

2-hr. Fire Rated Wall Construction Overview



County of Henrico Building Inspections

Table of Contents

1. List of common 2-hr. rated walls
 2. What are the major differences between the 4 manufacturer's 2-hr. rated walls?
 3. What exactly gives you the 2-hr. rating in a rated wall?
 4. Maintaining the $\frac{3}{4}$ " air gap for the U347 wall
 5. Wall clips
 6. Fireblocking between the floor joist and the 2-hr. rated wall
 7. Stand-up showers/bathtubs adjacent to the rated wall
 8. Mix-and-matching shaft liners from different manufacturers in a rated wall
 9. Tradesmen's work located in the rated assembly
 10. Installing a vapor barrier between the $\frac{1}{2}$ " gyp. and stud wall framing
 11. Protecting the fire-rated wall in attic and/or crawlspaces
 12. Attaching siding/brick veneer at roof/wall offsets
 13. Exterior vented soffits (under roof overhangs) adjacent to the rated wall
 14. Using faced or unfaced batt insulation in the walls
 15. STC ratings
- Appendix: A) Firewall Comparisons B) Construction Methods at Offsets

1. List of common 2-hr. rated walls

U336 - USG

U347 - National Gypsum

U373 - Georgia Pacific

U366 - Certainteed

2. What are the major differences between the 4 manufacturer's 2-hr rated walls?

- Maximum wall height permitted for the rated wall
- Optional use of steel studs in lieu of wood studs
- Fastening schedule of $\frac{1}{2}$ " gypsum to stud wall
- Wall clip spacing
- The shaft liner is produced by a specific manufacturer and is thus specific to the manufacturer's 2-hr. rated wall

See attached "Firewall Comparisons" document in Appendix A.

3. What exactly gives you the 2-hr. rating in a rated wall?

The two layers of 1" gypsum shaft liner provides the 2 hour rating, and maintaining the $\frac{3}{4}$ " air gap is as important as the 2 hour rated wall (National Gypsum's representative says the shaft liner and the $\frac{3}{4}$ " air gap is the "rated assembly".) Beyond the $\frac{3}{4}$ " air gap, the wood stud wall, the $\frac{1}{2}$ " layer of gypsum on the outside of the wall, and any insulation (mineral or fiberglass) in the stud wall cavity is not as critical.

4. Maintaining the $\frac{3}{4}$ " air gap for the U347 wall

For National Gypsum's 2-hr. rated wall, if the $\frac{3}{4}$ " air gap cannot be maintained between the H-stud and the wood stud wall (ie. the gap is less than $\frac{3}{4}$ "), then a $\frac{1}{2}$ " x 6" wide strip of Gold Bond Fire-Shield G gypsum wallboard may screw-attached to the H-stud to provide a layer of protection.

If the $\frac{3}{4}$ " air gap cannot be maintained on another manufacturer's wall assembly (ie. USG, GP), we will allow the use of a strip of $\frac{1}{2}$ " type X gypsum to be used on the H-studs in lieu of the $\frac{3}{4}$ " air gap.

5. Wall clips

Wall clips should be attached to the metal H-stud framing with 3/8" Type S pan head screws and attached to the wood stud with a 1 $\frac{1}{4}$ " Type W screw. One screw is required in the H-stud and one screw in the wood stud. The extra holes in the clip are there for when a hole does not line up with a stud, and thus you can choose another hole in the clip that does line up with the stud to secure the clip to. The clip may be manipulated (ie. bent, straightened, added on to, etc.) to connect the stud wall to the H-stud.

Wall clips are to be spaced 24" O.C. horizontally max. (ie. one clip per H-stud).

6. Fireblocking between the floor joist and the 2-hr. rated wall

The manufacturers' literature for all four rated walls show fireblocking located between the floor joist and the rated wall for the full depth of the

joist. The fireblocking does not necessarily have to extend the full depth of the joist. Fireblocking may be used to fill the gap at the top and bottom of the joist only. In fact, gypsum liner may be attached to the top plates and sole plate of the stud wall to prohibit the passage of flame between floors. The key here is to provide enough fireblocking so that the fire cannot proceed through the air gap between the floors.

