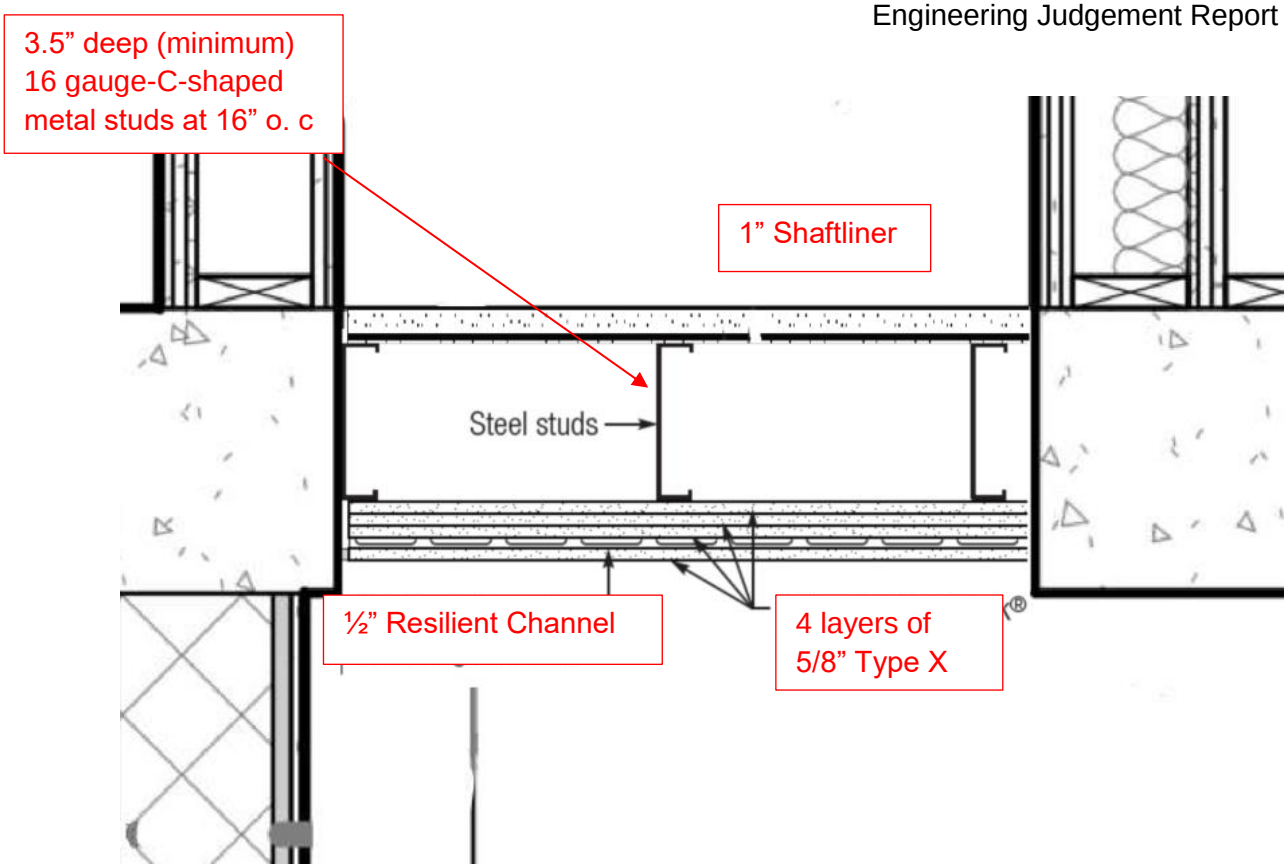
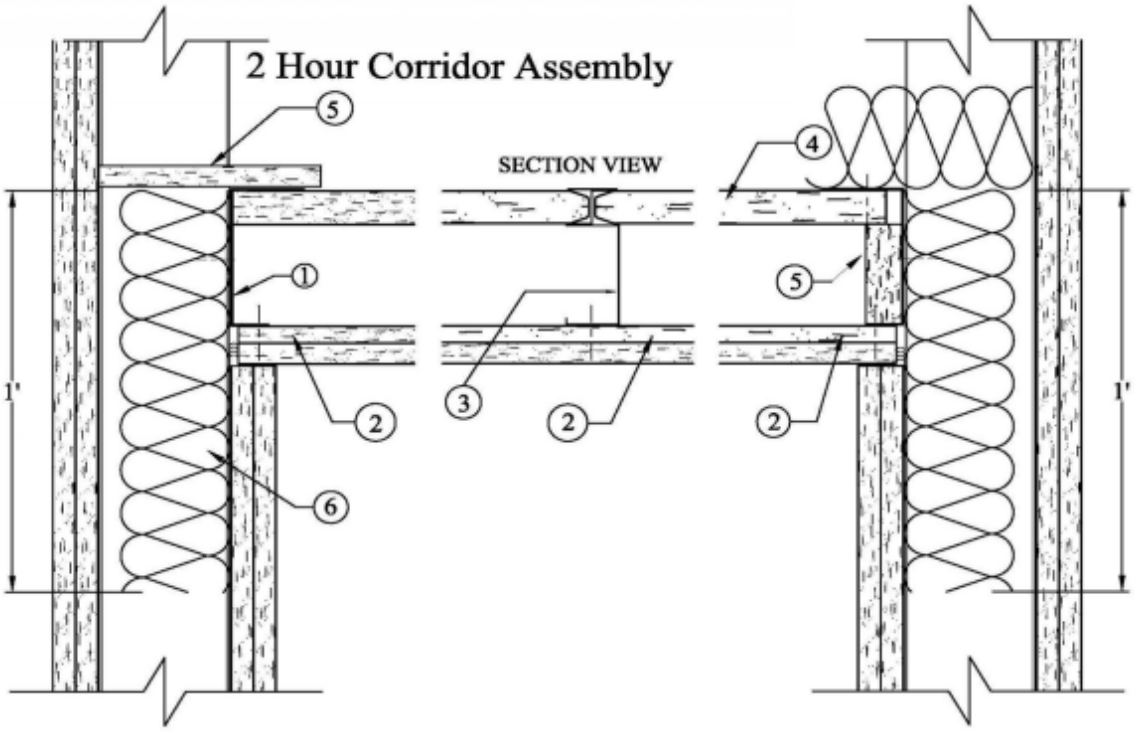


Figure 1. Vertical Section View, showing the 3-hour rated horizontal lid assembly

5. ASSEMBLY ANALYSIS

The assembly has been compared to 2-hour corridor ceiling assembly listed in the NER-258, AER-09038 report, which requires minimum 2-½” C-H shaped metal studs at 24” o/ c. The proposed assembly exceeds the requirements of figure 9, AER-09038 with C-shaped studs at 16” o/ c.

Note: NER 258 refers to the ICC, ES-Legacy Report, while AER-09038 refers to PEI evaluation providing additional detailing.



2-Hour Exit Corridor Ceiling and Stair Soffits[1]	
Double layer 1/2-in gypsum panels	Maximum Span
212CH25-18<2>	7-ft - 10-in
212CH20-34<3>	9-ft - 8-in
400CH25-18<2>	7-ft - 7-in
400CH20-34<3>	14-ft - 0-in
600CH20-34<3>	19-ft - 7-in

Notes:

1. Based on L/240 allowable deflection with studs at 24-in o.c. and JR24 runner.
2. J-Runner connection to wall/building must meet or exceed 189-lbs capacity at every stud location (24-in o.c.).
3. J-Runner connection to wall/building must meet or exceed 386-lbs capacity at every stud location (24-in o.c.).

Figure 2. AER-09038 figure 9 – Two Hour Corridor Ceiling Assembly and Limiting Spans

Table 1: Comparison between Tested and Proposed Assemblies

Element	NER 258/ AER-09038	Proposed Assembly
1. J-runner	A min 2-½" deep 24-gauge J-runner attached horizontally to perimeter or boundary walls with a power actuated fasteners.	A min 2-½" deep 24-gauge J-runner attached horizontally to perimeter or boundary walls (Slab Edge) with a power actuated fastener.
2. Gypsum Wall Board	Attached 2 layers of min ½" thick SHEETROCK® Brand FIRECODE® C Core Gypsum Panels (Type C) to the underside of the "Corridor Ceiling" of the C-H stud and the perimeter J-For the BASE layer, use a 1" long Type S screw that is spaced 24" o. c. along the perimeter and the edges. The FACE layer should be applied with a 1-5/8" long Type S screw that is spaced 12" o. c. in the field and perimeter. All joints must be staggered a minimum of 24" o. c. from the adjacent layer.	2 layers of min 5/8" thick type X Gypsum Panels to the underside of the C-shaped stud members. The **BASE** layer uses a 1" long Type S screw that is spaced 24" o. c. along the perimeter and the edges. The **FACE** layer should be applied with a 1-5/8" long Type S screw that is spaced 12" o. c. in the field and perimeter. All joints must be staggered a minimum of 24" o. c. from the adjacent layer. **(Equivalent, see Summary section below)**
3. Studs	Install C-H studs (max 20 gauge) perpendicular to J-runner spaced 24" o. c. with C-section of C-H stud facing downward towards the corridor side of the assembly with two (2) screws a min ½" long Type S-12 screws, one on each side.	3.5" deep (minimum) **16 gauge**-C-shaped metal studs at **16" o. c**. **(Superior Components - provided additional protection with higher gauge and spaced closely.**
4. Shaft liner	1" thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.	1" thick Gypsum Shaft liner over the C-shaped studs. **(Equivalent)**
5. Ripper Board	a. Where the liner panel (item 4) is cut short to be installed, gaps must be filled by using a strip of 1" thick SHEETROCK Brand Gypsum Liner Panel. b. As an alternative you can use mineral fiber insulation to prevent exposure to the top leg of the J-runner that forms the ceiling. c. Where the wall section extends above the corridor ceiling, above corridor height a rip of board must be used to cap the opening between studs and a strip of mineral fiber insulation as described in item 6 must be used.	a. N/A to conventional 5/8" GWB. b. Alternate not used. c. N/A to assembly.

6. Insulation	In order to prevent the passage of heat and gases, a 12” long strip of mineral fiber insulation must be used to fill in the stud cavity of the walls.	N/A to the proposed ceiling assembly. This requirement is provided only if wall cavities pass adjacent to the ceiling assembly are unprotected. **(Equivalent)**
Fire-resistance rating (Top Assembly)	**2-hour**	**2-hour (Equivalent)**
1-Hour Component Additive Method		
Element		**Proposed Assembly**
Gypsum Wall Board		2 layers of min 5/8” thick type X **(80 Min. estimated Fire Resistance)**
RC Channel		½” RC Channel to provide Air Gap **(Reduced Heat transfer through conduction)**
Fire-resistance (Lower portion)		**1-hour allowance (Component Additive Method)**

6. SUMMARY

The tested assembly is for nonbearing horizontal separation providing fire-resistance of 2 hours. Additionally, two layers of 5/8” Type X GWB will be added for an additional 60 minutes of protection.

