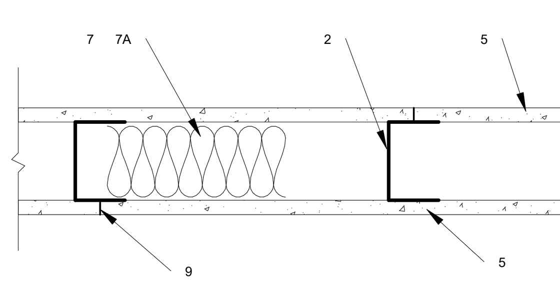
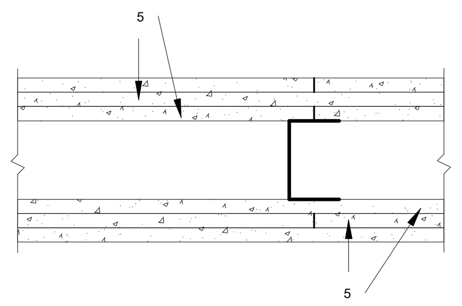
Design No. U423

October 10, 2017

Bearing Wall Ratings — 3/4 Hr, 1, 1-1/2 or 2 Hr (See Items 5 & 7)
This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide BXUV or BXUV7

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.





1. Floor and Ceiling Runners — (Not Shown) — Channel shaped, fabricated from min 0.0329 in., bare metal thickness (No. 20 MSG) corrosion-protected steel, that provide a sound structural connection between steel studs and adjacent assemblies such as floors, ceilings and/or other walls. Attached to floor and ceiling assemblies with steel fasteners spaced not greater than 24 in. OC.

1A. Floor and Ceiling Runners — (Not Shown, As an alternate to Item 1, For Use With Item 5A and 5C) — Channel shaped runners min 3-1/2 in. deep with 1-1/4 in. flanges fabricated from min No. 20 MSG corrosion-protected steel. Attached to floor and ceiling assemblies with steel fasteners spaced not greater than 24 in. OC.

2. Steel Studs — Min 0.0329 in., bare metal thickness (No. 20 MSG) corrosion-protected steel studs, min 3-1/2 in. wide, cold formed, designed in accordance with the current edition of the Specification for the Design of Cold-Formed Steel Structural Members by the American Iron and Steel Institute (AISI). All design details enhancing the structural integrity of the wall assembly, including the axial design load of the studs, shall be as specified by the steel stud designer and/or producer, and shall meet the requirements of all applicable local code agencies. The max stud spacing shall not exceed 24 in. OC. Studs attached to floor and ceiling runners with 1/2 in. long Type S-12 steel screws on both sides of the studs or by welded or bolted connections designed in accordance with the AISI specifications.

2A. Steel Studs — (As an alternate to Item 2, For use with Item 5A, 5C, 5D, and 5E) — Channel shaped, fabricated from min 20 MSG corrosion-protected or galv steel, 3-1/2 in. min width, min 1-1/2 in. flanges and 1/4 in. return, spaced a max of 16 in. OC. Studs friction-fit into floor and ceiling runners.

2B. Steel Studs — (As an alternate to Item 2 and 2A, For Use With Item 5B) — Min 0.0329 in., (No. 20 MSG) corrosion-protected cold formed steel studs, min 3-1/2 in. deep by 1-5/8 in. wide with 1/2 in. returns. Braced at mid-height and designed in accordance with the current edition of the Specification for the Design of Cold-Formed Steel Structural Members by the American Iron and Steel Institute (AISI). All design details enhancing the structural integrity of the wall assembly, including the axial design load of the studs, shall be as specified by the steel stud designer and/or producer, and shall meet the requirements of all applicable local code agencies. The max stud spacing shall not exceed 24 in. OC. Studs attached to floor and ceiling runners with 1/2 in. long Type S-12 steel screws on both sides of the studs or by welded or bolted connections designed in accordance with the AISI specifications.

2C. Framing Members - Steel Studs — (As an alternate to Item 2, For use with Item 5C) — Channel shaped, fabricated from min 20 MSG (0.0327 in. thick) corrosion-protected or galv steel, 3-1/2 in. min width, min 1-1/2 in. flanges and 1/4 in. return, spaced a max of 16 in. OC. Studs friction-fit into floor and ceiling runners. Studs to be cut 5/8 to 3/4 in. less than assembly height.

3. Lateral Support Members — (Not shown) — Where required for lateral support of studs, support shall be provided by means of steel straps, channels or other similar means as specified in the design of a particular steel stud wall system.

4. Wood Structural Panel Sheathing — (Optional, For use with Item 5 only) — (Not Shown) — 4 ft wide, 7/16 in. thick oriented strand board (OSB) or 15/32 in. thick structural 1 sheathing (plywood) complying with DOC PS1 or PS2, or APA Standard PRP-108, manufactured with exterior glue, applied horizontally or vertically to the steel studs. Vertical joints centered on studs, and staggered one stud space from wallboard joints. Attached to studs with flat-head self-drilling tapping screws with a min. head diam. of 0.292 in. at maximum 6 in. OC. in the perimeter and 12 in. OC. in the field. When used, gypsum panels attached over OSB or plywood panels and fastener lengths for gypsum panels increased by min. 1/2 in.

The maximum loading on the steel studs was evaluated with the steel studs braced at mid-height and not braced by the plywood sheathing.

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 when load is reduced to 90 percent of max stud capacity. When load is at 100 percent, horizontal edge joints and horizontal butt joints on opposite sides of studs staggered a min of 12 in. Horizontal edge joints and horizontal butt joints in adjacent layers (multilayer systems) staggered a min of 12 in. When used in widths other than 48 in., gypsum panels to be installed horizontally. The thickness and number of layers and percent of design load for the 45 min, 1 hr, 1-1/2 hr, and 2 hr ratings are as follows:

Wallboard Protection on Each Side of Wall

Rating	No. of Layers & Thkns of Panel	% of Design Load
45 Min	1 layer, 1/2 in. thick	100
1 hr	1 layer, 5/8 in. thick	100
1-1/2 hr	2 layer, 1/2 in. thick	100
2hr	2 layer, 5/8 in. thick	80
2hr@	2 layer, 5/8 in. thick	100
2hr	3 layer, 1/2 in. thick	100
2hr	2 layer, 3/4 in. thick	100

@Rating applicable when Batts and Blankets (Item 7) are used.