If gypsum liner is used as fireblocking between the floors, the liner may rest on top of the wall clips. It does not necessarily have to be fastened in any way. Any remaining gaps left after the liner is installed can be filled with mineral wool.

7. Stand-up showers/bathtubs adjacent to the rated wall

$\frac{1}{2}$ " gypsum is not required to be located between the shower/bathtub and the stud wall of the fire rated assembly. Also, insulation is not required to be installed behind the tub as well (unless required for an STC rating). The purpose of the $\frac{1}{2}$ " gypsum is to provide a layer of protection for the shaft liner. Any material could be used to provide protection, including a fiberglass shower stall or wood sheathing.

8. Mix-and-matching shaft liners from different manufacturers in a rated wall

Using another manufacturer's shaft liner in a rated wall is PROHIBITED. An example would be using a USG shaft liner in a National Gypsum rated wall assembly or using a generic, unmarked shaft liner in a rated wall assembly.

The USG and National Gypsum representatives both gave the same reason: In the event of a fire, if the 2 hr. rated wall does not perform as it should have, then no manufacturer will accept responsibility. If the builder mix-and-matches shaft liners from various manufacturers, then the builder will need to contact our building official to resolve the issue. If the builder uses a different manufacturer's shaft liner *entirely* in a rated wall assembly the builder may be able to resubmit the correct manufacturer's rated wall construction details to the plan reviewer for approval if the wall can be made to comply with the new details.

For example, if a U347 wall by National Gypsum is what is shown on the approved plans, and a Certainteed shaft liner was used in the rated wall assembly, the builder may be able to submit the construction details for Certainteed's U366 wall assembly for approval, provided that the rated wall is no taller than 44 ft (as opposed to the 66 ft max. height allowed by U347) and that the $\frac{1}{2}$ " gypsum is fastened to the stud wall at 8" O.C. max (as opposed to 12" O.C. as allowed by U347).

The rated wall that is shown on the approved plans is what will be expected to be built in the field.

It should be noted that the $\frac{1}{2}$ " gypsum required on the wood stud wall of a 2-hr. rated assembly may come from any manufacturer since the $\frac{1}{2}$ " gypsum isn't an integral part of the rated wall assembly. Furthermore, all four manufacturers of the 2-hr. rated wall do not specify a specific brand of $\frac{1}{2}$ " gypsum to be used here.

On the other hand, if any 1-hr. rated walls are to be used (ie. at wall offsets), refer to the UL listing for the 1-hr. rated wall to see if the gypsum that is required on the stud wall needs to be from a specific manufacturer, as the gypsum here is an integral part of the fire rated

assembly. Many 1-hr. rated wall assemblies listed in UL will allow gypsum from most major manufacturers to be used.

9. Tradesmen's work located in the rated assembly

There are no concerns with running wire or some other type of trade work in the $\frac{3}{4}$ " air gap between the shaft liner and the wood stud wall. Per USG's representative, there is not much difference running the wire behind the stud wall or running it through the studs since the studs are a combustible material anyway. Again, the key here is that the two layers of 1" gypsum shaft liner provides the 2 hour rating, along with maintaining the $\frac{3}{4}$ " air space. Materials located beyond the air space are not as critical.

It should be noted that the IRC has other code provisions for electrical boxes used in 2 hour rated wall assemblies (See R302.4.2).

10. Installing a vapor barrier between the $\frac{1}{2}$ " gyp. and stud wall framing

The IRC2009 requires a vapor barrier to be installed between the $\frac{1}{2}$ " gypsum and stud wall framing. Does this have an adverse effect on the wall rating? Both representatives from National Gypsum and USG did not express an issue with this. And in a letter from Underwriters Laboratories to USG (dated 2/18/2011), UL stated that a vapor barrier located within the rated assembly would not have an adverse effect on the rated wall's performance as the vapor barrier would char away rather quickly.