The assembly has been compared to NER 258, which is an ICC legacy report that has been attached. The proposed horizontal system exceeds the tested system by using:

- 16 Ga studs which are much heavier than the tested assembly
- RC Channel providing an air gap in the assembly, extending is fire resistance.
- The assembly will only span 5 ft. wide, thus creating a structurally robust assembly.
- The bottom of the assembly will utilize 2 layers of GWB, conservatively adding an additional 60 minutes of protection.

The bottom of the assembly will be protected with 2 layers of 5/8” GWB, which replaces the ½” Type C. An equivalent thickness of Type C is superior for fire endurance, due to its structural core stiffening under higher temperatures. The proposed assembly has compensated for the difference between Type X and Type C by utilizing 5/8” thickness vs the ½” Type used in the test (additional 25% thickness). The limited span of 5 ft between the slab will ensure the assembly will remain in place during a fire.

It can be argued that the two (2) layers of 5/8” Type X can be utilized for **two-hour** assemblies as shown below in Appendix A. The ASTM E119 Test FC 2116, which matches the lower half of our assembly contains 2 layers of 5/8” Type X GWB. The FC 2116 test provides an example for the steel protection within the cavity for the duration of the test. The important consideration for an E119 test is the requirement where the steel member average temperature does not exceed 1100°F.

Harmathy's Rules for Evaluating Fire Resistance

*The thermal fire resistance of multiple parallel layers exceeds the sum of fire resistance of individual layers (*or in our case, assemblies).

7. CONCLUSION

The membrane assembly can be reviewed as a non-loaded ceiling assembly. The ceiling assembly is equivalent or superior to ICC Legacy Report NER-258, when the comparison includes the additional layers of gypsum board on the lower face and an air gap with heavier gauge of the steel studs included. In addition, a secondary assembly has been added which exceed a 60-minute rating. As documented above, the complete assembly meets the minimum requirements of the OSSC for a non-load bearing 3-hr ceiling assembly.

Franklin Callfas
Principal/Fire Protection Engineer
Code Unlimited

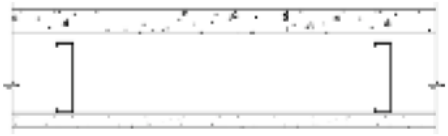
8. APPENDIX A

GA FILE NO. FC 2116	GENERIC	2 HOUR FIRE

GYPSUM WALLBOARD, STEEL CHANNEL JOIST, CONCRETE SLAB

Base layer 5/8" type X gypsum wallboard or veneer base applied at right angles to channel shaped, minimum 7 1/4" deep, 18 gage galvanized steel joists 24" o.c. with 1" Type S-12 drywall screws 12" o.c. End joints located midway between joists and staggered between rows. **Face** layer 5/8" type X gypsum wallboard or veneer base applied at right angles to joists with 1 7/8" Type S-12 drywall screws 12" o.c. placed 2" from edges and 1 1/2" Type G drywall screws 12" o.c. placed 2" back on either side of end joints. End joints located midway between joists and all joints offset 24" from base layer joints.

Joists supporting 28 gage corrugated metal deck and 2 1/2" concrete slab measured from the bottom of flutes. Joists braced at midspan with continuous 2" wide, 18 gage, galvanized steel straps attached to the bottom flange of each joist with one 3/8" Type S-12 panhead screw.



Approx. Ceiling Weight: 5 psf
Fire Test: FM FC 224-2, 9-19-75

*Contact the manufacturer for more detailed information on proprietary products

LEGACY REPORT

NER-258

Reissued July 1, 2008

ICC Evaluation Service, Inc.
www.icc-es.org

Business/Regional Office ■ 5360 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
Regional Office ■ 900 Montclair Road, Suite A, Birmingham, Alabama 35213 ■ (205) 599-9800
Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

Legacy report on the BOCA® *National Building Code*/1990, the 1988 *Standard Building Code*© with 1989/1990 Revisions, the 1988 *Uniform Building Code*™ with 1990 Accumulative Supplement

DIVISION: 09—FINISHES
Section: 09260—Gypsum Board Assemblies

REPORT HOLDER:

USG CORPORATION
550 WEST ADAMS STREET
CHICAGO, ILLINOIS 60661

EVALUATION SUBJECT:

USG Drywall Shaft Partition Systems

1.0 SUBJECT

USG® Drywall Shaft Partition Systems

2.0 PROPERTY FOR WHICH EVALUATION IS SOUGHT

Fire Resistance

3.0 DESCRIPTION

CAVITY SHAFT WALL SYSTEMS

A. One-Hour Cavity Shaft Wall (Nonload-Bearing)

1. Two and one-half-inch-wide, minimum No. 25 gauge "J" floor and ceiling runners.
2. One-inch-thick SHEETROCK brand Gypsum Liner panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG Steel C-H stud. Screws not required to attach stud to runner. E-shaped studs may be used for closure panels at end walls or columns. (If "J" runners are used at end walls, the gypsum liner is fastened at the ends with $1^5/_8$-inch Type S screws 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. A single ply $^5/_8$-inch USG SHEETROCK FIRECODE© Type C gypsum panels installed vertically with 1 inch Type S screws 12 inches on center in field and at edges - 6 inches from top, bottom and ends. Joints and screw heads are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound on this ply, when required for decorative purposes.

B. Two-Hour Cavity Shaft Wall (Nonload-Bearing)

1. Two and one-half-inch-wide, minimum No. 25 gauge "J" floor and ceiling runner.
2. One-inch-thick SHEETROCK brand Gypsum Liner Panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG Steel C-H stud. Screws not required to attach stud to runner. E-shaped studs are used for closure panels at end walls or columns, or in lieu of C-H studs. (If "J" runners are used at end walls, the gypsum liner is fastened at the ends with $1^5/_8$ inch Type S screws, 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. Gypsum panels attached as follows:
   a. Base layer: $^1/_2$-inch SHEETROCK FIRECODE© TYPE C or $^5/_8$-inch SHEETROCK FIRECODE© Type X gypsum panels applied vertically with 1-inch Type S screws 24 inches on center in field and at edges.
   b. Finish layer: $^1/_2$-inch SHEETROCK FIRECODE© Type C or $^5/_8$-inch SHEETROCK FIRECODE© Type X gypsum panels applied vertically or horizontally and attached with $1^5/_8$ inch Type S screws at 12 inches on center in field and at edges - 6 inches from top, bottom and ends. When applied vertically, the joints must be staggered with the joints in the base layer.

   Joints and screw heads on outer layer only are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound when required for decorative purposes.
5. Fire Damper (optional) (not shown) - $1^1/_2$ hour curtain-type fire damper encased in a No. 22 gauge galvanized sleeve, installed in a 48 inches wide × 36 inches high opening framed with E-Studs and J-Runners. No. 16 gauge galvanized steel, $1^1/_2$ inches × $1^1/_2$ inches mounting angles are attached to the damper sleeve on the face layer side of the wall only around all 4 sides of the sleeve using 2 inch long No. 10 sheet screws 2 inches from each end and 6 inches o.c. The mounting angles must be installed such that

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an overlap of the wall of not less than 1 inch is maintained. The angles are secured to the framed opening with the same type of screws (2 screws on each side angle 3 inches from each end; 3 screws on each head and sill angle with 1 screw in the center and 1 at each end 3 inches from ends).

C. Two-Hour Cavity shaft Wall - Alternative (Nonload-Bearing)

1. Two and one-half-inch-wide, minimum No. 25 gauge "J" floor and ceiling runners.
2. One-inch-thick SHEETROCK brand Gypsum Liner Panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG STEEL C-H stud. Screws not required to attach stud to runner. E-shaped studs are used fro closure panels at end walls or columns, or in lieu of C-H stud. (If "J" runners are used at end walls, the gypsum liner is fastened at the ends with $1^5/_8$ inch Type S screws, 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. One-half-inch USG SHEETROCK FIRECODE® Type C or $^5/_8$-inch SHEETROCK FIRECODE® Type X gypsum panels applied vertically and attached with 1-inch type S screws at 12 inches on center in field and at edges - 6 inches from top, bottom and ends. Joints and screw heads are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound on outer layer only, when required for decorative purposes. Vertical joint must be staggered on opposite sides of the walls.

D. Two-Hour Cavity Shaft Sound Wall (Nonload-Bearing) STC Over 50

1. Two and one-half-inch wide, minimum No. 25 gauge "J" floor and ceiling runners.]
2. One-inch-thick SHEETROCK brand Gypsum Liner Panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG Steel C-H stud. Screws not required to attach stud to runner. E-shaped studs are used for closure panels at end walls or columns, or in lieu of C-H stud. (If "J" runners are used at end walls, the gypsum is fastened at the ends with $1^5/_8$-inch Type S screws, 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. One and one-half-inch thick USG THERMAFIBER® Sound Attenuation Blanket.
5. One-half-inch SHEETROCK FIRECODE® Type C or $^5/_8$-inch SHEETROCK FIRECODE® Type X gypsum panels applied vertically and attached with 1-inch Type S screws at 12 inches on center. Joints and screw heads are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound on outer layer only, when required for decorative purposes. Vertical joints in the base layer must be staggered with the vertical joints in the finish layer.
6. USG RC-1 resilient channels at 24 inches on center horizontally and attached with $^3/_8$-inch panhead screws.

E. Three-Hour Cavity Shaft Wall (Nonload-Bearing)

1. Two and one-half-inch-wide, minimum No. 25 gauge "J" floor and ceiling runners.
2. One-inch-thick SHEETROCK brand Gypsum Liner Panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG Steel C-H stud. Screws not required to attach stud to runner. E-shaped studs are used for closure panels at end walls or columns, or in lieu of C-H stud. (If "J" runners are used at end walls, the gypsum liner is fastened at the ends with $1^5/_8$ inch Type S screws, 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. Gypsum panels attached as follows:
   a. Base layer: $^5/_8$ inch SHEETROCK FIRECODE® Type C gypsum panels applied vertically or horizontally with 1 inch Type S screws at 24 inches on center in field and at edges.
   b. Middle layer: $^5/_8$ inch SHEETROCK FIRECODE® Type C gypsum panels applied vertically or horizontally with $1^5/_8$ inch Type S screws at 24 inches on center in field and at edges. When applied vertically the joints must be staggered with the base and finish layer joints.
   c. Finish layer: $^5/_8$ inch USG SHEETROCK FIRECODE® Type C gypsum panels applied vertically or horizontally and attached with $2^1/_4$ inch Type S screws at 16 inches on center in field and at edges - 6 inches from top, bottom and ends.

Joint and screw heads on outer layer only are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound systems, when required for decorative purposes.

SOLID AND VENT SHAFT SYSTEMS

F. Two-Hour 2-inch Solid Gypsum Partition (Nonload-Bearing)

1. No. 22 gauge metal angles.
2. One-half-inch USG SHEETROCK FIRECODE Type C gypsum panels laminated to core panels with SHEETROCK Setting Type Joint Compound.
3. One-inch USG V-Edge Gypsum Coreboard 2 feet 0 inch wide (attachment - No. 22 gauge angle: 1 inch Type S screws).
4. No. 22 gauge metal angles.