CGC INC — 1/2 in. thick Type IP-X2, IPC-AR, C, WRC, or; 5/8 in. thick Type SCX, SHX, WRX, IP-X1, AR, C, IP-AR, IP-X2, IPC-AR, ULX, or WRC; 3/4 in. thick Types AR, IP-AR, IP-X3, ULTRACODE

UNITED STATES GYPSUM CO — 1/2 in. thick Type C, IP-X2, IPC-AR, or WRC; 5/8 in. thick Type AR, C, FRX-G, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SGX, SHX, ULX, WRX, or WRC; 3/4 in. thick Types AR, IP-AR or IP-X3, ULTRACODE

USG BORAL DRYWALL SFZ LLC — 1/2 in. Type C; 5/8 in. Types C, SCX, SGX, ULTRACODE

USG MEXICO S A DE C V — 1/2 in. thick Type C, IP-X2, IPC-AR, WRC; 5/8 in. thick Type AR, C, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, ULX, WRX or WRC; 3/4 in. thick Types AR, IP-AR, IP-X3, ULTRACODE

5A. Gypsum Board* — (As an alternate to Item 5 when used as the base layer on one or both sides of wall, For direct attachment only, not to be used with Item 4) — Nom 5/8 in. or 3/4 in. may be used as alternate to all 5/8 in. or 3/4 in. shown in Item 5, Wallboard Protection on Each Side of Wall table. Nom 5/8 in. or 3/4 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over 20 MSG steel studs and staggered min 1 stud cavity on opposite sides of studs. See Items 1A, 2A 8, 8A(a). Wallboard secured to studs with 1-1/4 in. long Type S-12 steel screws spaced 8 in. OC at perimeter and 12 in. OC in the field. To be used with Lead Batten Strips (see Item 12) or Lead Discs or Tabs (see Item 13).

RAY-BAR ENGINEERING CORP — Type RB-LBG

5B. Gypsum Board* — (As an alternate to Items 5 and 5A) — Nom 5/8 in. thick gypsum panels with square edges, applied horizontally or vertically. For the1 hour single layer system -when the gypsum board panels are installed horizontally the joints are to be staggered by a minimum of 12 in. on opposite sides of assembly, they are to be secured on each side of the studs with 1-1/4 in. long Type S-12 bugle head steel screws spaced 8 in. OC to the top and bottom tracks and in the field with screws 1 in. and 4 in. from the horizontal joints. When the gypsum board panels are installed vertically all vertical joints must be centered over studs and staggered min 1 stud cavity on opposite sides of studs. Gypsum board secured to studs with 1-1/4 in. long Type S-12 steel screws spaced 8 in. OC to the top and bottom tracks and in the field with screws 1 in and 4 in. from the perimeter. For the 2 hour double layer system - when the gypsum board panels are installed horizontally the joints need not be staggered on opposite sides of assembly. Base layer secured on each side of the studs with 1-1/4 in. long Type S-12 bugle head steel screws spaced 16 in. OC to the top and bottom track and in the field with screws beginning 1 in. and 8 in. from the horizontal joints. Face layer horizontal joints staggered 8 in from base layer joints and secured with 1-5/8 in. long Type S-12 bugle head steel screws spaced 16 in. OC to the top and bottom tracks and in the field with screws beginning 1 in. and 8 in. from the horizontal joints. Face layer screws offset 8 in. from base layer screws. When the gypsum board panels are installed vertically all vertical joints must be centered over studs and staggered min 1 stud cavity on opposite sides of studs. Face layer gypsum boards secured to studs with 1-1/4 in. long Type S-12 steel screws spaced 16 in. OC with screws 2 in. and 16 in. from the perimeter. Base layer gypsum boards secured to studs with 1-1/4 in. long Type S-12 steel screws spaced 16 in. OC with screws 1-1/2 in and 8 in. from the perimeter. Face layer screws offset 8 in. from base layer screws.

CGC INC — Type USGX

UNITED STATES GYPSUM CO — 5/8 in. thick Type USGX (Joint tape and compound, Item 9, optional with Type USGX)

USG BORAL DRYWALL SFZ LLC — 5/8 in. thick Type USGX (Joint tape and compound, Item 9, optional with Type USGX)

USG MEXICO S A DE C V — Type USGX

5C. Gypsum Board* — (As an alternate to Item 5 when used as the base layer on one or both sides of wall, For direct attachment only, not to be used with Item 4) — Nominal 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-1/4 in. long Type S-12 (or #6 by 1-1/4 in. long bugle head fine driller) steel screws spaced 8 in. OC at perimeter and 12 in. OC in the field.

NEW ENGLAND LEAD BURNING CO INC, DBA NELCO — Nelco

5D. Gypsum Board* — (As an alternate to Item 5 when used as the base layer on one or both sides of wall, For direct attachment only, not to be used with Item 4) — Nom 5/8 or 3/4 in. may be used as alternate to all 5/8 or 3/4 in. shown in Item 5, Wallboard Protection on Each Side of Wall table. Nom 5/8 or 3/4 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over 20 MSG steel studs and staggered min 1 stud cavity on opposite sides of studs. See Items 1A, 2A 8, 8A(a). Wallboard secured to studs with 1-1/4 in. long Type S-12 steel screws spaced 8 in. OC at perimeter and 12 in. OC in the field. To be used with Lead Batten Strips (see Item 12A) or Lead Discs (see Item 13A).