11. Protecting the fire-rated wall in attic and/or crawlspaces

Each of the manufacturers' literature on 2-hr. rated walls do show a level of protection for the shaft liner in the attic or crawlspace, usually accomplished with a stud wall with a $\frac{1}{2}$ " layer of gypsum. Additionally, the U347 offers three other options (listed under "5B" of the UL listing) in lieu of using $\frac{1}{2}$ " gypsum, but all three still utilize a stud wall. National Gypsum's representative verbally stated that you could attach a $\frac{1}{2}$ " x 6" layer of gypsum to the H-stud in lieu of constructing a stud wall in front of the shaft liner.

The issue here is this: If a townhouse is on fire, the H-stud supporting the shaft liner between a burning townhouse and a non-burning townhouse will get hot. If anything in the attic of the non-burning unit is touching the H-stud, then a fire could start in the non-burning unit.

We will enforce a layer of protection for the H-stud in the attic or crawlspace. The preferred option will be to attach a $\frac{1}{2}$ " x 6" strip of gypsum to the stud. A stud wall with $\frac{1}{2}$ " gypsum (such as what the manufacturer's literature shows) can be used as well. Another option could be to attach OSB to face of the last truss before the fire rated wall. All we're doing is providing a layer of protection for the H-stud.

12. Attaching siding/brick veneer at roof/wall offsets

The manufacturers literature is not necessarily clear on how to attach siding/brick veneer at roof/wall offsets. The USG and National Gypsum representatives have both stated that vinyl siding may be attached to the shaft liner wall, but brick veneer cannot be attached. For vinyl siding, OSB sheathing may be placed over the shaft liner and fastened to the H-studs.

Then, a vapor barrier and vinyl siding may be attached to the sheathing. For brick veneer, no easy solution was provided by either manufacturer because they don't want the brick to be attached directly to the shaft liner.

See "Construction Methods at Offsets" in Appendix B. The County will allow the following details to be used when attaching siding/brick veneer at roof/wall offsets.

13. Exterior vented soffits (under roof overhangs) adjacent to the rated wall

The rated wall at most terminates at the front exterior wall. The rated wall is not required to run through the roof overhang. The County recommends a solid roof soffit for the first four feet of horizontal run away from the rated wall, but it's not required by code, nor by any manufacturer of 2-hr rated walls.

14. Using faced or unfaced batt insulation in the walls

There is no problem with using faced or unfaced batt insulation in the walls for achieving an R-value or STC rating.

15. STC ratings

Each of the four manufacturers have STC testing data that are fairly similar with each other. Some have been tested with fiberglass only, some with mineral wool only, and some with both fiberglass and mineral wool. The minimum STC code requirement for a wall between units is 45 (USG's 2-hr.

rated wall is a 46 without insulation and National Gypsum's 2-hr. rated wall is a 50 without insulation. The other two walls did not have a listing). A fairly common subdivision STC proffer is 54.

To avoid confusion, we will use the following guideline:

- A 2-hr. rated wall without insulation has an STC rating of at least 45, which is the code requirement.
- A 2-hr. rated wall with 3 ½" of insulation (mineral wool or fiberglass) on one side of the wall will have an STC rating of 55.
- A 2-hr. rated wall with 3 ½" of insulation (mineral wool or fiberglass) on both sides of the wall will have an STC rating of 61.

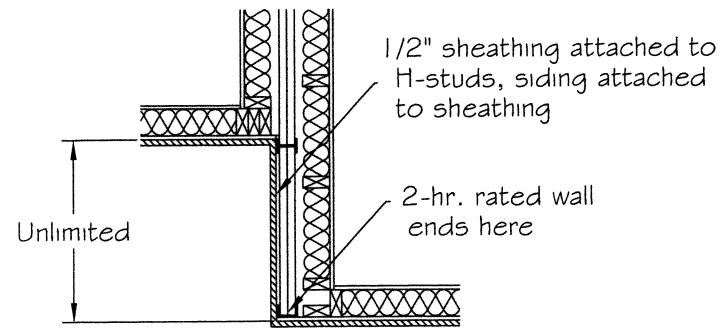
Since 54 is a common STC proffer, it doesn't matter if one manufacturer's wall will get you a 55 and another gets you 57 using insulation on one side of the wall. Both walls still exceed the STC proffer requirement.