An alternative assembly sequence for F above: Where construction is limited to application of gypsum panels from one side, "L" runners are anchored to floor and ceiling with suitable attachments at 24 inches on center. If "L" runners frame an opening in concrete, a 2-inch-by-2-inch "L" runner is used to permit fasteners to be driven further from concrete edge. The 1 inch coreboard is fastened to angle runners with two $1^1/_4$-inch Type S screws placed 3 inches in from each edge. Two layers of $^1/_2$ inch USG SHEETROCK FIRECODE® Type C gypsum panels are laminated to one side of 1 inch coreboard with all

vertical joints being offset at least 3 inches. Joints need not be taped or finished on inside.

Alternative Construction: As an alternative for all of the above described constructions. Imperial Gypsum Base of the same thickness and core type shall be substituted for the gypsum panels. Joints on the face layer, other than the inside of shaft or duct partitions, may be covered with tape and the entire surface is covered with a minimum of $^1/_{16}$ inch of USG Veneer Plaster (Imperial or Diamond Interior Finish) in accordance with manufacturer's directions.

G. USG Cavity Shaft Wall System

To provide a fire-resistive protection to corridor ceilings or the underside of stairs.

USG "J" runners are attached to all existing horizontal and vertical framing intersected at the boundaries of the area to be protected. The "J" runners are attached to the existing framing members using mechanical fasteners spaced at a maximum of 24 inches on center and having an assigned design load of 200 pounds in either shear or pullout. USG C-H studs of the required gauge are attached to the "J" runners at 24 inches on center by means of two Types S-12, $^1/_2$-inch panhead screws to frame the walls and/or soffits of the enclosures. Corners of the enclosure which do not intersect existing framing are built up of two "J" runners fastened together with two Type S-12, $^1/_2$-inch panhead screws at 24 inches on center. The USG C-H studs are fastened to the "J" runners as previously described. One-inch-thick SHEETROCK brand Gypsum Liner Panels, 24 inches wide, is installed on the interior face of the enclosure within the slots of the C-H studs. No screw attachments are required. Where the Gypsum Liner Panel intersects the "J" runners against the existing horizontal and/or vertical framing, $1^5/_8$-inch Type S screws are installed at a maximum of 12 inches on center.

Gypsum panels are attached to the exterior surfaces of the framing in the manner required for the fire-resistive rating as follows:

1. One-hour construction consists of one layer of $^5/_8$ inch SHEETROCK FIRECODE® Type C gypsum panels applied parallel to the C-H studs, with all vertical joint on studs. The panels are fastened to each C-H stud and end "J" runners with 1-inch Type S screws 12 inches on center in the field and at edges. Joints and screw heads on the outer face panels are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound.

2. Two-hour construction consists of a base layer of $^1/_2$-inch SHEETROCK FIRECODE® Type C panels applied parallel to the C-H studs and attached with 1-inch Type S screws at 24 inches on center in the field and at edges. The finish layer of $^1/_2$-inch SHEETROCK FIRECODE® Type C panels are applied either parallel or normal to the C-H studs, with joints staggered 24 inches from the base layer. One and five-eights-inch Type S screws at 12 inches on center in the field and at edges fasten the finish layer. Joints and screw heads on the outer layer only are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound.

H. USG Cavity Shaft Wall for Two-Hour Horizontal Membrane or Horizontal Duct Shaft Protection

Basically the same as described in paragraph "G" above, but uses three layers of $^1/_2$ inch SHEETROCK FIRECODE® Type C gypsum panels. (See Figure III-H at the end of this report.) The base layer is applied identical to the base layer described in item G.2. above. The second layer is applied the same as the base layer, except that joints are offset 24 inches and $1^5/_8$-inch type S screws are 4 inches on center. The face layer is installed perpendicular to the C-H studs with $2^1/_8$-inch screws 12 inches on center. Butt joints in face layer fall between C-H studs and are secured with $1^1/_2$-inch Type G screws 8 inches on center. Treatment of wallboard joints and fasteners is not necessary.

I. Materials

USG Steel C-H studs are roll formed from ASTM A 526 steel having a minimum yield strength of 33,000 psi.

Cement for laminating - SHEETROCK Setting Type Joint Compound.

For taping and sealing joints - SHEETROCK Joint Tape and SHEETROCK Joint Compound.

SHEETROCK FIRECODE® is a USG registered trademark for a Type X core gypsum panel. Type C is a USG trademark for an improved Type X core. USG Type C panels may be substituted for any Type X gypsum panel permitted by the code, provided the panel thickness is the same.

4.0 INSTALLATION

USG Drywall Shaft Partition Systems shall be installed in accordance with the fire rated assembly details and other information contained in this report.

5.0 IDENTIFICATION

Face panels are bundled in two panel groups and bound with a red, white and blue tape with panel designation printed on the tape.

SHEETROCK brand Gypsum Liner Panels are shipped unbundled in units with end banding. The face and back paper is green. The long edges are paper wrapped and have a $^3/_8$-inch bevel on top and bottom edge. The back of each liner panel has an Underwriters Laboratories, Inc. Label that denotes UL design U438, lists USG File No. R 1319 and identifies the panel as USG Type SLX (shaft liners fire-rated).

6.0 EVIDENCE SUBMITTED

Results of fire-endurance tests conducted in accordance with ASTM E 119.

7.0 CONDITIONS OF USE

The National Evaluation Service Committee finds that, in their opinion, the USG® Drywall Shaft Partition Systems described in this report are alternates to types of fire-resistive construction specified in the 1990 BOCA National Building Code, the 1988 Standard Building Code with 1989/1990 Revisions, and the 1988 Uniform Building Code with 1990 Accumulative Supplement, subject to the following conditions:

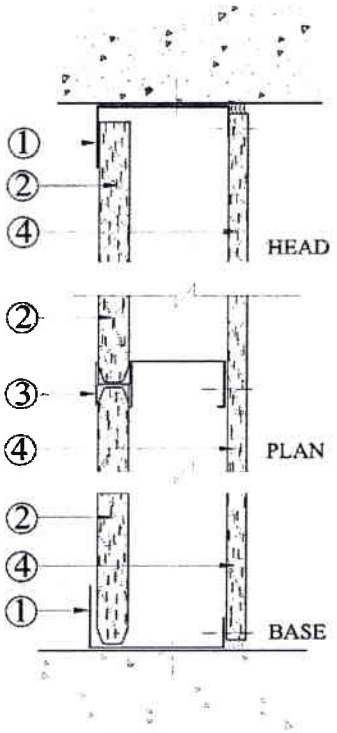
1. The report does not include structural evaluation of the products listed.

2. All cut openings and horizontal joints in metal-framed shaft partitions with coreboard must be cased with system metal framing.

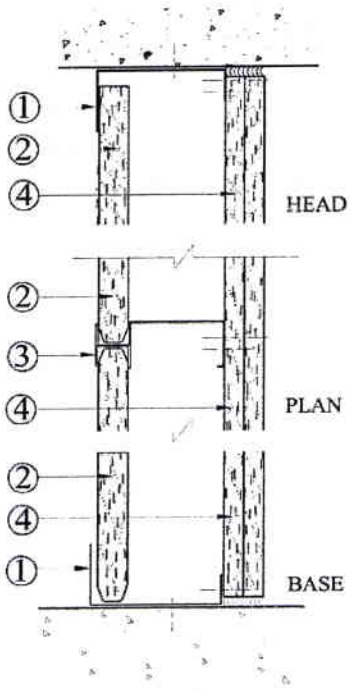
3. System G shaft walls are limited for use as corridor ceilings or as the horizontal enclosure on the underside of stairs (i.e. "Stair Soffits").

4. Assembly described in paragraph H may be used to protect two-hour horizontal ducts (horizontal duct shafts) or where a two-hour horizontal membrane is required and is not part of a floor/ceiling or roof/ceiling assembly. This system is designed to support its own dead weight only and should not be used where there is an attic or loft above, or any probability of storage.

This report is subject to periodic re-examination. For information on the current status of this report, contact the ICC-ES.



SYSTEM A



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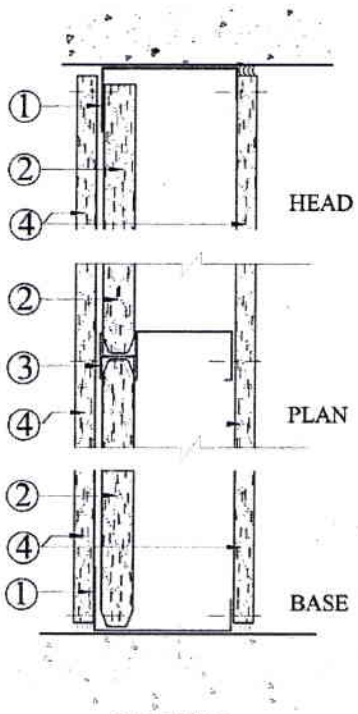

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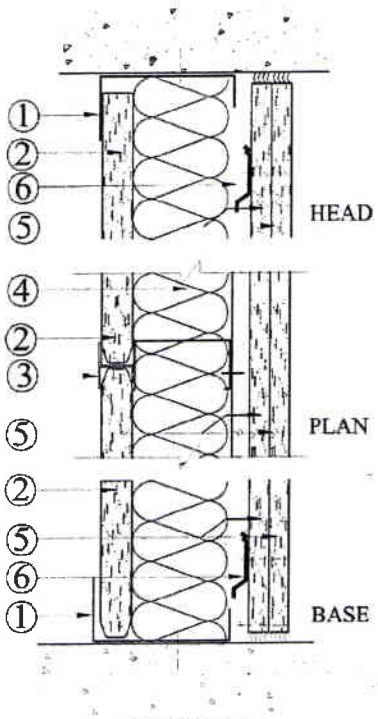

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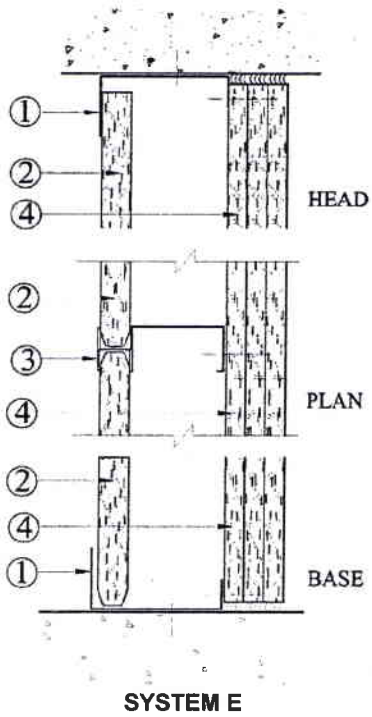