MAYCO INDUSTRIES INC — Type X-Ray Shielded Gypsum

5E. Gypsum Board* — (As an alternate to Item 5 when used as the base layer on one or both sides of wall, For direct attachment only, not to be used with Item 4) — Nom 5/8 in. may be used as alternate to all 5/8. shown in Item 5, Wallboard Protection on Each Side of Wall table. Nom 5/8 in. or 3/4 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over 20 MSG steel studs and staggered min 1 stud cavity on opposite sides of studs. See Items 1A, 2A 8, 8A(a). Wallboard secured to studs with 1-1/4 in. long Type S-12 steel screws spaced 8 in. OC at perimeter and 12 in. OC in the field.. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 8 ft long with a max thickness of 0.14 in. placed on the face of studs and attached to the stud with construction adhesive and two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, nominal 3/8 in. diam by max 0.085 in. thick. Compression fitted or adhered over the screw heads. Lead batten strips and discs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C".

RADIATION PROTECTION PRODUCTS INC — Type RPP - Lead Lined Drywall

5F. 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. 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 between layers need not be staggered. When used in widths other than 48 in., gypsum panels to be installed horizontally. Insulation (Item 7D) required when using Type ULIX for the 1 hour Rating. The thickness and number of layers and percent of design load are as follows:

Wallboard Protection on Each Side of Wall

Rating	No. of layers & Thkns of Panel	% of Design Load
1 hr	1 layer,5/8 inch thick	100
2 hr	2 layers, 5/8 inch thick	80
2hr@	2 layers, 5/8 inch thick	100

@Rating applicable when Batts and Blankets (Item 7) are used.

UNITED STATES GYPSUM CO — 5/8 in. thick Type ULIX

6. Fasteners — (Not Shown) — For use with Item 5 and 5F - Type S-12 steel screws used to attach panels to runners (Item 1 or 1A) and studs (Item 2 or 2A) or furring channels (Item 8). 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 12 in. OC when panels are applied 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. and 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. thick panels, spaced 24 in. OC. Second layer- 1-5/8 in. long for 1/2 in. thick panels, spaced 24 in. OC. Third layer- 2-1/4 in. long for 1/2 in. thick panels, spaced 12 in. OC. Screws offset min 6 in. from layer below.

7. Batts and Blankets* — (Required as indicated under Item 5 and 5F) — Nom 2 in. thick mineral wool batts, friction fitted between studs and runners. See Batts and Blankets (BKNV or BZJZ) Categories for names of Classified companies.

7A. Batts and Blankets* — (Optional, Not Shown) — 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.

7B. Batts and Blankets* — (Optional, Not Shown) — Placed in stud cavities, glass fiber insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance.

OWENS CORNING — Type QuietZone Acoustic Batts

7C. Fiber, Sprayed* — (Optional) — As an alternate to Batts and Blankets (Item 7) — Not for use with Items 8A or 8B) — Spray applied mineral wool insulation. The fiber is applied with adhesive, at a minimum density of 4.0 pcf, to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. See Fiber, Sprayed (CCAZ).

AMERICAN ROCKWOOL MANUFACTURING, LLC — Type Rockwool Premium Plus

7D. Batts and Blankets* — Placed in stud cavities, any 3-1/2 in. thick glass fiber 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.

8. Furring Channels — (Optional on one or both sides, not shown, for single or double layer systems) — Resilient furring channels fabricated from min 25 MSG corrosion-protected steel, spaced vertically a max of 24 in. OC. Flange portion attached to each intersecting stud with 1/2 in. long Type S-12 panhead steel screws. Not for use with type FRX-G gypsum panels and Item 5A or 5C.

8A. Steel Framing Members (Not Shown)* — (Optional on one or both sides, not shown, for single or double layer systems) — As an alternate to Item 8, furring channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel. 2-9/16 in. or 2-23/32 in. wide by 7/8 in. deep, spaced max. 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Gypsum board attached to furring channels as described in Item 6. Not for use with type FRX-G gypsum panels and Item 5A or 5C.

b. **Steel Framing Members*** — Used to attach furring channels (Item 8a) to studs (Item 2). Clips spaced max. 48 in. OC., and secured to studs with No. 8 x 1-1/2 in. minimum self-drilling, S-12 steel screw through the center grommet. Furring channels are friction fitted into clips. RSIC-1 clip for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) clip for use with 2-23/32 in. wide furring channels.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-1 (2.75).

8B. Steel Framing Members* — (Not Shown) — (Optional on one or both sides, not shown, for single or double layer systems) — As an alternate to Item 8, furring channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel. 2-3/8 in. wide by 7/8 in. deep, spaced max. 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Gypsum board attached to furring channels as described in Item 6. Not for use with type FRX-G gypsum panels and Item 5A or 5C.

b. **Steel Framing Members*** — Used to attach furring channels to studs (Item 2). Clips spaced max. 48 in. OC., and secured to studs with No. 8 x 1-1/2 in. minimum self-drilling, S-12 steel screw through the center grommet. Furring channels are friction fitted into clips.

PLITEQ INC — Type GENIECLIP

8C. Steel Framing Members* — (Not Shown) — (Optional on one or both sides, not shown, for single or double layer systems) — As an alternate to Item 8, furring channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel, spaced max. 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 AWG galvanized steel wire. Gypsum board attached to furring channels as described in Item 6. Not for use with type FRX-G gypsum panels and Item 5A or 5C.

b. **Steel Framing Members*** — Used to attach furring channels to studs (Item 2). Clips spaced max. 48 in. OC., and secured to studs with 2 in. coarse drywall screw with 1 in. diam washer through the center hole. Furring channels are friction fitted into clips.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237R

9. Joint Tape and Compound — Vinyl or casein, dry or premixed joint compound applied in two coats to joints and screw heads of outer layers. Paper tape, nom 2 in. wide, embedded in first layer of compound over all joints of outer layers. Paper tape and joint compound may be omitted when gypsum boards are supplied with square edges.

10. Siding, Brick or Stucco — (Optional, Not Shown) — Aluminum, vinyl or steel siding, brick veneer or stucco, meeting the requirements of local code agencies. Brick veneer attached to studs with corrugated metal wall ties attached to each stud with steel screws, not more than each sixth course of brick.

11. Caulking and Sealants* — (Optional, Not Shown) — A bead of acoustical sealant applied around the partition perimeter for sound control.