End of document

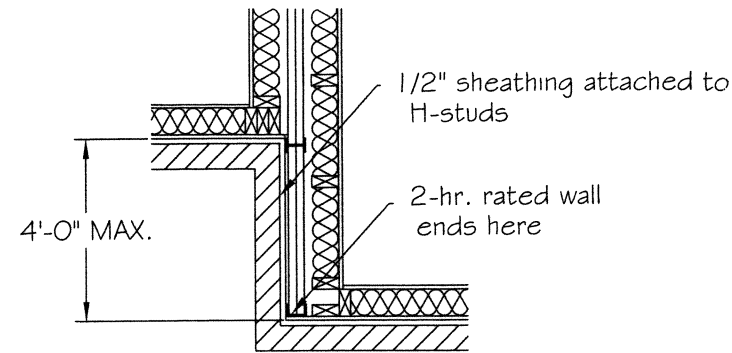
There is an extended version of this document, including explanations and notes from the manufacturer's representatives, as well as support documentation for the information above. This document was compiled using the various manufacturers' 2-hr. rated wall literature, meetings conducted with the County of Henrico and USG and National Gypsum, and support documentation provided by Underwriters Laboratories.

FIREWALL COMPARISONS				
	U336 (USG)	U347 (National Gypsum)	U373 (Georgia Pacific)	U366 (CertainTeed)
Print 2 wide: print 11x17 in portrait				
Max. wall height	66 ft.	66 ft. (54 ft. if batt and blanket option used in lieu of 1/2" gypsum)	44 ft.	44 ft.
Steel track	No. 25 MSG galv. steel, 2" wide channel w/ 1" long legs, fastened with suitable fasteners at 24" O.C.	No. 25 MSG galv. steel, 2" wide channel w/ 1" long legs, fastened with suitable fasteners at 24" O.C.	No. 25 MSG galv. steel, 2 3/16" wide channel w/ 1" long legs, fastened with suitable fasteners at 24" O.C.	No. 25 MSG galv. steel, 2" wide channel w/ 1" long legs, fastened with suitable fasteners at 24" O.C.
Steel studs (for shaftfliner)	No. 25 MSG galv. steel, H-shaped flange, 2" depth, 1 3/8" flange width, spaced 24" O.C.	No. 25 MSG galv. steel, H-shaped flange, 2" depth, 1 3/8" flange width, spacing not specified	No. 25 MSG galv. steel, H-shaped flange, 2 1/8" depth, 1 1/2" flange width, spaced 24" O.C.	No. 25 MSG galv. steel, H-shaped flange, 2" depth, 1 3/8" flange width, spaced 24" O.C.
Shaftfliner	2 layers of 1" thick gyp. liner panels, 24" width, vert. edges are friction fit into steel studs, using USG Type SLX panels	2 layers of 1" thick gyp. liner panels, 24" width, vert. edges are friction fit into steel studs, using National Gyp. Type FSW, FSW-B, or FSW-7 panels	2 layers of 1" thick gyp. liner panels, 24" width, vert. edges are friction fit into steel studs, using GP Types TRSL or DGUSL panels	2 layers of 1" thick gyp. liner panels, 24" width, vert. edges are friction fit into steel studs, using CertainTeed ProRoc Shaftfliner or EGRG Shaftfliner
Wood stud wall	2x4, max. spacing 24" O.C., cross braced at mid-height for clip attachment (if needed), min. 3/4" separation between wood framing and shaftfliner, bearing or non-bearing wall	2x4, max. spacing 24" O.C., cross braced at mid-height for clip attachment (if needed), min. 3/4" separation between wood framing and shaftfliner, bearing or non-bearing wall	2x4, max. spacing 24" O.C., cross braced at mid-height for clip attachment (if needed), min. 3/4" separation between wood framing and shaftfliner, bearing or non-bearing wall	2x4, max. spacing 24" O.C., cross braced at mid-height for clip attachment (if needed), min. 3/4" separation between wood framing and shaftfliner, bearing or non-bearing wall
Steel studs (in lieu of wood stud wall)	(No option) (No option)	See 4A in UL U347 for No. 20 MSG galv. steel, 3 1/2" wide steel studs for load bearing wall purposes. See 4B in UL U347 for No. 25 MSG, 3 1/2" wide steel channels for non-load bearing wall purposes.	See 4A in UL U373 for No. 20 MSG galv. steel, 3 1/2" wide steel studs for load bearing wall purposes. See 4B in UL U373 for No. 25 MSG, 3 1/2" wide steel channels for non-load bearing wall purposes.	(No option) (No option)
1/2" gypsum board	Rated or non-rated, min 1/2" thick, 4 ft. wide, applied horiz. or vert., attached to studs w/ 1 1/4" long steel drywall nails spaced 8" O.C. (No option) Vert. joints located over studs Optional: joints covered w/ paper tape, nail heads covered with joint compound.	Rated or non-rated, min 1/2" thick, 4 ft. wide, applied horiz. or vert., attached to studs w/ 1 1/4" long steel drywall nails spaced 12" O.C. (for wood stud wall framing) If steel studs used in lieu of wood, use 1" long Type S steel screw spaced 12" O.C. Vert. joints located over studs Horiz. joints to be butted tight to form a closed joint. Optional: joints covered w/ paper tape, nail heads covered with joint compound.	Rated or non-rated, min 1/2" thick, 4 ft. wide, applied horiz. or vert., attached to studs w/ 1 1/4" long steel drywall nails spaced 12" O.C. (for wood stud wall framing) If steel studs used in lieu of wood, use 1" long Type S steel screw spaced 12" O.C. Vert. joints located over studs Optional: joints covered w/ paper tape, nail heads covered with joint compound.	Rated or non-rated, min 1/2" thick, 4 ft. wide, applied horiz. or vert., attached to studs w/ 1 1/4" long steel drywall nails spaced 8" O.C. (No option) Vert. joints located over studs Optional: joints covered w/ paper tape, nail heads covered with joint compound.
