Established wall system goes to new angles

Horizontal applications to high-performance wall system provide added options

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Lightweight, high-performance drywall shaft-enclosure systems were introduced in the mid-1960s and quickly became a standard for mid and high-rise buildings. By displacing concrete block and lighter, but more complicated, gypsum systems, these shaft wall systems made it possible to construct ultra-high-rise buildings, such as the Sears Tower, World Trade Center and CN Tower (Canada). The premier drywall shaft-enclosure system is the USG Cavity Shaft Wall System, and it has proven very effective in designs requiring thin, 1 or 2-hr. fire-resistive walls in elevator shafts, strairways and a wide variety of other "life-line" shafts in multistory buildings.

More recently, however, these high-performance systems have been turned on their sides and used for a whole series of new, but equally critical, applications. Horizontal applications of the USG Cavity Shaft Wall System have the advantages of providing high-performance, fire-protective assemblies that are very thin and can be installed from one side. These assemblies are thus ideal for use under ducts, on stair soffits or for corridor ceilings that require fire protection.

The system

A major component of the system is the USG Steel C-H Stud (Fig. 1) available in depths of 2-1/2 in., 4 in. or 6 in. and 25, 22 or 20-gauge thicknesses. The appropriate stud depth and gauge are determined by stud span. A limiting span table, not to be confused with limiting height table, is shown in Table 1 of this article and in the current USG literature (SA-926, USG Cavity Shaft Wall Systems).

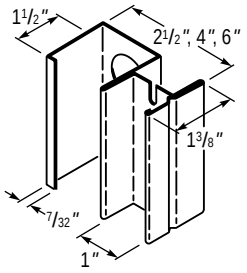

Fig. 1. USG Steel C-H Stud is the basic framing element of the USG Cavity Shaft Wall System.

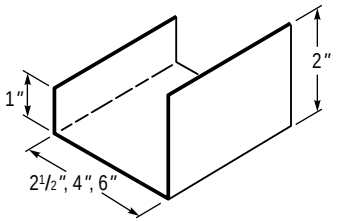

Fig. 2. USG Steel J-Runner is used to cap C-H studs at intersections with other surfaces.

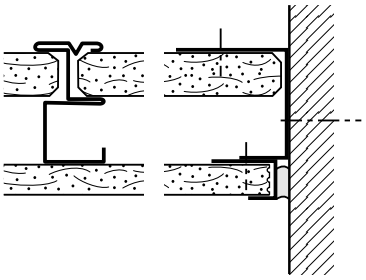

Fig. 3. Construction of typical USG Horizontal Shaft Wall System for 1-hr. corridor or stair soffit fire rating.

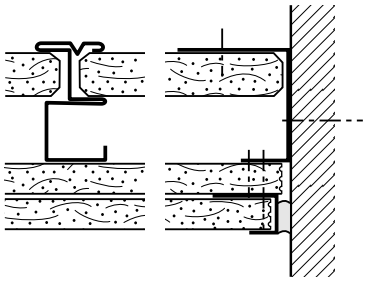

Fig. 4. For corridor or stair soffit applications requiring 2-hr. fire rating, USG Horizontal Shaft Wall System is detailed with two layers of 1/2-in. SHEETROCK brand Gypsum Panels, FIRECODE C Core.

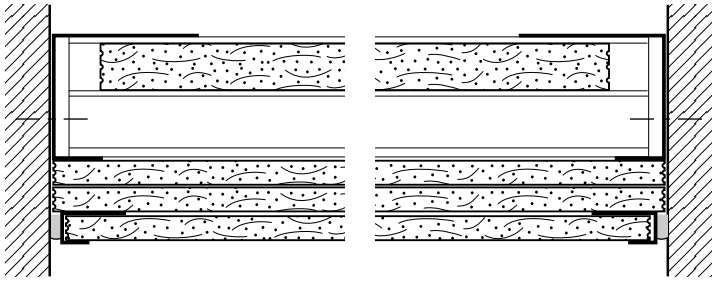

Fig. 5. Three layers of 1/2-in. SHEETROCK brand Gypsum Panels, FIRECODE C Core, are used in the 2-hr. horizontal membrane or metal duct enclosure using USG Horizontal Shaft Wall System.