UNITED STATES GYPSUM CO — Type AS

12. Lead Batten Strips — (Not Shown, For Use With Item 5A) — Lead batten strips, min 1-1/2 in. wide, max 10 ft long with a max thickness of 0.125 in. Strips placed on the interior face of studs and attached from the exterior face of the stud with two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead batten strips to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Lead batten strips required behind vertical joints of lead backed gypsum wallboard (Item 5A) and optional at remaining stud locations. Required behind vertical joints.

12A. Lead Batten Strips — (Not Shown, for use with Item 5D) — Lead batten strips, 2 in. wide, max 10 ft long with a max thickness of 0.140 in. Strips placed on the face of studs and attached to the stud with two min. 1 in. long min. Type S-8 pan head steel screws, one at the top of the strip and one at the bottom of the strip or with one min. 1 in. long min. Type S-8 pan head steel screw at the top of the strip. Lead batten strips to have a purity of 99.5% meeting the Federal specification QQ-L-201f, Grades "B, C or D". Lead batten strips required behind vertical joints of lead backed gypsum wallboard (Item 6) and optional at remaining stud locations.

13. Lead Discs or Tabs — (Not Shown, For Use With Item 5A) — Used in lieu of or in addition to the lead batten strips (Item 12) or optional at other locations - Max 3/4 in. diam by max 0.125 in. thick lead discs compression fitted or adhered over steel screw heads or max 1/2 in. by 1-1/4 in. by max 0.125 in. thick lead tabs placed on gypsum boards (Item 5A) underneath screw locations prior to the installation of the screws. Lead discs or tabs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C".

13A. Lead Discs — (Not Shown, for use with Item 5D) — Max 5/16 in. diam by max 0.140 in. thick lead discs compression fitted or adhered over steel screw heads. Lead discs to have a purity of 99.5% meeting the Federal Specification QQ-L-201f, Grades "B, C or D".

14. Lead Batten Strips — (Not Shown, For Use With Item 5C) — Lead batten strips, 2 in. wide, max 10 ft long with a max thickness of 0.142 in. Strips placed on the face of studs and attached to the stud with two min. 1 in. long min. Type S-8 pan head steel screws, one at the top of the strip and one at the bottom of the strip or with one min. 1 in. long min. Type S-8 pan head steel screw at the top of the strip. Lead batten strips to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Lead batten strips required behind vertical joints of lead backed gypsum wallboard (Item 5C) and optional at remaining stud locations.

15. Lead Tabs — (Not Shown, For Use With Item 5C) — 2 in. wide, 5 in. long with a max thickness of 0.142 in. Tabs friction-fit around front face of stud, the stud folded back flange, and the back face of the stud. Tabs required at each location where a screw (that secures the gypsum boards, Item 5C) will penetrate the steel stud. Lead tabs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Lead tabs may be held in place with standard adhesive tape if necessary.

16. Wall and Partition Facings and Accessories* — (Optional, Not Shown) — For use with Item 1, Item 2 to 2C, Item 3, Item 5,Item 6, Item 7A, Item 8 and Item 9. For a maximum fire rating of 1 hour. On one side of the wall, over the first layer of Gypsum Board (Item 5), install RefleXor membrane with the gold side facing outwards. Membrane installed with T50 staples spaced 12 inches on center in both directions as per manufacturer's instructions, seams in membrane to be overlapped by 2 inches. When RefleXor membrane is used an additional layer of Gypsum Board identical to the one used in the first layer and as specified in Item 5 shall be installed over the membrane. Additional layer of Gypsum Board to be installed through the membrane to the stud as specified in Item 5 except the fastener length shall be increased by a minimum of 5/8 inch. Install Batts and Blankets in the stud cavity as per Item 7A. On the other side of the wall prior to the installation of the Gypsum Board install Resilient Channels as per Item 8. Over the Resilient Channels install 3/4 inch thick SONOpan panel secured to the Resilient Channels with drywall screws and washers spaced at 16 in. OC on the perimeter of the panel and 8 in. OC in the field of the panel. Over the SONOpan panel install the same Gypsum Board as specified in Item 5 with the fastener length increased by minimum 3/4 inch. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

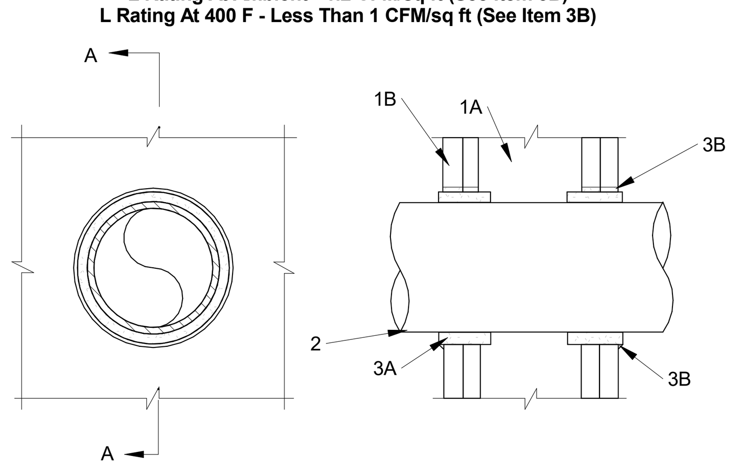
MSL — RefleXor membrane, SONOpan panel.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

System No. W-L-2406

November 29, 2005

F Ratings — 1 and 2 Hr (See Item 1)
T Ratings — 0, 1/2 and 3/4 Hr (See Item 2)
L Rating At Ambient - 1.2 CFM/sq ft (See Item 3B)
L Rating At 400 F - Less Than 1 CFM/sq ft (See Item 3B)