3 alternatives to using 1/2" gypsum board:				
1) Plywood or OSB sheathing		Min. 1/2" thick plywood or OSB, applied horiz. or vert. to wood or steel studs. Vert joints located over studs, horiz. joints butted tight, fastened to studs with nails or screws of adequate length, spaced 12" O.C. Fiberglass or mineral wool, 3 1/2" thick, completely fill the wood or steel stud cavity, aluminum clips shall be spaced max. 5 ft. O.C. vertically, insulation must meet UL-BKNV (which is FHC 25/50)	(No option) Fiberglass or mineral wool, placed in stud cavities, max. 3.0 pcf density, insulation must meet UL-BKNV (which is FHC 25/50). I believe this is the intent of what the UL U373 is saying under 7.	(No option) (No option)
2) Batts and blankets	In a UL letter to USG (dated 8/17/05), UL says that the 1/2" gypsum board is merely a protective barrier for the shaftfliner and that other materials could be used for protection, including plywood, OSB, and fiberglass insulation, especially in areas such as attics where the barrier isn't subjected to abuse.			
3) Wall and partition facing		4ft. wide panels applied vert. panels attached to wood studs w/ 1 5/8" long steel drywall screws, spaced 16" O.C., vert. joints located over studs, joints covered w/ tape or mud.	(No option)	(No option)
Attachment clips	Aluminum angle, 0.063" thick, 2" wide, 2" and 2 1/4" wide legs, secured with Type S screws, 3/8" long to H studs and Type W screws 1 1/4" long to wood framing	Aluminum angle, 0.049" thick, 2" wide, 2" and 2 1/4" wide legs, secured with Type S screws, 3/8" long to H studs and Type W screws 1 1/4" long to wood framing	Aluminum angle, 0.062" thick, 2" wide, 2" and 2 1/4" wide legs, secured with Type S screws, 3/8" long to H studs and Type W screws 1 1/4" long to wood framing	Aluminum angle, 0.063" thick, 2" wide, 2" and 2 1/4" wide legs, secured with Type S screws, 3/8" long to H studs and Type W screws 1 1/4" long to wood framing
Clip spacing	For walls up to 23 feet tall: Spaced 10 ft. O.C. max vert. For walls up to 44 feet tall: Spaced 10 ft. O.C. for upper 24 ft. and 5 ft. O.C. for remaining wall area below For walls up to 66 feet tall: Spaced 10 ft. O.C. for upper 24 ft., 5 ft. O.C. for the next 20 ft. in the middle, and 40" O.C. for remaining wall area below	For walls up to 23 feet tall: Spaced 10 ft. O.C. max vert. For walls up to 54 feet tall: Spaced 10 ft. O.C. for upper 24 ft. and 5 ft. O.C. for remaining wall area below For walls up to 66 feet tall: Spaced 10 ft. O.C. for upper 24 ft., 5 ft. O.C. for the next 30 ft. in the middle, and 39" O.C. for remaining wall area below	For walls up to 23 feet tall: Spaced 10 ft. O.C. max vert. For walls up to 44 feet tall: Spaced 10 ft. O.C. for upper 24 ft. and 5 ft. O.C. for remaining wall area below (Max. height of wall can only be 44 feet tall)	For walls up to 23 feet tall: Spaced 10 ft. O.C. max vert. For walls up to 44 feet tall: Spaced 10 ft. O.C. for upper 24 ft. and 5 ft. O.C. for remaining wall area below
Non-bearing wall partition intersection (i.e. where an interior wall frames perpendicularly into the rated wall)	Permitted, see 8 in UL U336 for construction details (same detail as U347 and U366)	Permitted, see 8 in UL U347 for construction details (same detail as U336 and U366)	(Not mentioned in UL U373, but we will allow it)	Permitted, see 7 in UL U366 for construction details (same detail as U336 and U347)
STC ratings:	STC 46 STC 50 STC 54 STC 55 STC 57 STC 58 STC 60 STC 61 STC 66	2-hour rated wall as is, no insul. 2" mineral wool on one side 3" mineral wool on one side 2" mineral wool on both sides 3" mineral wool on both sides	3 1/2" fiberglass insulation on both sides	3 1/2" fiberglass on both sides