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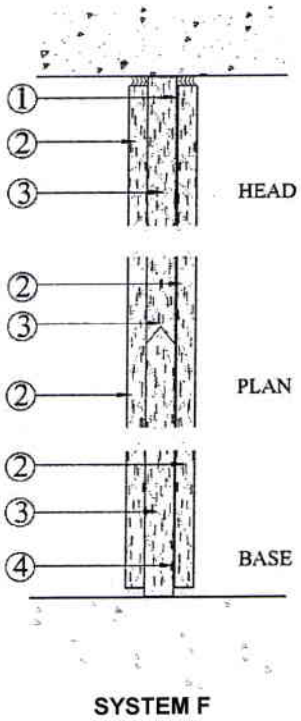

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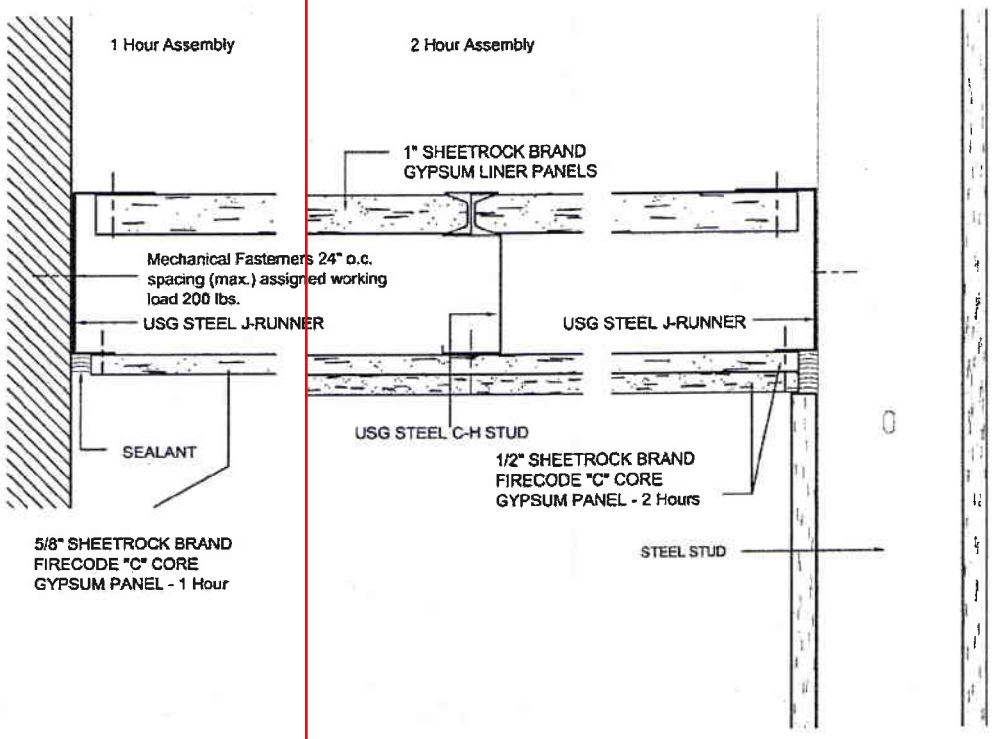

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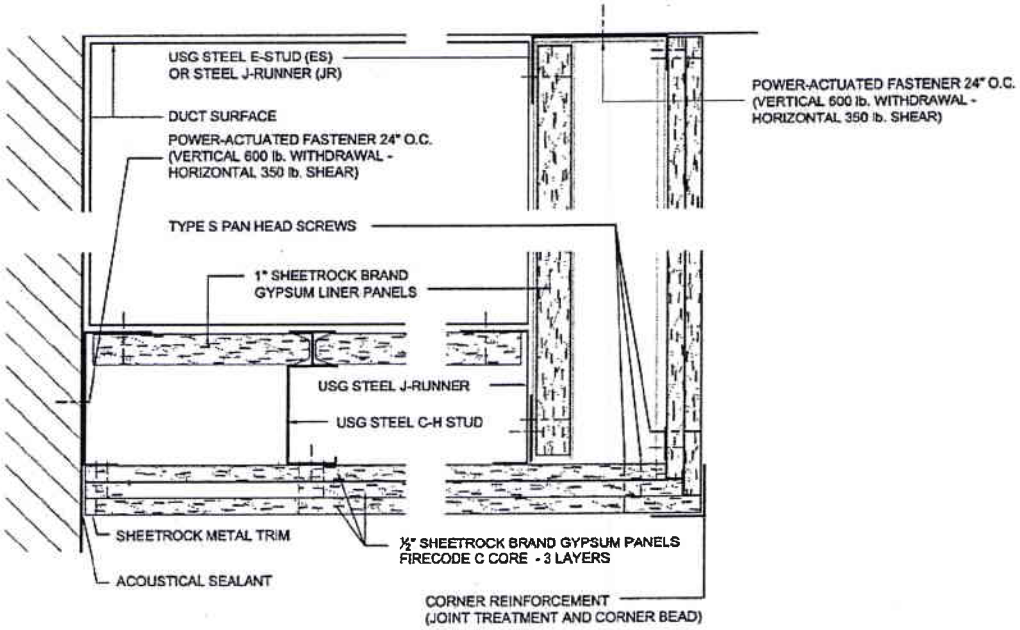


SYSTEM H

Evaluation Service®

AER-09038

Pei **Evaluation Service®** is an accredited **ISO Standard 17065** Product Certifier, accredited by the IAS. This **Assembly Evaluation Report** represents a system that *Pei* **ES** has Evaluated. This **Assembly Evaluation Report** in no way implies warranty for these products or relieves **United States Gypsum Company** of their liabilities for their products and this system. This **AER** is an official document if it is within one year of the Initial or Re-Approval date.

Initial Approval	Re-Approved
April, 2009	February, 2018

See all Pei **ES** *Listings at: www.p-e-i.com*

Report Owner

United States Gypsum Company
550 West Adams Street
Chicago, IL 60661

Product

USG Shaft & Stair Wall Systems

For Evaluation Report Questions

usg4you@usg.com
USG Support: 800.USG4YOU

USG Contact: Manny Hurtado, Building Codes Manager
Phone: 847-970-5179
Email: mhurtado@usg.com

Assemblies Evaluated For

1. Non Axial Load Bearing Wall
2. Transverse Load Capacity
3. Fire Resistance
4. Abuse Resistance

Code Compliance

2012 & 2015 International Building Code			
Section 403.2.3	Section 703.2	Section 703.2.1	Section 707
Section 707.3	Section 707.5	Section 713.4	Section 713.12
Section 2203.1	Section 2203.2		

1. **USG Shaft & Stair Walls Systems** meet the requirements of 1-hour, 2-hour, and 3-hour fire resistive rated assemblies when tested in accordance with ASTM E119 and constructed in accordance with the requirements of the applicable UL Design Number (or equivalent).
2. Meets the requirements for structural integrity of exit enclosures and elevator hoist way enclosures for High-Rise Buildings (Section 403.2.3. of the 2012 and 2015 IBC) when installed in accordance with the abuse resistant assemblies listed on page two (2) of this **Assembly Evaluation Report** (**AER**). Approved abuse resistant assemblies have been tested in accordance with ASTM C1629 and ASTM E695.

Component Descriptions

USG **Shaft & Stair Wall Systems** are generally constructed with the following components.

1. J-Runners

The metal framing members used in construction of USG **Shaft & Stair Wall Systems** are manufactured from cold roll-formed light gauge galvanized steel conforming to ASTM A653 SS Grade 33 for 24ga thickness and ASTM A653 SS Grade 40 for 20ga thickness. The galvanization coating shall be a G40 minimum. The available sizes are 2-1/2-in, 4-in and 6-in deep and a length of 16-ft in 24 or 20 gauge. Position steel J-runners at floor and ceiling with the 1-in leg towards the finished side of the wall. Securely attach the runners to the structure supports with power actuated fasteners.

For attachment to steel framed construction install floor and ceiling J-runners and End wall J-Runners or E-Studs, on columns and beams before the steel is fireproofed, except where Z-Clips are used as in UL Design HW-D-0609.

2. Steel Studs

USG Steel C-H and E Studs are manufactured from cold roll-formed light gauge steel conforming to ASTM A653 SS Grade 33 for 25ga thickness and ASTM A653 SS Grade 40 for 20ga thickness. The galvanization coating shall be a G40 minimum. The available sizes are 2-1/2-in, 4-in and 6-in deep and a length of 16-ft in 25 or 20 gauge.

Cut the C-H Studs 3/8-in to 5/8-in shorter than the floor-to-ceiling height. Install C-H Studs interlocked between the SHEETROCK® Brand Gypsum Liner Panels with the liner panels securely engaged.

Terminations: Install full length steel E-Studs or J-Runners vertically at T-Intersections, corners, door jambs and columns.
Openings: Frame with vertical E-Stud or J-Runner at vertical edges, horizontal J-runner at head or sill.
Control Joints: Install full length steel E-Stud or J-Runner at edges of control joints, to fully support gypsum panels.
C-H Studs: Based on stud size shown in Table 1 and Figure 7 of this **AER**.

Component Descriptions Continued

3. Gypsum Liner Panels

Tested for Composite Limiting Heights Tables 2, 3, & 4:

SHEETROCK® Brand Gypsum Liner Panels a high performance panel that is composed of a non-combustible gypsum core encased in a water resistant 100% recycled **green** face and back paper. Gypsum Liner Panels are a nominal thickness of 1-in x 24-in wide x 8-ft -- 14-ft long. Must meet the minimum requirements of ASTM C1396.

Alternatives for UL Fire Resistance:

SHEETROCK Brand Mold Tough™ Gypsum Liner Panels feature a non-combustible, moisture- and mold-resistant gypsum core encased in moisture and mold-resistant, 100% recycled **blue** face and back papers. Available 1-in thick, 24-in wide and in lengths up to 14-ft. Must meet the minimum requirements of ASTM C1396.

SHEETROCK Brand Glass-Mat Liner Panel have a noncombustible, moisture- and mold-resistant gypsum core that is encased in moisture- and mold-resistant glass mat. Available 1-in thick, 24-in wide, and lengths up to 14-ft. Must meet the minimum requirements of ASTM C1658.

Note: All of these panels should be cut 1-in shorter than the floor-to-ceiling height, to allow for the panel to be fitted between the top and bottom J-runners. Where shaft wall height exceeds the length of the liner panel; it must be butted together with meeting factory end cuts. The joints should be staggered and positioned in the upper or lower 1/3 of the wall. Panels must be UL/ULC classified for fire resistance and identified as Type SLX on the UL marking and UL Fire Resistance Directory.

4. Gypsum Wallboard

Tested for Composite Limiting Heights Tables 2, 3, & 4:

SHEETROCK Brand FIRECODE C Core Gypsum Panels have been tested generate the shaft/stairwall limiting heights for wall assemblies shown in Figures 1, 2, 3, 4, and 5. Panels are available in 1/2-in and 5/8-in thicknesses, 48-in wide and lengths up to 14-ft. Product must be UL Classified for fire-rated construction (Type C) and meet the requirements of ASTM C1396.