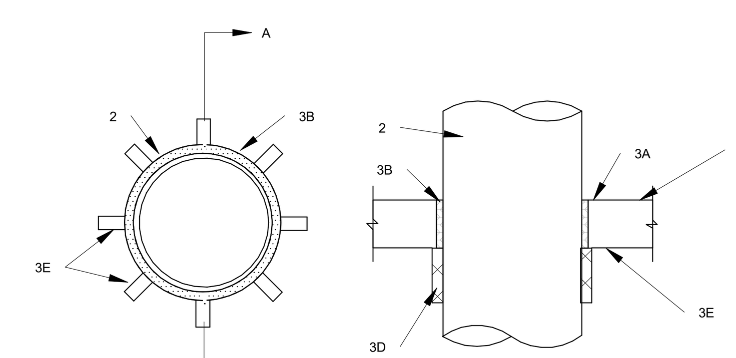
1. **Wall Assembly —** The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
A. **Studs —** Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
B. **Gypsum Board* —** One or two layers of nom 5/8 in. (16 mm) thick gypsum board, as specified in the individual Wall and Partition Design. See Table under Item 3B for max diam of opening.
2. **Through-Penetrants —** One nonmetallic pipe installed within the firestop system. See Table under Item 3B for annular space required in the firestop system. Pipe to be rigidly supported on both sides of wall assembly. The following types and sizes of nonmetallic pipes may be used:
A. **Polyvinyl Chloride (PVC) Pipe —** Nom 6 in. (152 mm) diam (or smaller) Schedule 40 cellular or solid core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.
B. **Chlorinated Polyvinyl Chloride (CPVC) Pipe —** Nom 6 in. (152 mm) diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping system.
C. **Acrylonitrile Butadiene Styrene (ABS) Pipe —** Nom 4 in. (102 mm) diam (or smaller) Schedule 40 cellular or solid core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.
The T Rating for 2 hr fire-rated walls is 0 hr. The T Rating for 1 hr fire-rated walls is 3/4 hr for nom 1-1/2, 2 and 3 in. (38, 51 and 76 mm) diam through penetrants. The T Rating for 1 hr fire-rated walls is 1/2 hr for nom 4 and 6 in. (102 and 152 mm) diam through penetrants.
3. **Firestop System —** The firestop system shall consist of the following:
A. **Fill, Void or Cavity Material* — Wrap Strip —** See Table under Item 3B for min size of intumescent wrap strip. The wrap strip is continuously wrapped around the outer circumference of the pipe once and slid into the annular space such that approx 1/8 in. (3 mm) of the wrap strip protrudes from the wall surface. Wrap strip is held in place with integral fastening tape. Wrap strip installed on each surface of wall.
HILTI CONSTRUCTION CHEMICALS, DIV OF
HILTI INC — CP 648S - 1.5" US, CP 648S - 2" US, CP 648S - 3" US, CP 648S - 4" US and CP 648S - 6" US
B. **Fill, Void or Cavity Material* — Caulk —** Min 1/4 in. (6 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. For 2 hr fire-rated walls, 1/4 in. (6 mm) bead fill material also applied at wrap strip/gypsum wall interface. In 1 hr fire-rated walls, fill material is optional for nom 1-1/2, 2, 3 and 4 in. (38, 51, 76 and 102 mm) diam penetrants. In 2 hr fire-rated walls, fill material is optional for nom 1-1/2, 2 and 3 in. (38, 51 and 76 mm) diam penetrants. Fill material is required to be used to attain L Ratings.
HILTI CONSTRUCTION CHEMICALS, DIV OF
HILTI INC — FS-One Sealant

Nom Pipe Diam, in. (mm)	Wrap Strip	Wrap Strip Size, thick. x width, in. (mm)	Max Diam of Opening, in. (mm)	Annular Space, in. (mm)	
				Min	Max
1 1/2 (38)	CP 648s- 1.5" US	3/16 x 1 (5x25))	2 3/8 (60)	3/16 (5)	5/16 (8)
2 (51)	CP 648s - 2" US	3/16 x 1 (5 x 25)	3 (76)	3/16 (5)	5/16 (8)
3 (76)	CP 648S -3" US	3/16 x 1 -3/4 (5 x 44)	4 (102)	3/16 (5)	5/16 (8)
4 (102)	CP 648S - 4" US	3/8 x 1 3/4 (10 x 44)	5 3/8 (137)	3/8 (10)	1/2 (13)
6 (152)	CP 648S -6" US	1/2 x 1 3/4 (13 x 44)	8 (203)	9/16 (14)	13/16 (21)

System No. C-AJ-2362

December 08, 2008

F Rating — 2 Hr
T Rating — 2 Hr
L Rating At Ambient — Less Than 1 CFM/sq ft
L Rating At 400 F — Less Than 1 CFM/sq ft



Section A-A

1. **Floor or Wall Assembly —** Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks***. Max diam of opening is 14 in. (356 mm).
See **Concrete Blocks** (CAZT) category in the Fire Resistance Directory for names of manufacturers.

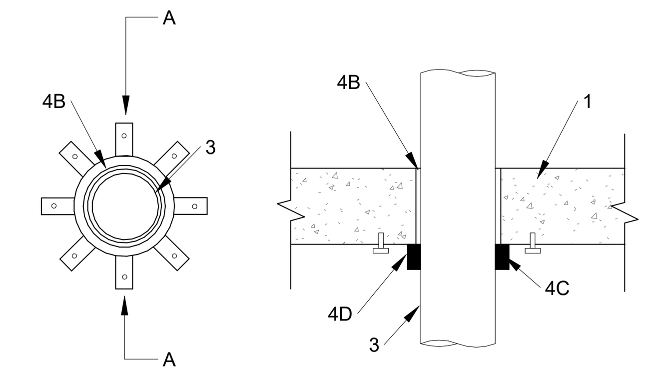
2. **Through Penetrants —** One nonmetallic pipe to be installed within the opening. A nom annular space of 5/8 in. (16 mm) is required within the firestop system. Pipe to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of nonmetallic pipe may be used:
A. **Polyvinyl Chloride (PVC) Pipe —** Nom 12 in. (305 mm) diam (or smaller) Schedule 40 solid core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
B. **Chlorinated Polyvinyl Chloride (CPVC) Pipe —** Nom 12 in. (305 mm) diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping systems.

