Four Frequently Asked Questions about Cold-Formed Steel (CFS) Resilient Channels

By Robert Grupe, SFIA General Manager, Architectural Services

1. What are resilient channels, and what is their purpose?

A furring channel provides a supporting framework for the finish cladding.

The recognized standard furring channel is defined in AISI S220 North American Standard for Cold-Formed Steel Framing—Nonstructural Members. See Figure 1.

One of the most typical furring channel profiles has an overall minimum width of 2-1/2 inches. The attachment flange has a width of 1-1/4 inches, with the standard web depth of 7/8 inch.

One application is the installation of gypsum board ceilings in a non-residential ceiling application. A ceiling grillage is suspended from a structural deck, and this furring channel is wire-tied to the support carrying channel. This attachment method is required to accommodate movement (expansion) of the channel in the event of a fire. The furring may not need to be suspended for in some cases it is attached directly to floor or roof framing.

SOUND CONTROL

The furring channel attachment to any substrate, either framing or solid, is through ½-inch flanges. (Figure 1.)

The main difference between the above channel and a resilient furring channel is the method of attachment. The resilient furring channel is designed where only one flange, as defined above, meets the underlying framing structure.

In ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products this flange is called out as “Attachment Flange”, which can also be called “Attachable Flange.”

Another difference is that the web depth for the furring channel is 7/8 inch whereas the resilient channel depth is ½ inch. The resilient furring channel is then designed for only one web member to be rigidly attached through its “attachment flange.”

Figure 1. Furring channel profile. Source: AISI S220

 widths. Consult with the manufacturer to obtain the properties of the furring channel member you plan to use.
In sound control, four factors impact the passage of sound energy through an assembly:

- Mass
- Isolation
- Absorption
- Decoupling

The resilient furring channel was designed to focus on the last factor which is decoupling. What is called “transmission loss” of energy that passes through the assembly is a function of the individual elements within the assembly. The “stiffer” the element, the more sound energy transmitted.

The concept of the resilient channel was originally developed to account for the inherent stiffness of wood framing. For many years the use of the resilient channel was the only way to achieve a specific threshold of acoustical performance with an assembly consisting of a single row of wood studs and a single layer of 5/8 inch Type X gypsum board on each side of the wood stud. This same acoustical phenomenon occurs with cold-formed steel (CFS) framing. The 18-mil nonstructural stud is very resilient in and of itself, however sound performance drops off as the steel thickness increases.

When gypsum boards are rigidly (i.e., with mechanical fasteners) attached to the underlying framing, sound energy is directly transmitted from one material to the next. Therefore, the idea is to create a connection between the framing and the gypsum board that is not rigid but elastic. This will greatly increase the sound attenuation, or in other words, the ability to impede the transmission of sound energy through the system.

A single number rating system was developed to provide a measure of how much sound energy is lost at specific frequencies as it passes through a wall assembly (or ceiling). This is called Sound Transmission Classification, STC. The higher the STC value that an assembly attains the better its ability to decrease sound energy at specific frequencies that pass through the system.

Nonstructural cold-formed steel (CFS) framing has resiliency built into the framing itself. The original 18 mil steel stud (as is the next generation of nonstructural framing) was able to achieve excellent acoustical performance with gypsum boards attached directly to both flanges. To achieve structural requirements, it’s common to use thicker steel or reduce the framing spacing. However, both will negatively affect STC. The use of resilient furring channels in these applications will help to attain the required sound performance.

**FIRE RESISTANCE**

While originally introduced to aid acoustical design, the resilient furring channel found a niche in fire resistance as well. Many floor-ceiling assemblies incorporate the channel as a means for supporting the fire resistive gypsum board ceiling membrane. This is commonly found when a single layer of gypsum board is desired. Another condition is where multiple layers of gypsum board are required to meet what is called horizontal membrane protection.

An example of this can be found in GA 600 Fire Resistance and Sound Design Manual and is listed as GA File No. HM 7202. It’s important to note that the spacing of the channel in single gypsum board systems will vary with the presence of any acoustical insulation in the ceiling plenum. Insulation placed directly on top of the gypsum board traps heat, which will tend to degrade the performance of the gypsum board and require the spacing of the resilient furring channels to be reduced to provide added support to the gypsum board. Resilient furring channels are often used in this application for enhanced fire resistance, because they provide an excellent attachment surface for gypsum board while reducing the heat transfer through the assembly and increasing acoustical performance.

**GENERAL PROFILE**

One way to conceptualize the resilient furring channel is to imagine the furring channel shown in Figure 1 with one web member eliminated, as shown in Figure 2 from the Gypsum Association GA 600.
2. Where are resilient channels installed?