SHEETROCK Brand FIRECODE Core Gypsum Panels (Type X) have been tested generate the shaft/stairwall limiting heights for the wall assembly described by Figure 6. Panels are available 5/8-in thick, 48-in or 54-in wide and lengths up to 14-ft. Product must be UL Classified for fire-rated construction (Type SCX) and meet the requirements of ASTM C1396.

Alternatives for UL Fire Resistance and/or Abuse Resistance:

SHEETROCK Brand Mold Tough Gypsum Panels, have a non-combustible, moisture- and mold-resistant gypsum core encased in moisture- and mold-resistant, 100 percent recycled **green** face and **brown** back paper. Available in FIRECODE and FIRECODE C core formulations in the same widths, thicknesses and lengths listed above. Product must be UL Classified for fire-rated construction (Type C or Type SCX) and meet the requirements of ASTM C1396.

SHEETROCK Brand Mold Tough VHI (Very High Impact) Abuse Resistant Gypsum Panels have a non-combustible, moisture-resistant core encased in moisture- and mold-resistant, 100 percent recycled **green** face and **brown** back papers. A fiberglass reinforcing mesh is imbedded in the core adjacent to the back paper. Available in FIRECODE Core formulation in the same widths, thicknesses, and lengths listed above. The panels have been tested for use in abuse resistant assemblies in accordance with ASTM C 1629. Product must be UL Classified for fire-rated construction (Type AR) and meet the requirements of ASTM C1278.

FIBEROCK® Brand AR (Abuse-Resistant) Interior Panels (Type X) are high performance abuse resistant panels. Available panels are 5/8-in thick x 48-in wide and available in lengths up to 12-ft. The panels have been tested for use in abuse resistant assemblies in accordance with ASTM C 1629. Product must be UL Classified for fire-rated construction (Type FRX-G) and meet the requirements of ASTM C1278.

Tested Abuse Resistant Assemblies:

1. **Single layer of 5/8-in FIBEROCK VHI on 24-in o.c. 400CH20-34 Studs** - Passed ASTM C1629 Hard Body Impact Level 2.
2. **Single layer of 5/8-in SHEETROCK FIRECODE Core Face and Single layer of 5/8-in FIBEROCK VHI Base on 24-in o.c. 400CH20-34 Studs** - Passed ASTM C1629 Hard Body Impact Level 3 and Soft Body Impact Level 2.
3. **Two layers of 5/8-in FIBEROCK VHI on 24-in o.c. 400CH20-34 Studs** - Passed ASTM C1629 Hard Body Impact Level 3 and Soft Body Impact Level 2.

~ *Cavity Shaft Wall Systems* ~

One-Hour Cavity Shaft Wall (Non-Load Bearing), See Figure 1

1. A minimum 2-1/2-in wide 24 gauge floor and ceiling J-runners, attached to structure as described above.
2. Apply one (1) layer, 5/8-in thick SHEETROCK Brand FIRECODE C Core Gypsum Panels (Type C), installed vertically with 1-in long Type S screws spaced 12-in o.c. in field and at edges for vertical application, and 8-in o.c. for horizontal application.
3. A minimum 2-1/2-in deep USG C-H Studs 25 gauge 24-in o.c., with the H-Section of C-H Stud towards the shaft side of the assembly. Screw attachment is not required to affix the stud to the runner, if Shaft Wall is less then 16-ft tall. E-shaped studs may be used for closure panels at end of the walls or columns. (If J-runners are used at end walls, the gypsum liner is fastened at the ends with 1-5/8-in long Type S Screws 12-in o.c.)
4. 1-in thick SHEETROCK Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.

Two-Hour Cavity Shaft Wall (Non-Load Bearing), See Figure 2

1. A minimum 2-1/2-in deep 24 gauge floor and ceiling J-runners, attached to structure as described above.
2. Apply two (2) layers, 1/2-in thick SHEETROCK® Brand FIRECODE® C Core Gypsum Panels. Apply base layer with 1-in long Type S screws 24-in o.c. in field and at the edges for vertical application and 16-in o.c. for horizontal applications. Apply face layer C-H studs and J-runners with 1-5/8-in long Type S screws. Space the screws 12-in o.c. at the edges and in the field when applied horizontally. All joints between the base and face layers must be staggered.
3. A minimum 2-1/2-in deep USG C-H studs 25 gauge, spaced 24-in o.c., with the H-Section of the C-H stud towards the shaft side of the assembly. Screw attachment is not required to affix the stud to the runner, if Shaft Wall is less then 16-ft tall. E-shaped studs may be used for closure panels at the end of walls or columns. (If J-runners are used at end walls, the gypsum liner needs to be fastened at the ends with 1-5/8-in long Type S screws that are spaced 12-in o.c.).
4. 1-in thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of CH studs.

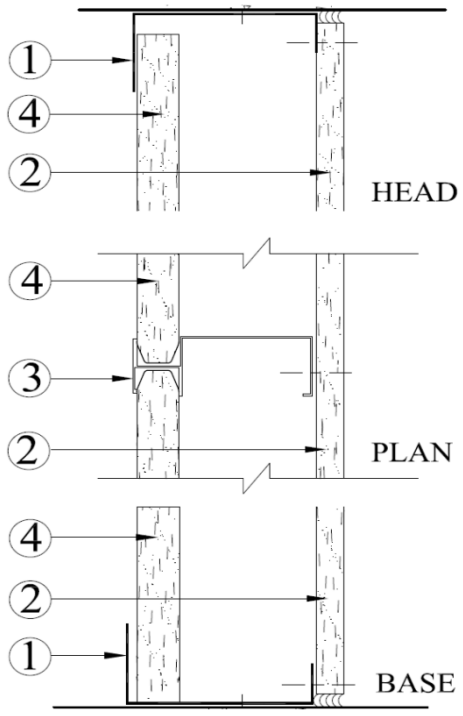


Figure 1 - 1-HR Cavity Shaft Wall (Non-Load Bearing)

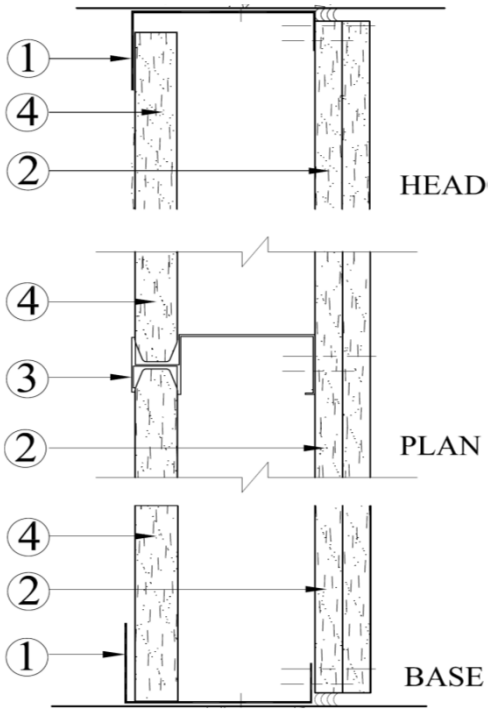


Figure 2 - 2-HR Cavity Shaft Wall (Non-Load Bearing)

Two-Hour Cavity Stair Wall (Non-Load Bearing), See Figure 3

1. A minimum 2-1/2-in deep, 24 gauge floor and ceiling J-runners, attached to the structure as described.

2. Apply one (1) layer of 1/2-in SHEETROCK® Brand FIRECODE® Gypsum Panels (Type C) to each side of the C-H stud. Attach the C-H stud with 1-in long Type S screws 12-in o.c. in the field and at the edges for a vertical application and 8-in o.c. center for a horizontal application.

3. A minimum of 2-1/2-in deep USG C-H studs 25 gauge, spaced 24-in o.c., with the H-section of the C-H stud towards the shaft side of the assembly, if the Shaft Wall is less than 16-ft tall. Screw attachment is not required to affix the stud to the runner, if Shaft Wall is less then 16-ft tall. E-shaped studs may be used for closure panels at the end of walls or columns. (If J-runners are used at end walls, the gypsum liner needs to be fastened at the ends with 1-5/8-in long Type S screws that are 12-in o.c.).

4. 1-in thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.

Three-Hour Cavity Shaft Wall (Non-Load Bearing), See Figure 4

1. A minimum 2-/12-in deep 24 gauge floor and ceiling J-runners, attached to the structure as described in the Figure 4.

2. Apply three (3) layers of 5/8-in thick SHEETROCK® Brand FIRECODE® C Core Gypsum Panels (Type C), vertically or horizontally to the room side of the C-H stud. First layer shall be attached with a 1-in long Type S screw placed 24-in o.c. in the field and at the edges when applied vertically, for horizontal applications the screws shall be spaced 16-in o.c. The second layer shall be applied with 1-5/8-in long Type S screws spaced 24-in o.c. when applied vertically or spaced 16-in o.c. when the applied horizontally. The Face layer shall be applied with 2-1/4-in long Type S screws that are spaced 16-in o.c. when the board is applied vertically, and spaced 12-in o.c. when the board is applied horizontally. All joints must be staggered a minimum of 24-in o.c. from the adjacent layers, where screws are offset a minimum of 6-in from the layer below.

3. A minimum 2-1/2-in USG C-H studs 25 gauge that are spaced 24-in o.c., with the H-section of the C-H stud towards the shaft side of the assembly. Screw attachment is not required to affix the stud to the runner, if Shaft Wall is less then 16-ft tall. E-shaped studs may be used for closure panels at the end of walls or columns. (If J-runners are used at the end walls, the gypsum liner needs to be fastened at the ends with 1-5/8-in Type S screws spaced 12-in o.c.)

4. 1-in thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.