3. **Firestop System —** The firestop system shall consist of the following:
A. **Packing Material —** Min 4 in. (102 mm) thickness of 4 pcf (64 kg/m3) mineral wool firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or from both surfaces of wall as required to accommodate the required thickness of fill material.
B. **Fill, Void or Cavity Material — Sealant or Putty —** Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall assembly.
SPECIFIED TECHNOLOGIES INC — SpecSeal Series SSS Sealant, SpecSeal LCI Sealant or SpecSeal Putty
C. **Aluminum Foil Tape —** (Not Shown) — Nom 3 mil (0.08 mm) thick pressure sensitive aluminum foil tape wrapped around the outer circumference of the through penetrant with a 1 in. (25 mm) wide overlap along its perimeter joint. Foil tape shall abut against the bottom surface of the concrete floor or both surfaces of the wall and extend a min 6 in. below the bottom surface of the concrete floor or both surfaces of the wall.
D. **Fill, Void or Cavity Materials* — Wrap Strip —** Nom 1/8 in. (3.2 mm) or 3/16 in. (4.8 mm) thick intumescent material faced on both sides with a plastic film, supplied in 2 in. (51 mm) wide strips. Two and one-half stacks ((5 in. (127 mm) stack height)) of wrap strips are individually or continuously wrapped around the through penetrant. Each stack shall consist of five layers. When wrap strips are individually wrapped, ends of wrap strips shall be butted and held in place with tape. Butted ends in successive layers may be aligned or offset. The edge of the wrap strips shall abut the surface of the concrete floor or wall assembly. In floors, the two and one-half stacks of wrap strips are installed on the bottom side of the concrete floor. In wall assemblies, the two and one-half stacks of wrap strips are installed on each side of the concrete wall.
SPECIFIED TECHNOLOGIES INC — SpecSeal BLU Wrap Strip or SpecSeal BLU2 Wrap Strip
E. **Steel Collar —** Collar fabricated from coils of precut 0.029 in. (0.7 mm) thick (No. 22 MSG) galv sheet steel available from wrap strip manufacturer. Collar shall be nom 5 in. (127 mm) deep with a min of six 1 in. (25 mm) wide by 2 in. (51 mm) long anchor tabs for securement to the concrete floor or wall. Retainer tabs, 3/4 in. (19 mm) wide tapering down to 1/4 in. (6 mm) wide and located opposite the anchor tabs, are folded 90 degrees toward through penetrant surface to maintain the annular space around wrap strips and through penetrant and to retain the wrap strips. Steel collar wrapped around wrap strips and through penetrant with a 1 in. (25 mm) wide overlap along its perimeter joint. Steel collar tightened around wrap strips and through penetrant using min 1/2 in. (13 mm) wide by 0.028 in. (0.7 mm) thick stainless steel hose clamps located 1 in. (25 mm) and 4 in. (102 mm) from concrete surface. Collar secured to concrete surface with 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long steel concrete screws in conjunction with min 1 in. (25 mm) diam steel fender washers through each of a min of six symmetrically-located anchor tabs. As an alternate to the steel concrete screws, nom 1-1/4 in. (32 mm) long steel powder actuated fasteners provided with 3/4 in. (19 mm) diam steel washers may be used to secure anchor tabs.
*Bearing the UL Classification Mark

System No. C-AJ-2297

March 18, 2014

F Ratings — 2 and 3 Hr (See Item 4C)
T Ratings — 0, 1, 2 and 3 Hr (See Item 4C)
L Rating At Ambient — Less Than 1 CFM/sq ft
L Rating At 400 F — Less Than 1 CFM/sq ft
W Rating — Class 1 (See Item 4B)



1. Floor or Wall Assembly — Lightweight or normal weight (100-150 pcf or 1600-2400 kg/ m3) concrete. Except as footnoted in the table under Item 4C, min thickness of concrete floor or wall assembly is 4-1/2 in. (114 mm). Floor may also be constructed of any min 6 in. (152 mm) thick hollow-core Precast Concrete Units*. Wall may also be constructed of any UL Classified Concrete Blocks*. Diam of opening to be min 1/8 in. (3.2 mm) to max 1-1/2 in. (38 mm) larger than outside diam of pipe or conduit.

See Concrete Blocks (CAZT) or Precast Concrete Units (CFTV) categories in the Fire Resistance Directory for names of manufacturers.

2. Steel Sleeve — (Optional, Not Shown) - Nom 5 in. (127 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe or nom 5 in. (127 mm) diam (or smaller) No. 26 ga (0.022 in. or 0.56 mm thick) sheet steel sleeve with nom 2 in. wide square or circular anchor flange spot welded to the sleeve at it's approx mid-height. Sleeve cast or grouted into min 4-1/2 in. (114 mm) thick floor or wall assembly, flush with floor or wall surfaces.

3. Through Penetrant — One nonmetallic pipe or conduit to be installed eccentrically or concentrically within the firestop system. Pipe or conduit to be rigidly supported on both sides of the floor or wall assembly. The following types and sizes of nonmetallic pipes or conduits may be used:

A. Polyvinyl Chloride (PVC) Pipe — Nom 6 in. (152 mm) diam (or smaller) solid or cellular core Schedule 40 polyvinyl chloride (PVC) pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

B. Chlorinated Polyvinyl Chloride (CPVC) Pipe — Nom 6 in. (152 mm) diam (or smaller) SDR 13.5 chlorinated polyvinyl chloride (CPVC) pipe for use in closed (process or supply) piping systems.

C. Rigid Nonmetallic Conduit+ — Nom 6 in. (152 mm) diam (or smaller) Schedule 40 PVC conduit installed in accordance with Article 347 of the National Electrical Code (NFPA 70).

D. Acrylonitrile Butadiene Styrene (ABS) Pipe — Nom 6 in. (152 mm) diam (or smaller) solid or cellular core Schedule 40 acrylonitrile butadiene styrene (ABS) pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

E. Fire Retardant Polypropylene (FRPP) Pipe — Nom 6 in. (152 mm) diam (or smaller) solid or cellular core Schedule 40 fire retardant polypropylene (FRPP) pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

F. High Density Polyethylene (HDPE) Pipe — Nom 4 in. (102 mm) diam (or smaller) Schedule 40 HDPE pipe for use in closed (process or supply) piping systems.