The C-H stud is uniquely designed to receive a 1-in. thick SHEETROCK brand Gypsum Liner Panel in the "H" portion of the stud. This feature allows the system to be installed from one side. On the finished side of the system, over the 1-1/2-in. flange of the C-H stud, one to three layers of SHEETROCK brand Gypsum Panels, FIRECODE C Core, are attached. Both the appropriate thickness of panels, 1/2-in. or 5/8-in., and number of layers are determined by the fire endurance rating desired.

The USG Steel J-Runner is designed to cap the C-H stud at both ends and be attached to the vertical walls (Fig. 2). The long leg of the runner further facilitates one-side installation. The type and size of the

a

b

c

Fig. 6. Typical horizontal shaft wall installation under ductwork starts with USG Steel C-H Stud framing installed below ductwork, with SHEETROCK brand Gypsum Liner Panels installed between the studs (a). This is followed by application of triple-layer 1/2-in. SHEETROCK brand Gypsum Panels, FIRECODE C Core (b). Large size of ducts enclosed in USG Cavity Shaft Wall System is apparent (c).

fasteners are important to ensure a safe installation of the system. All structural attachments should be verified by a qualified professional prior to the release of the contract documents.

When the USG Shaft Wall System is installed vertically, the studs do not have to be screw-attached to the runner; however, in the horizontal mode, pan-head screws are required to transfer the loads from the system back to the structure. This should be designed prior to release of the contract documents. The gypsum face panels are installed with a suitable length bugle-head screw. The correct screw spacing is determined by the corresponding fire test. SHEETROCK Corner Bead and Trim are then used with a USG Joint Finishing System to finish the system. The proper location of any control joints should be predetermined. The SHEETROCK Zinc Control Joint No. 093 is designed to accommodate movement of up to 1/2 in. Contact your local USG technical manager for details on USG Horizontal Shaft Wall and SHEETROCK Control Joints.

System limitations

Horizontal application of the USG Shaft Wall system is intended to carry dead load only. It is not designed to carry any live load. It is not a floor-ceiling system. The published limiting span tables only consider the dead load of the assembly, and the weight of the gypsum panels and the various steel components. It does not include any concentrated loads from fixtures that might, (but should not) be supported by the C-H stud. It cannot be assumed to carry the added load of a mechanic installing the system. The building owner cannot use the horizontal membrane for storage.

System application

Fire endurance ratings are obtained for construction systems when tested according to ASTM E-119. The test procedure is very specific when dealing with horizontal building elements, and by definition these assemblies are called either floor/ceiling or roof/ceiling systems. As the definition implies, a floor/ceiling system must have the ability to carry all the live and dead loads it

Table 1. Limiting span—horizontal shaft walls[1].

Stud style	Single-layer 5/8″ gypsum panels[2]	Double-layer 1/2″ gypsum panels[2]	Triple-layer 1/2″ gypsum panels[3]
212CH25	6′-7″	6′-0″	6′-5″
212CH22	9′-4″	8′-6″	7′-11″
212CH20	10′-3″	9′-2″	8′-3″
400CH25	8′-8″	7′-10″	8′-6″
400CH20	14′-6″	13′-2″	12′-0″
600CH20	17′-5″	15′-10″	13′-8″

(1) Based on L/240 allowable deflection and JR24 runner. (2) Allowable steel stress reduced 50%. (3) Full steel stress allowed based on ASTM E119.

Table 2. Selecting the right system for horizontal applications.