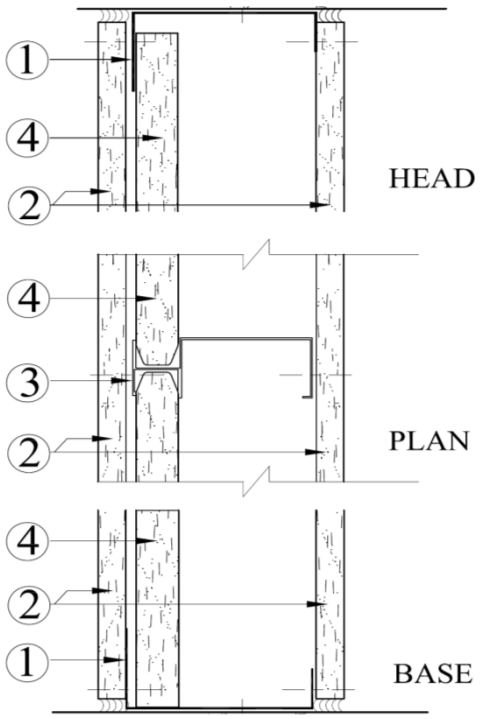


Figure 3 - 2-HR Cavity Stair Wall (Non-Load Bearing)

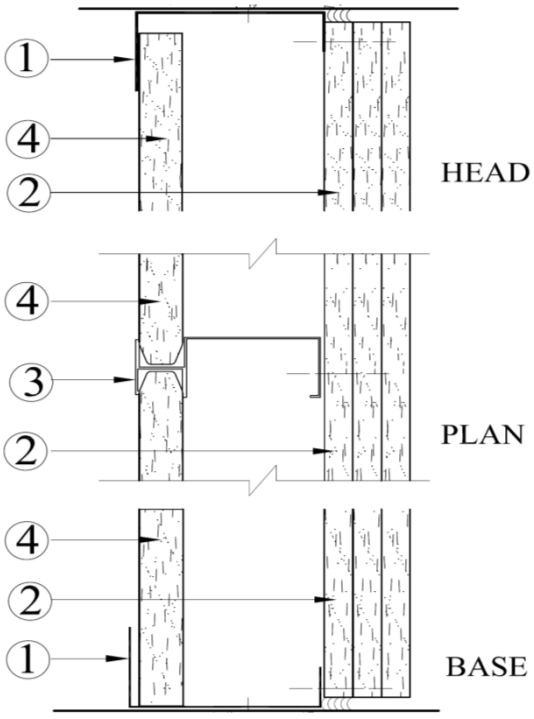


Figure 4 - 3-HR Cavity Shaft Wall (Non-Load Bearing)

Three-Hour Cavity Stair Wall (Non-Load Bearing), See Figure 5

1. A minimum 2-1/2-in deep 24 gauge floor and ceiling J-runners attached to the structure as described above.

2. Apply two (2) layers of 5/8-in thick SHEETROCK® Brand FIRECODE® C Core Gypsum Panels (Type C), vertically or horizontally to the "room" side of the C-H stud. For vertical applications using a 1-in long Type S screw spaced 24-in o.c. in the field and at the edges. For vertical applications the gypsum panels need to be spaced 16-in o.c. and for horizontal applications they need to be spaced at 16-in o.c.

3. A minimum 2-1/2-in deep USG C-H Stud 25 gauge spaced 24-in o.c., where the H-section of the C-H stud faces the shaft. Screw attachment is not required to affix the stud to the runner, if Shaft Wall is less then 16-ft tall. E-shaped studs may be used for closure panels at the end of the walls or columns. (If J-runners are used at end walls, the gypsum liner should be fastened at the ends with a 1-5/8-in long Type S screw, spaced 12-in o.c.)

4. 1-in thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.

Two-Hour Horizontal Stud Shaft Wall Assembly (Non-Load Bearing), See Figure 6

1. A minimum 4-in deep 20 gauge J-runner to be installed vertically, on the ends of the wall.

2. Apply two (2) layers of 5/8-in thick SHEETROCK® Brand FIRECODE® Core Gypsum Panels (Type X) vertically or horizontally to the room side of the C-H stud, with 1-in long Type S screws spaced 12 -in o.c. in the field and at the edges for the BASE layer. The FACE layer shall be installed with 1-5/8-in long Type S screws spaced 8-in o.c. All joints must be staggered a minimum of 24-in from the adjacent layers.

3. A minimum 4-in deep USG C-H stud or E Studs 20 gauge, are to be installed horizontally between the J-runners. The H-section of the C-H stud faces the shaft. C-H Studs should be attached to vertical J-runners with Type S fasteners.

4. 1-in thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.

5. Horizontal Stud Wall Assembly - The wall width is limited to the length of the Gypsum Liner Panel.

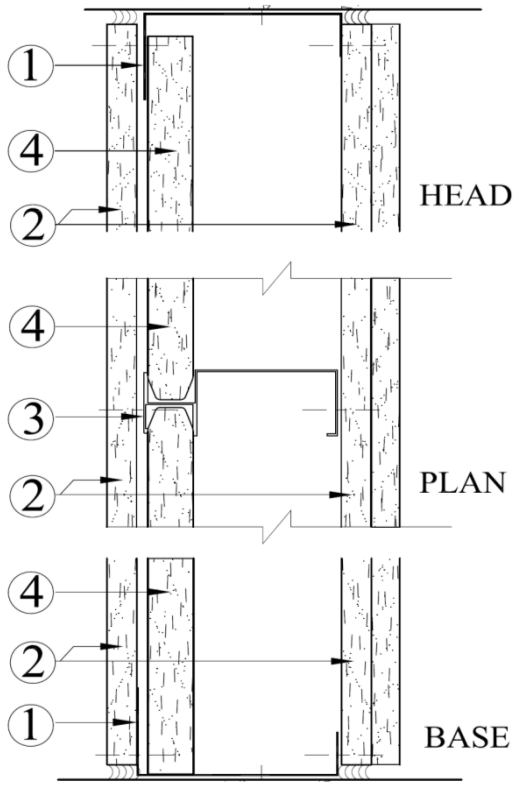


Figure 5 - 3-HR Cavity Stair Wall (Non-Load Bearing)

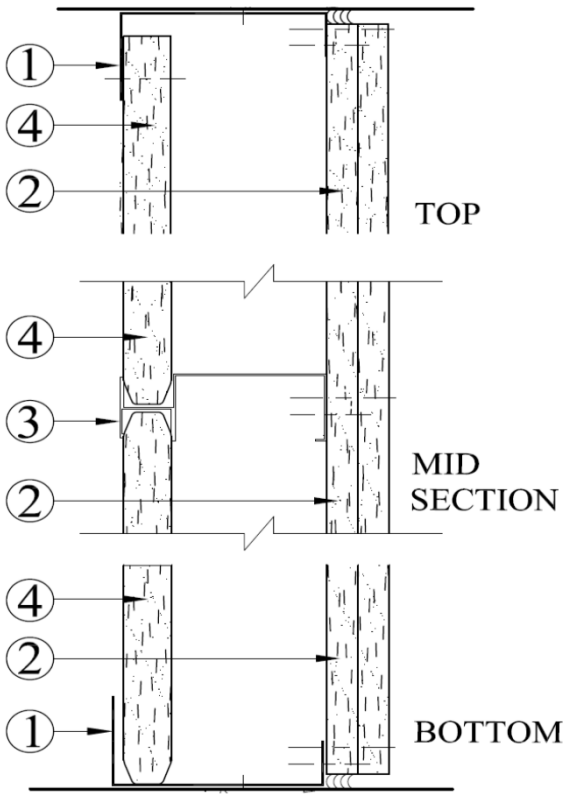


Figure 6 - 2-HR Horizontal Stud Shaft Wall Assembly (Non-Load Bearing)

Table 1 - Nominal C-H Stud Dimensions[1] (inches)

Stud Designation	A	B	C	D	E	F[2]
212CH25-18	2 1/2	1 3/8	1 29/64	31/32	7/32	25ga
212CH20-34	2 1/2	1 3/8	1 29/64	31/32	7/32	20ga
400CH25-18	4	1 3/8	1 29/64	31/32	7/32	25ga
400CH20-34	4	1 3/8	1 29/64	31/32	7/32	20ga
600CH20-34	6	1 3/8	1 29/64	31/32	7/32	20ga

Notes:

1. Refer to Figure 7 for location of tabulated dimensions.
2. Dimension "F" refers to the steel thickness and is shown as the minimum nominal gauge thickness of the material.

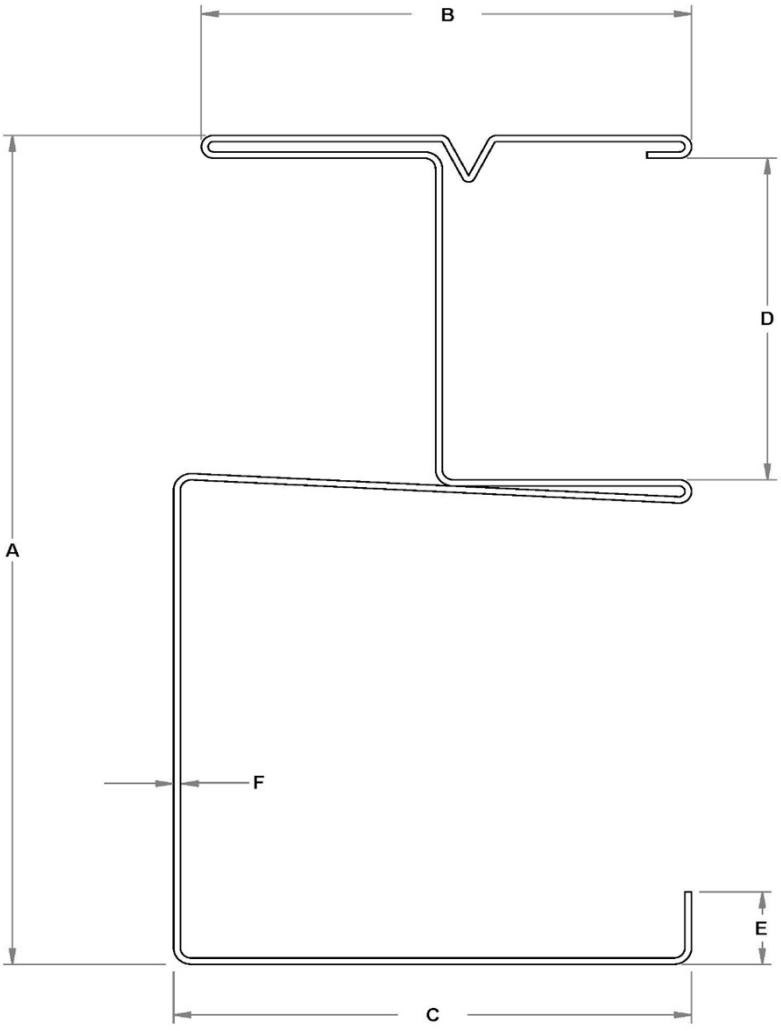


Figure 7 - Nominal C-H Stud Dimension Locations (See Table 1 for Values)

Table 2 - Limiting Heights Vertical Shaft Walls[1,2]

		1-hr Shaft Wall / Stair Wall			
Stud Description	Allowable Deflection	5psf design (ft - in)	7.5psf design (ft - in)	10psf design (ft - in)	15psf design (ft - in)
212CH25-18	L/120	13 10	9 4	7 0	4 8
	L/240	11 0	9 4	7 0	4 8
	L/360	9 7	8 4	7 0	4 8
212CH20-34	L/120	16 0	14 0	12 9	11 1
	L/240	12 9	11 1	10 1	8 8
	L/360	11 1	9 8	8 8	7 5
400CH25-18	L/120	10 6	7 0	5 3	3 6
	L/240	10 6	7 0	5 3	3 6
	L/360	10 6	7 0	5 3	3 6
400CH20-34	L/120	22 3	19 5	17 8	14 3
	L/240	17 8	15 5	14 0	12 3
	L/360	15 5	13 6	12 3	10 8
600CH20-34	L/120	30 11	21 5	16 1	10 8
	L/240	24 6	21 5	16 1	10 8
	L/360	21 5	18 8	16 1	10 8

Notes:

1. See Figure 1 for vertical stud installation details within shaft/stair wall.
2. Tabulated limiting heights are based upon the tested composite behavior of the 1 hour wall assemblies described in this **AER** only. Alternative designs are outside the scope of this **AER**.