4. Firestop System — The firestop system shall consist of the following:

A. Packing Material — (Not Shown) - When required, min 4 pcf (64 kg/m3) mineral wool batt insulation compressed and installed to the thickness specified in the table under Item 4C. Packing material to be recessed from top surface of floor or both surfaces of wall as required to accommodate sealant (Item 4B).

B. Fill, Void or Cavity Material* - Sealant or Putty — Fill material installed flush with top surface of floor or both surfaces of wall, as specified in the table under Item 4C.

SPECIFIED TECHNOLOGIES INC — SpecSeal LCI Sealant, SpecSeal Series SSS Sealant, SpecSeal Putty, Pensil 300 Sealant or SpecSeal Series SIL300 Sealant for floors or walls and Pensil 300 S/L Sealant or SpecSeal Series SIL300 Sealant for floors only.

W Rating applies only when a min 1/2 in. (13 mm) depth of Pensil 300, SpecSeal Series SIL300 Sealant ,Pensil 300 S/L or SpecSeal Series SIL300SL Sealants are used.

C. Fill, Void or Cavity Material* - Wrap Strip — Nom 1/8 in. (3.2 mm) by 1-1/2 in. (38 mm) wide (RED2), nom 1/4 in. (6 mm) thick by 1-1/2 in. (38 mm) wide (RED), 3/16 in. (4.8 mm) by 2 in. (51 mm) wide (BLU) or 1/8 in. (3.2 mm) by 2 in. (51 mm) wide (BLU2) intumescent strips faced on both sides with a plastic film. Strips tightly wrapped around nonmetallic pipe with edges butted against the underside of the floor or both surfaces of the wall. The wrap strips may be installed with butted seams with butted seams in successive layers aligned or offset or continuously wrapped around through penetrant. Wrap strips are temporarily held in place with masking tape. The min number of layers required is dependent upon the pipe type, nom pipe diam, floor or wall thickness and the hourly F and T Ratings required, as shown in the following table:

Pipe type	Max Pipe Diam, in. (mm)	Min Concrete Thickness, in. (mm)	Wrap Strip Type	Min No. of Wrap Strip Layers	F Rating, hr	T rating hr,	Min Packing Material Depth, in. (mm)	Min Fill Material Depth, in. (mm)	Max Annular Space, in. (mm)
PVC, ccPVC, CPVC, RNC, ABS, ccABS	2(51)	2-1/2 (64)	RED, RED2, BLU or BLU2	1	2	1	N/A	1/2 (13)	1/16(1.6)
HDPE	2(51)	2-1/2 (64)	RED, RED2, BLU or BLU2	1	2	2	N/A	1/2 (13)	1/16 (1.6)
PVC, ccPVC, CPVC, RNC, ABS, ccABS	2(51)	2-1/2 (64)	RED, RED2, BLU or BLU2	1	2	1	2(51)	1/2 (13)	3/4 (19)
HDPE	2(51)	2-1/2 (64)	RED, RED2, BLU or BLU2	1	2	2	2(51)	1/2 (13)	3/4 (19)
PVC, ccPVC, CPVC, RNC, ABS, ccABS	4 (102)	2-1/2 (64)	RED, RED2, BLU or BLU2	2	2	1	2(51)	1/2 (13)	3/4 (19)
HDPE	4(102)	2-1/2 (64)	RED, RED2, BLU or BLU2	2	2	2	2(51)	1/2(13)	3/4 (19)
PVC, ccPVC, CPVC, RNC,	2(51)	4-1/2 (114)	RED, RED2, BLU or BLU2	1	3	2	N/A	1/4(6)	1/4 (6)
HDPE	2(51)	4-1/2 (114)	RED, RED2, BLU or BLU2	1	2	2	N/A	1/4 (6)	1/4 (6)
PVC, ccPVC, CPVC, RNC,	3(76)	4-1/2 (114)	RED, RED2, BLU or BLU2	2	3	2	N/A	1/4(6)	1/4 (6)
HDPE	3(76)	4-1/2 (114)	RED, RED2, BLU or BLU2	2	2	2	N/A	1/4(6)	1/4 (6)
PVC, ccPVC, CPVC, RNC,	4(102)	4-1/2 (114)	RED, RED2, BLU or BLU2	3	3	2	N/A	1/4 (6)	1/4 (6)
HDPE	4(102)	4-1/2 (114)	RED, RED2, BLU or BLU2	3	2	2	N/A	1/4 (6)	1/4 (6)
PVC, ccPVC, CPVC, RNC,	6(152)	4-1/2 (114)	RED, RED2,	3(a)	3	0	N/A	1/4(6)	1/2 (13)
PVC, ccPVC, RNC,	6(152)	4-1/2 (114)	RED, RED2, BLU or BLU2	4*	3	3	4(102)	1/2 (13)	1/4 (6)
PVC, ccPVC, CPVC, RNC, FRPP	6 (152)	4-1/2 (114)	BLU or BLU2	3(a)	3	2	N/A	1/4 (6)	3/16 (4.8)
ABS, ccABS	2(51)	4-1/2 (114)	RED, RED2,	1	3	0	N/A	1/4 (6)	1/2 (13)
ABS, ccABS	2(51)	4-1/2 (114)	BLU or BLU2	1	3	2	N/A	1/4 (6)	1/2 (13)
ABS, ccABS	3(76)	4-1/2 (114)	RED, RED2,	2	2	0	N/A	1/4 (6)	1/2 (13)
ABS, ccABS	3(76)	4-1/2 (114)	BLU or BLU2	2	3	2	N/A	1/4 (6)	1/2 (13)
ABS, ccABS	4(102)	4-1/2 (114)	RED, RED2,	3	2	0	N/A	1/4 (6)	1/2 (13)
ABS, ccABS	6(102)	4-1/2 (114)	BLU or BLU2	3	3	2	N/A	1/4 (6)	1/2 (13)
ABS, ccABS	6(152)	4-1/2 (114)	RED, RED2, BLU or BLU2	4*	2	2	4(102)	1/2 (13)	1/4 (6)
ABS, ccABS	6(152)	4-1/2 (114)	RED, RED2,	3(a)	3	0	N/A	1/2 (13)	3/8 (10)
ABS, ccABS FRPP	6(152)	4-1/2 (114)	BLU or BLU2	3(a)	3	3	N/A	1/2 (13)	3/8 (10)

(a) Where indicated, two sets of three wrap strip layers are "stacked" to attain a 3 in. (76 mm) wrap strip width for RED or RED2 wrap strip or a 4 in. (102 mm) wrap strip width for BLU or BLU2 wrap strip

* One stack of four layers of wrap strip, two layers of steel collar. See Item 4D.