System	1-hr. Stair Soffit/ Corridor Ceiling	2-hr. Stair Soffit/ Corridor Ceiling	2-hr. Horizontal Membrane
2-1/2″ 25 ga. C-H Stud, 2-1/2″ J-Runner, 1″ Gypsum Shaft Liner Panel, Single Layer 5/8″ SHEETROCK brand FIRECODE C	X		
2-1/2″ 25 ga. Stud. 2-1/2″ J-Runner, 1″ Gypsum Shaft Liner, Double Layer 1/2″ SHEETROCK brand FIRECODE C		X	
2-1/2″ 25 ga. C-H Stud, 2-1/2″ J-Runner, 1″ Gypsum Shaft Liner Panel Triple Layer 1/2″ SHEETROCK brand FIRECODE C		X	X

Note: Stud and runner size and guage are minimums, use span table to deternine proper size.

was designed for. The specific application of the USG Horizontal Shaft Wall System described here is model code defined, and falls outside the scope of testing procedures and definitions. Stair soffits, corridor ceilings, and horizontal metal duct enclosures only serve to provide fire separation, with no intention of carrying any live loads.

Horizontal shaft wall membrane applications include stair soffit protection, corridor ceilings, and metal duct enclosures (see Table 2). The Council of American Building Officials (CABO) National Evaluation Service Report Number 258 covers the USG Drywall Shaft Partition Systems in general, and specifically the horizontal application. Per this model code document, if the intended application is specific to a stair soffit or corridor ceiling, the single-layer (1-hr.) or the double-layer (2-hr.) system is appropriate; all other installations require the triple-layer system (fire tested). The triple-layer system was fire tested at Warnock-Hersey, Inc., Laboratories in California. The test did not include any superimposed live loads. It did remain in place and stop the passage of flame and hot gases for the intended time.

System installation

The following installation is applicable to the protection of corridor ceilings, and the underside of stairs:

USG J-Runners are attached to all corridor wall or stair stringer framing, (this is analogous to attaching the wall angle for a suspended ceiling to all wall surfaces) using mechanical fasteners spaced at a maximum of 24 in. on center. USG Steel C-H Studs of proper depth and gauge are screw-attached to the USG Steel J-Runners with pan-head screws at each end. The system is installed in a progressive manner with steel C-H Studs, 1-in. thick SHEETROCK brand Gypsum Liner Panels and SHEETROCK brand Gypsum Panels, FIRECODE C Core, face panels installed as required.

The 1-hr. construction is comprised of a single layer of 5/8-in. SHEETROCK brand Gypsum Panels, FIRECODE C Core, installed parallel to the USG Steel C-H studs and finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound. All exposed screw heads should be covered with the same joint compound (Fig. 3).

The 2-hr. construction consists of two face layers of 1/2-in. SHEETROCK brand Gypsum Panels, FIRECODE C Core, C-H studs and runners (Fig. 4). The base layer panel will be oriented parallel to the studs. The finish layer of 1/2-in. SHEETROCK brand Gypsum Panels, FIRECODE C Core, can be installed either parallel or perpendicular to the framing. Panel joints must be staggered by 24 in. from the base layer. Gypsum panel joints on the finish layer are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound, and screw heads on the finished layer should be covered with SHEETROCK Joint Compound.

The 2-hr. horizontal membrane or metal duct enclosure is basically the same as above except there are three layers of 1/2-in. SHEETROCK brand Gypsum Panels, FIRECODE C Core, on the finished side (Fig. 5). The base layer is attached parallel to the studs and fastened to the studs and runners. The second layer is with joints staggered and the third layer is attached perpendicular to the framing with screws spaced 12 in. on center. End joints of the gypsum panels that fall between the framing are fastened to the prior layers of panels with 1-1/2-in. Type G screws. It is not necessary to finish the joints or screw heads with a joint finishing system. Additional information and details of these systems are available through your local USG technical manager.

Horizontal applications of the USG Cavity Shaft Wall System have been used successfully for many years. Here is a typical list of successful projects in North America using one of the systems described in this article: American Heritage Life, Jacksonville, Fla.; Blue Cross and Blue Shield, Jacksonville, Fla.; One Peachtree Center, Atlanta, Ga.; One-Ninety-One Peachtree Tower, Atlanta, Ga.; Crystal Dining Room, Fort Myers, Fla.; West Terminal Expansion, New Orleans International Airport, New Orleans, La.; Crocker Center, Los Angeles, Calif.; Daniel Burnham Courts, San Francisco, Calif.; Lockheed Corp., Ft. Worth, Texas; and Eaton Centre, Toronto, Ont. (Canada). □

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