Table 3 - Limiting Heights - Shaft Walls with Vertical & Horizontal Stud Orientation[1,2,3]

		2-hr Stair Wall								2-hr Shaft Wall							
Stud Description	Allowable Deflection	5psf design (ft - in)		7.5psf design (ft - in)		10psf design (ft - in)		15psf design (ft - in)		5psf design (ft - in)		7.5psf design (ft - in)		10psf design (ft - in)		15psf design (ft - in)	
212CH25-18	L/120	14	4	12	6	10	5	6	11	14	6	12	8	10	5	6	11
	L/240	11	4	9	11	9	0	6	11	11	6	10	0	9	1	6	11
	L/360	9	11	8	8	7	10	6	10	10	0	8	9	8	0	6	11
212CH20-34	L/120	19	0	16	7	14	7	12	3	17	1	14	11	13	6	11	10
	L/240	14	7	12	3	10	10	9	3	13	6	11	10	10	9	9	4
	L/360	12	3	10	4	9	3	7	10	11	10	10	4	9	4	7	10
400CH25-18	L/120	19	0	15	7	13	2	8	9	18	4	15	0	13	0	8	9
	L/240	17	4	14	7	12	11	8	9	16	1	14	1	12	9	8	9
	L/360	14	7	12	3	10	11	8	9	14	1	12	4	11	2	8	9
400CH20-34	L/120	23	0	23	0	21	0	17	4	23	0	21	0	19	1	16	5
	L/240	21	0	17	7	15	8	13	3	19	1	16	8	15	2	13	3
	L/360	17	7	14	11	13	3	11	3	16	8	14	7	13	3	11	7
600CH20-34	L/120	31	0	29	3	21	11	14	7	31	0	27	4	21	11	14	7
	L/240	28	0	23	10	21	4	14	7	25	8	22	5	20	5	14	7
	L/360	23	10	20	5	18	3	14	7	22	5	19	7	17	10	14	7

Notes:

1. See Figure 2 and 3 for vertical stud installation details within shaft/stair wall.
2. See Figure 6 for horizontal stud installation details within shaft/stair wall. The horizontal wall width is limited to the length of the Gypsum Liner Panel and only 400CH20-34 and 600CH20-34 steel studs are permitted for horizontal stud installations.
3. Tabulated limiting heights are based upon the tested composite behavior of the 2 hour wall assemblies described in this **AER** only. Alternative designs are outside the scope of this **AER**.

Table 4 - Limiting Heights Vertical Shaft Walls[1,2] - Applicable to Fig. 4 & 5

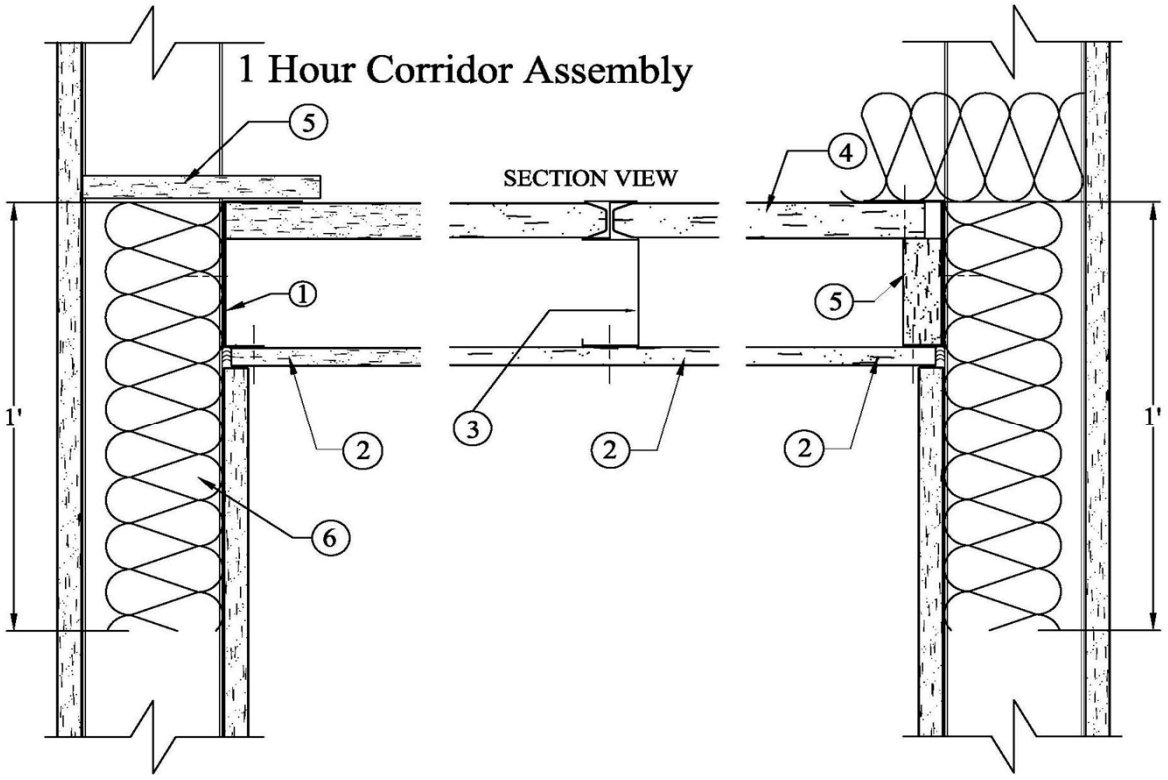
		3-hr Stair Wall								3-hr Shaft Wall							
Stud Description	Allowable Deflection	5psf design (ft - in)		7.5psf design (ft - in)		10psf design (ft -in)		15psf design (ft - in)		5psf design (ft - in)		7.5psf design (ft - in)		10psf design (ft - in)		15psf design (ft - in)	
212CH25-18	L/120	14	4	12	6	10	5	6	11	14	6	12	8	10	5	6	11
	L/240	11	4	9	11	9	0	6	11	11	6	10	0	9	1	6	11
	L/360	9	11	8	8	7	10	6	10	10	0	8	9	8	0	6	11
212CH20-34	L/120	19	0	16	7	14	7	12	3	17	1	14	11	13	6	11	10
	L/240	14	7	12	3	10	10	9	3	13	6	11	10	10	9	9	4
	L/360	12	3	10	4	9	3	7	10	11	10	10	4	9	4	7	10
400CH25-18	L/120	19	0	15	7	13	2	8	9	18	4	15	0	13	0	8	9
	L/240	17	4	14	7	12	11	8	9	16	1	14	1	12	9	8	9
	L/360	14	7	12	3	10	11	8	9	14	1	12	4	11	2	8	9
400CH20-34	L/120	23	0	23	0	21	0	17	4	23	0	21	0	19	1	16	5
	L/240	21	0	17	7	15	8	13	3	19	1	16	8	15	2	13	3
	L/360	17	7	14	11	13	3	11	3	16	8	14	7	13	3	11	7
600CH20-34	L/120	31	0	29	3	21	11	14	7	31	0	27	4	21	11	14	7
	L/240	28	0	23	10	21	4	14	7	25	8	22	5	20	5	14	7
	L/360	23	10	20	5	18	3	14	7	22	5	19	7	17	10	14	7

Notes:

1. See Figure 4 and 5 for vertical stud installation details within shaft/stair wall.
2. Tabulated limiting heights are based upon the tested composite behavior of the 3 hour wall assemblies described in this **AER** only. Alternative designs are outside the scope of this **AER**.

One Hour Corridor Ceiling or Underside Stair Applications, See Figure 8

1. A minimum 2-1/2-in deep 24 gauge J-runner attached horizontally to perimeter or boundary walls with a power actuated fasteners.
2. Gypsum Wall Board:
   a. For a one (1) hour assembly: Attach one (1) layer of 5/8-in thick SHEETROCK® Brand FIRECODE® Core Gypsum Panel (Type X), to the underside of the "Corridor Ceiling" of the C-H stud and the perimeter J-runners. Use 1-in long Type S screws that are spaced 12-in o.c. in the field and at the edges.
3. Install the C-H studs perpendicular to the J-runner spaced 24-in o.c. with the C-section of the C-H stud facing downward towards the corridor side of the assembly with two (2) screws a minimum 1/2-in long Type S-12 screws, one on each side.
4. 1-in thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.
5. Ripper Board:
   a. Where the liner panel (item 4) is cut short to be installed, gaps must be filled by using a strip of 1-in thick SHEETROCK Brand Gypsum Liner Panel.
   b. As an alternative you can use mineral fiber insulation to prevent exposure to the top leg of the J-runner that forms the ceiling.
   c. Where the wall section extends above the corridor ceiling, above corridor height a rip of board must be used to cap the opening between studs and a strip of mineral fiber insulation as described in item 6 must be used.
6. In order to prevent the passage of heat and gases, a 12-in long strip of mineral fiber insulation must be used to fill in the stud cavity of the walls.



1-Hour Exit Corridor Ceiling and Stair Soffits[1]	
Single layer 5/8-in gypsum panels	Maximum Span
212CH25-18<2>	8-ft - 6-in
212CH20-34<3>	10-ft - 4-in
400CH25-18<2>	9-ft - 3-in
400CH20-34<3>	14-ft - 11-in
600CH20-34<3>	20-ft - 10-in

Notes:

1. Based on L/240 allowable deflection with studs at 24-in o.c. and JR24 runner.
2. J-Runner connection to wall/building must meet or exceed 189-lbs capacity at every stud location (24-in o.c.).
3. J-Runner connection to wall/building must meet or exceed 386-lbs capacity at every stud location (24-in o.c.).

Figure 8 - One Hour Corridor Ceiling or Underside Stair Assembly and Limiting Spans

Two Hour Corridor Ceiling or Underside Stair Applications, See Figure 9

1. A minimum 2-1/2-in deep 24 gauge J-runner attached horizontally to perimeter or boundary walls with a power actuated fasteners.
2. Gypsum Wall Board:

    a. For a two (2) hour assembly: Attached two (2) layers of minimum 1/2-in thick SHEETROCK® Brand FIRECODE® C Core Gypsum Panels (Type C) to the underside of the "Corridor Ceiling" of the C-H stud and the perimeter J-For the BASE layer, use a 1-in long Type S screw that is spaced 24-in o.c. along the perimeter and the edges. The FACE layer should be applied with a 1-5/8-in long Type S screw that is spaced 12-in o.c. in the field and perimeter. All joints must be staggered a minimum of 24-in o.c. from the adjacent layer.