SPECIFIED TECHNOLOGIES INC — SpecSeal RED Wrap Strip, SpecSeal RED2 Wrap Strip, SpecSeal BLU Wrap Strip or SpecSeal BLU2 Wrap Strip

C1. Fill, Void, or Cavity Material - Wrap Strip — (Not Shown) - As an alternate to Item 4C for nom 2 in., 3 in. and 4 in. (51, 76 and 102 mm) diam pipes, precut intumescent wrap strip faced on both sides with a plastic film sized to fit the OD of the pipe. The size of the intumescent wrap strip for each pipe size is tabulated below:

Nom Pipe Diam, in. (mm)	Wrap Strip	Wrap Strip Size, thick. x width x length, in. (mm)
2 (51)	SSW125	1/8 x 1-1/2 x 8-1/8 (3 x 38 x 206)
3 (76)	SSW250	1/4 x 1-1/2 x 12-1/8 (6 x 38 x 308)
4 (102)	SSW375	3/8 x 1-1/2 x 16 (10 x 38 x 406)

SPECIFIED TECHNOLOGIES INC — SpecSeal SSW125, SSW250, or SSW375 Wrap Strip

D. Steel Collar — Nom 1-1/2 in. (38 mm), 2 in. (51 mm), 3 in. (76 mm) or 4 in. (102 mm) deep collar, dependent upon wrap strip width, with 1 in. (25 mm) wide by 2 in. (51 mm) long anchor tabs for attachment to concrete and min 3/4 in. (19 mm) wide retaining tabs tapering down to 1/4 in. (6 mm) wide and located opposite the anchor tabs. Steel collar, with anchor tabs bent outward 90 deg, wrapped tightly around wrap strip layers with min 1 in. (25 mm) overlap at seam. Retainer tabs to be bent 90 deg toward pipe to lock wrap strips in position. Anchor tabs to be pressed tightly against floor or wall surface(s), and collar to be secured in place with one 1/2 in. (13 mm) wide by 0.028 in. (0.7 mm) thick stainless steel hose clamp. Two band clamps are required for 3 in. high (or higher) collar on 6 in. (152 mm) pipe. As an alternate to the hose clamps on 1-1/2 in. (38 mm) and 2 in. (51 mm) deep collar, collar secured together by means of three No. 8 by 1/4 in. (6 mm) long steel screws. Collar to be secured to floor or wall surface(s) with 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long steel concrete screws in conjunction with min 1 in. (25 mm) diam steel fender washers. As an alternate to the steel concrete screws, nom 1-1/4 in. (32 mm) long steel powder actuated fasteners provided with 3/4 in. (19 mm) diam steel washers or nom 3/4 in. (19 mm) long steel powder actuated fasteners provided with 1 in. (25 mm) diam steel washers may be used to secure anchor tabs. The number of fasteners is dependent upon the nom diam of the through penetrant. Min two fasteners , symmetrically located, are required for nom 1-1/2 in. (38 mm) through 2 in. (51 mm) diam through penetrants. Min three fasteners , symmetrically located, are required for nom 2-1/2 in. (64 mm) through 3 in. (76 mm) diam through penetrants. Min four fasteners , symmetrically located, are required for nom 3-1/2 in. (89 mm) through 4 in. (102 mm) diam through penetrants. Min six fasteners , symmetrically located, are required for nom 6 in. (152 mm) diam through penetrants.
*When using one stack of four layers of wrap strip for nom 6 in. (152 mm) diam pipes, two layers of nom 1-1/2 or 2 in. (38 or 51 mm) deep collar (dependent upon wrap strip width) is to be wrapped around wrap strip and penetrant with min 1 in. (25 mm) overlap.

E. Firestop Device* — (Not Shown) - As an alternate to Items C and D, a firestop device consisting of a galv steel collar lined with an intumescent material sized to fit the specific diam of the through penetrant may be used. Device shall be installed around through-penetrant in accordance with the accompanying installation instructions. Device incorporates anchor tabs for securement to bottom surface of floor or both surfaces of wall assembly by means of 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long steel concrete screws in conjunction with min 1 in. (25 mm) diam steel fender washers. As an alternate to the steel concrete screws, nom 1-1/4 in. (32 mm) long steel powder actuated fasteners provided with 3/4 in. (19 mm) diam steel washers or nom 3/4 in. (19 mm) long steel powder actuated fasteners provided with 1 in. (25 mm) diam steel washers may be used to secure anchor tabs.
SPECIFIED TECHNOLOGIES INC — SpecSeal Firestop Collar, SpecSeal LCC Firestop Collar or SpecSeal SSC Collar.

+Bearing the UL Listing Mark

O 281 410 1349
www.wsquaredarch.com

W [SQUARED] ARCHITECTS

ISSUES AND REVISIONS

NO	DATE	DESCRIPTION
A	19 JUL 22	ISSUE FOR PERMIT
B	19 AUG 16	ISSUE FOR BID

REGISTERED ARCHITECT SHANE C. WILSON 25235 STATE OF TEXAS

2019 AUG 16

GH SCHOOL
4780 N MAIN STREET

SHEET TITLE

FIRE RATED ASSEMBLIES

SHEET NUMBER

G102

PROJECT # A041

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Architect shall own the overall conceptual design prepared and developed for the project on the intangible exclusive rights or copyright therein.