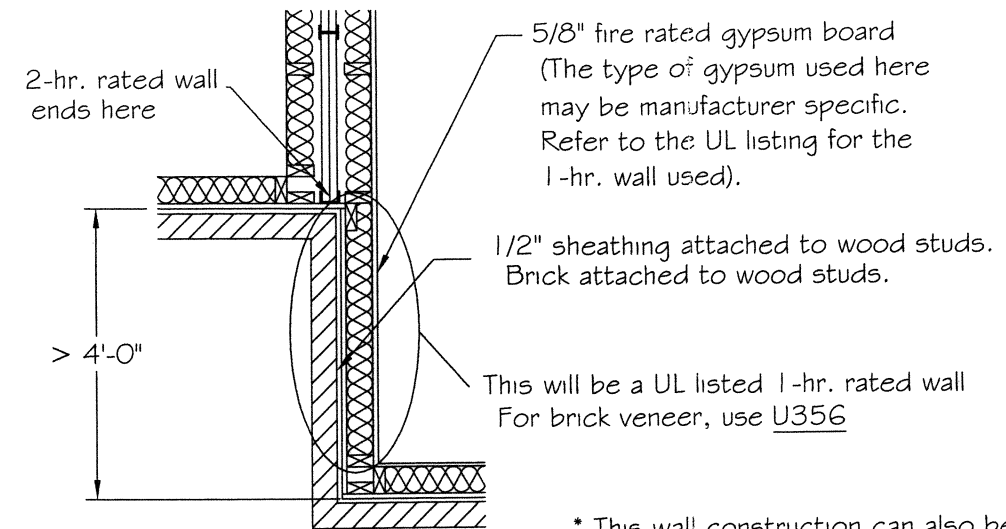
Construction Methods for Fire Rated Walls at Wall and Roof Offsets