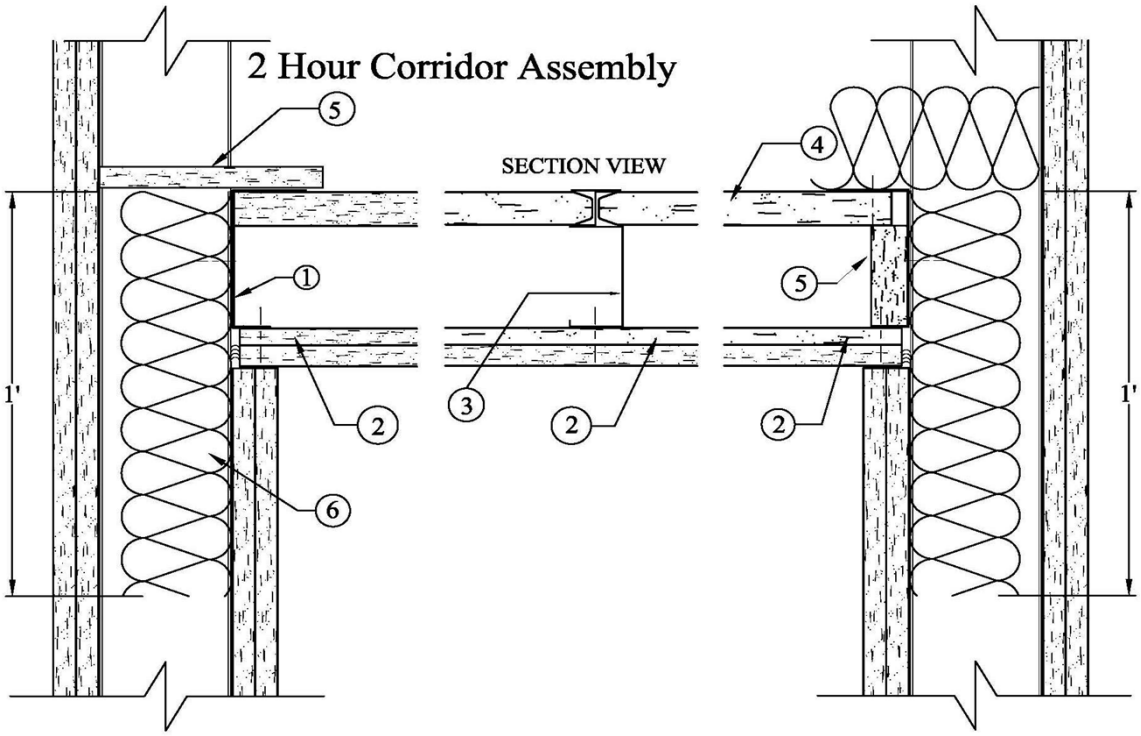
3. Install the C-H studs perpendicular to the J-runner spaced 24-in o.c. with the C-section of the C-H stud facing downward towards the corridor side of the assembly with two (2) screws a minimum 1/2-in long Type S-12 screws, one on each side.
4. 1-in thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.
5. Ripper Board:

    a. Where the liner panel (item 4) is cut short to be installed, gaps must be filled by using a strip of 1-in thick SHEETROCK Brand Gypsum Liner Panel.

    b. As an alternative you can use mineral fiber insulation to prevent exposure to the top leg of the J-runner that forms the ceiling.

    c. Where the wall section extends above the corridor ceiling, above corridor height a rip of board must be used to cap the opening between studs and a strip of mineral fiber insulation as described in item 6 must be used.

6. In order to prevent the passage of heat and gases, a 12-in long strip of mineral fiber insulation must be used to fill in the stud cavity of the walls.



2-Hour Exit Corridor Ceiling and Stair Soffits[1]	
Double layer 1/2-in gypsum panels	Maximum Span
212CH25-18 <2>	7-ft - 10-in
212CH20-34 <3>	9-ft - 8-in
400CH25-18 <2>	7-ft - 7-in
400CH20-34 <3>	14-ft - 0-in
600CH20-34 <3>	19-ft - 7-in

Notes:

1. Based on L/240 allowable deflection with studs at 24-in o.c. and JR24 runner.
2. J-Runner connection to wall/building must meet or exceed 189-lbs capacity at every stud location (24-in o.c.).
3. J-Runner connection to wall/building must meet or exceed 386-lbs capacity at every stud location (24-in o.c.).

Figure 9 - Two Hour Corridor Ceiling or Underside Stair Assembly and Limiting Spans

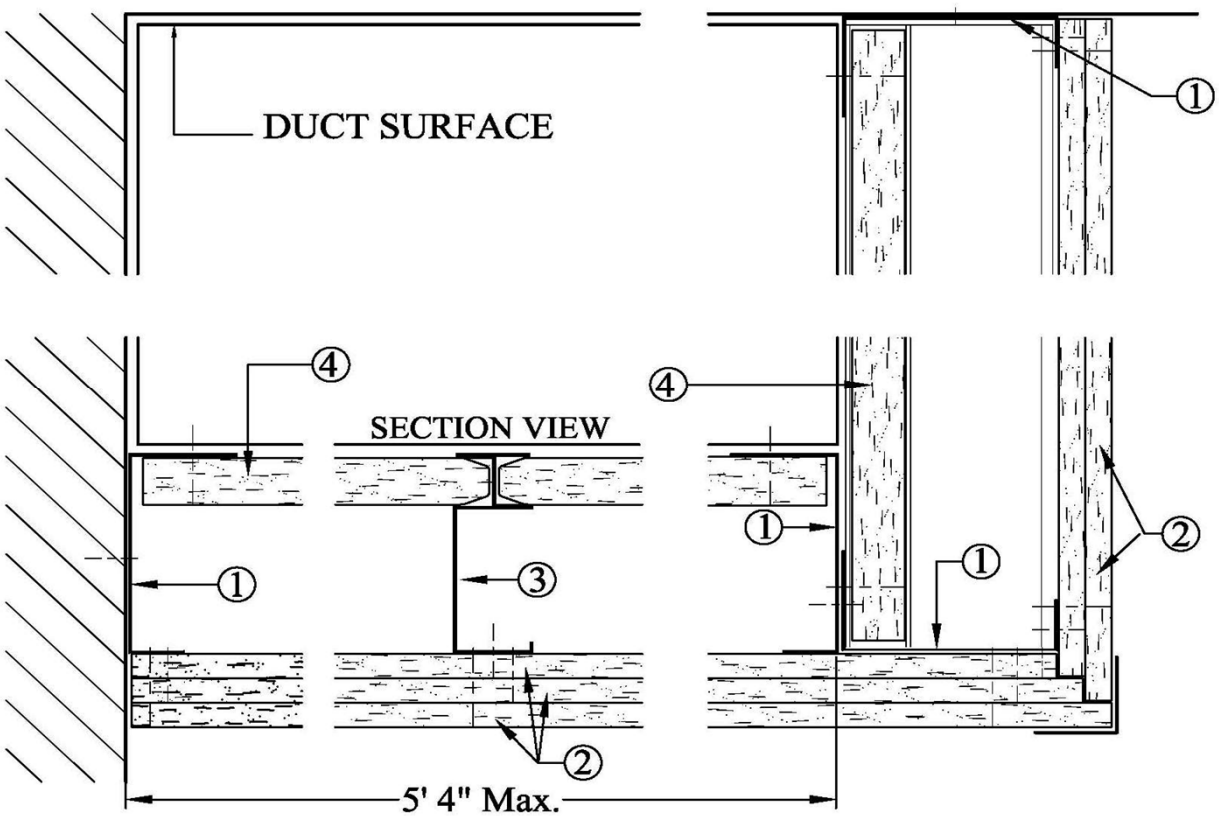
Two-Hour Horizontal Gypsum Duct Enclosure, See Figure 10

1. A minimum 2-1/2-in deep 24 gauge J-runners attached horizontally to the perimeter or boundary wall, with power actuated fasteners. Connection of the vertical C-H stud to the top J-runner and connection of the top J-runner to the structure shall be capable of carrying the weight of the duct enclosure and verified by a registered design professional.

2. Apply three (3) layers of 1/2-in (minimum) SHEETROCK® Brand FIRECODE® C Core Gypsum Panels to the underside "ceiling" side of the assembly. The base layer is attached with 1-in long Type S Screws that are spaced 24-in o.c. The second layer is attached with 1-5/8-in long Type S screws that are spaced 12-in o.c., with all the joints staggered 24in o.c. from the base layer. The face layer is attached perpendicular to the C-H Studs with 2-in long Type S screws that are spaced 12-in o.c. and the joints are staggered 24-in o.c. from the base layer.

3. Install the C-H studs perpendicular to the J-runners, spacing them 24-in o.c. with the C-section of the C-H stud facing downward towards the corridor side of the assembly with two (2) screws a minimum of 1/2-in long Type S-12 screws, one on each end.

4. 1-in thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.



2-Hour Horizontal Membrane or Metal Duct Enclosure[1,2]	
Triple layer 1/2-in gypsum panels	Maximum Span
All Stud Sizes	5-ft - 4-in

Notes:

1. Horizontal membrane maximum span based upon the maximum 5-ft - 4-in span tested in accordance with ASTM E119.
2. J-Runner connection to vertical C-H Stud shall consist of two #8 screws (or equivalent). J-Runner connection to wall/building shall meet the same requirments as the ceiling applications in Figures 8 and 9.

Figure 10 - Two Hour Horizontal Duct Enclosure Assembly and Limiting Spans

General Product Usage and Limitations

1. These products shall be installed in accordance with ASTM C 840 *Standard Specification for Application and Finishing of Gypsum Board,* and in accordance with USG Product Literature.

2. The USG SHEETROCK® Brand Cavity Shaftwall system is designed to enclose stairwalls, elevator shafts, mechanical components and other vertical shafts.

3. For horizontal ceiling and ductwork applications, please see manufacturer's product brochure *SA926 Shaft Wall Systems* .

4. Non-load bearing and limited to fire-resistance only. Structural and other requirements shall be in accordance with pertinent building code and manufacturer's requirements.

Product Labeling

Each assembled USG Drywall Shaft Partition System that is covered by this **AER**, must be marked with the following information:

Gypsum Board & Liner Panels:

1. USG Name
2. Product Name
3. Plant Identifier & Date Code
4. UL Classification (or equivalent) label for Firecode Resistance, surface burning characteristics and non-combustibility.

Steel C-H Studs:

1. Each bundle of steel studs contains a label with the steel gauge and yield strength.
2. Each stud is identified at a maximum spacing of 96-in with the manufacturer name, product code, minimum thickness, and yield strength.

Tested to

ICC-ES (Formerly ICBO) AC86 (1995) - Acceptance Criteria for determining limiting height of composite walls constructed of gypsum and steel studs to revision - Date: July, 1995.

ASTM E330-97 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Differences, following procedure A. (Test Reports 2004-0329 B-L were based on this test method)

ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials

Product Documentation

An Assembly Evaluation Service Agreement between *Pei* **Evaluation Service®** and United States Gypsum Company

USG Drywall Shaft Partition System Product Installation Guidelines - SA926-USA-ENG - Revised: 2/2017

Various Test Reports, Opinion Letters, & Third Party Product Listings Used as Verification of Fire Resistance, Abuse Resistance, and Transverse Load Capacity.

Various Engineering Calculations for Limiting Heights and Horizontal Spans.