2-HR. Firewall wall offset with siding attachment



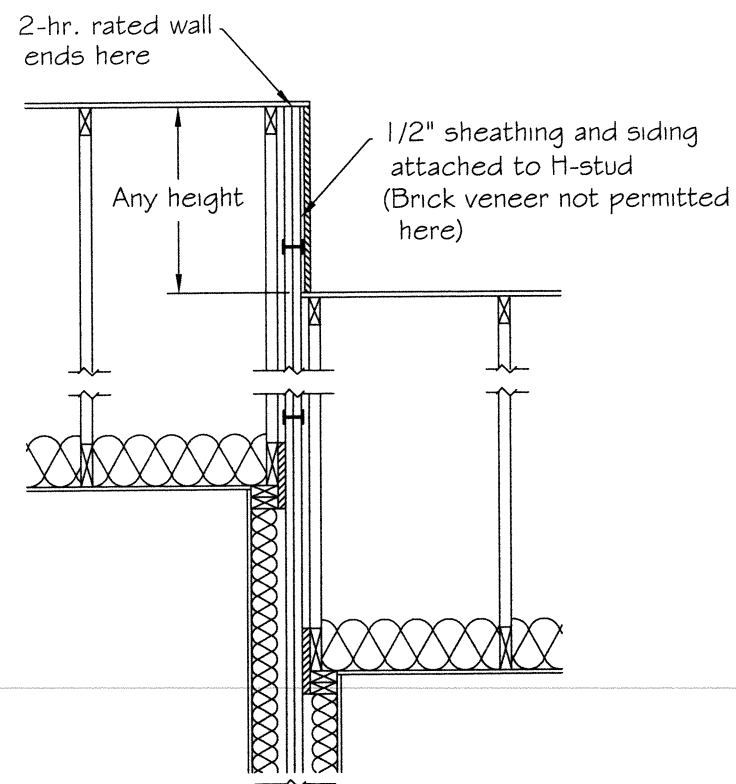
2-HR. Firewall wall offset with brick veneer attachment



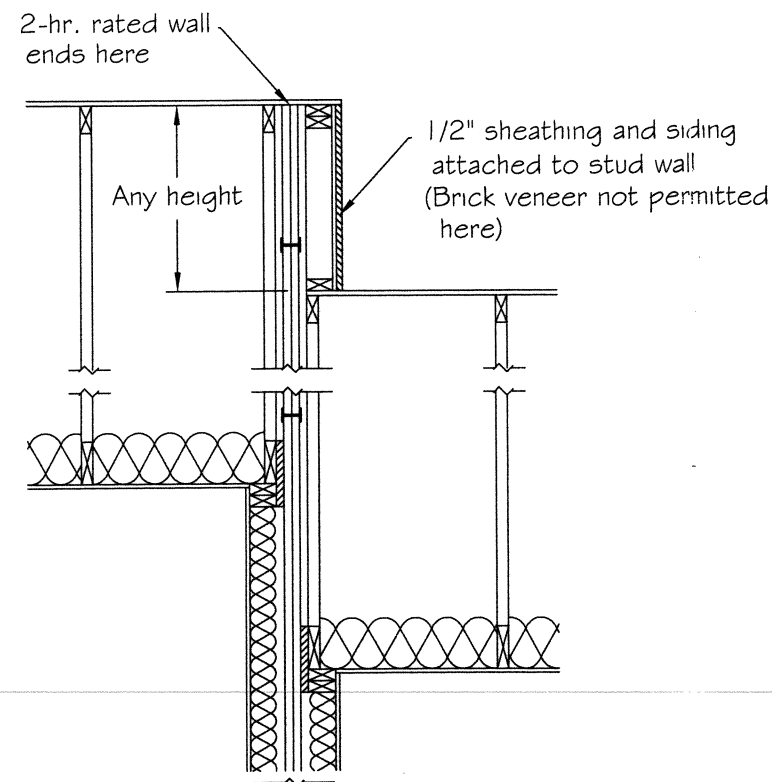
Wall offset using brick veneer when the offset exceeds 4'-0" in length *

* This wall construction can also be used for brick veneer when the wall offset is less than 4'-0" in length.

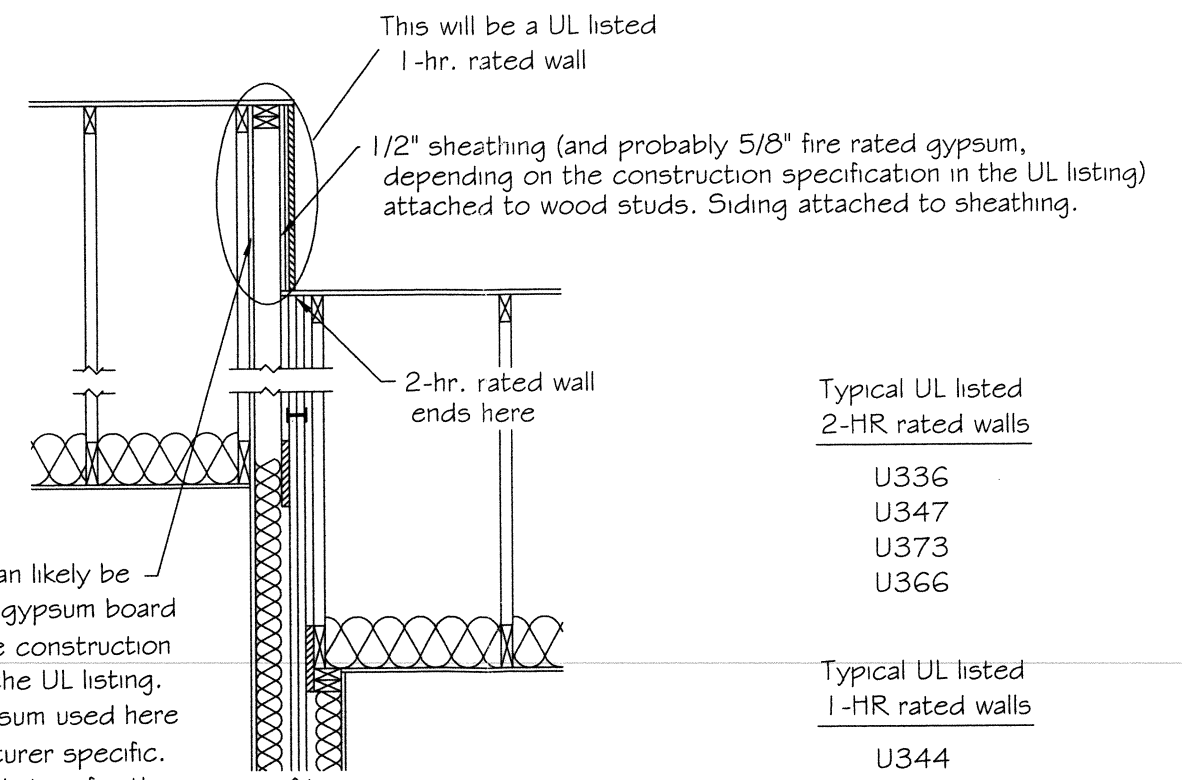
* This wall construction can also be used for siding for any length of wall offset.



2-HR. Firewall roof offset with siding attachment



2-HR. Firewall roof offset with stud wall and siding attachment



This will more than likely be a 5/8" fire rated gypsum board (depending on the construction specification in the UL listing. The type of gypsum used here may be manufacturer specific. Refer to the UL listing for the 1-hr. wall used).

Roof offset using 1-HR. rated wall at offset

Typical UL listed 2-HR rated walls

- U336
- U347
- U373
- U366

Typical UL listed 1-HR rated walls

- U344
- U305
- U355
- U356
- U357
- U359