The original concept for the resilient furring channel was for incorporation into wood framed walls. The channel was installed at right angles over the framing, with the gypsum board installed directly to the flange as signified by “A” in Figure 2.

To function as intended the furring channels should be installed over open framing with acoustical insulation in the cavity. Installing a gypsum board first and then the channel, with an additional layer of gypsum board doesn’t work acoustically.

Therefore, resilient furring channels are not intended as a retrofit to enhance the acoustical performance of an existing wall. Resilient furring channels work best when installed only on one side of the framing. Acoustical performance does not increase when they are installed on both stud flanges.

Ceiling applications work in the same manner, although in this case resilient furring channels may be used between gypsum boards, but it would only be for fire resistance. Again, the channels are installed perpendicular to the floor joists.

While initially designed for wood framing it was soon realized that resilient furring channels enhance the acoustical performance of steel framing as well. It wasn’t long before the resilient furring channels were being designed into cold-formed steel (CFS) framed assemblies in both structural and nonstructural applications.

In structural applications, the resilient furring channels offset the impact from the inherent rigidity caused by the thicker steel.
3. How are resilient channels installed?

The following is paraphrased from ASTM C754-20, Section 5.6 titled “Resilient Furring Channel Installation to Steel Members”:

The single leg resilient furring channel should be installed to cold-formed steel (CFS) stud wall framing members with the mounting flange (Figure 2 element “B”) of the resilient furring channel as shown in Figure 3. This is to assure that the weight of the gypsum board pulls the board itself away from the flange of the stud. The mounting flange in the up position will allow the weight of the board to collapse the channel into the framing, thereby shorting out the resiliency with the effect of reducing the STC. At the floor line it is acceptable to install the single leg resilient furring channel with the flange up.

This is illustrated in Figures 4 through 6. For ceiling applications, the first row and last row of the resilient furring channel should be installed no more than 6 inches from the adjacent wall.

The slots in the web element (element “C” in Figure 2) have an important role in the effectiveness of the channel. Therefore, the slots must be positioned such that they occur directly over the cold-formed steel (CFS) stud (Figure 7).

For wall framing conditions, the first (lowest) row of resilient furring channel shall be not more than 2 inches off of the floor (as measured from the floor to the center of the face of the resilient channel – element “A” in illustrations) and the highest row of resilient furring channel shall be not more than 6 inches from the ceiling (as measured from the ceiling to the center of the face of the resilient channel – element “A” in the illustration).
The correct fastener for the installation of the channel to stud is predicated on the thickness of the steel of the stud. For a steel thickness less than 33 mil the fastener should be attached according to ASTM C754 to the stud framing member with Type S, 3/8 inch-pan head framing screws using the screw hole provided in the mounting flange.

The Type S denotes that the fastener is a self-piercing screw and designed for steel thicknesses less than, or equal to 30 mils. The fastener is defined in ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs. For greater steel thicknesses the Type S-12 self-tapping fastener is recommended. ASTM C11 Standard Terminology Relating to Gypsum and Related Building Materials and Systems calls this fastener a steel drill screw. This fastener is designed specifically for the thicker steel and drills through the steel while “self-tapping” the steel to assure adequate fastener holding power.

There are special details required should the resilient furring channel need to be spliced. ASTM C754 offers two solutions. The first is the resilient channels shall be spliced by “nesting” the ends of the resilient furring channel members directly over the framing member and screwing through the mounting flange into the framing members.

Figure 8 shows the first channel directly over the flange of the cold-formed steel (CFS) stud.

Figure 6. Resilient channel at base with gypsum board. Source: SFIA

Figure 7. Resilient channel slot alignment. Source: SFIA

Figure 8. Resilient channel at splice step one. Source: SFIA

Figure 9. Resilient channel at splice step two. Source: SFIA

Figure 9 shows the second channel installed over the first channel.
The second method (Figure 10) is by butting the resilient furring channel members over the flange of the framing (in this case, stud) member and screwing through the mounting flange of each into the stud member flange. A gap of not less than 1/16 inch shall be left between the abutting channels. When nesting the ends of the members, an additional screw attaching the mounting flanges of the resilient furring channels to each other is required at the ends of each resilient furring channel.

Again, according to ASTM C754 (Section 5.6.5) gypsum board shall be screw attached to flange “A” of the resilient furring channel using screws. It is important that the length of the fastener is not so long that the screw then penetrates the cold-formed steel (CFS) stud beneath. Similar wording can be found in ASTM C 840 Standard Specification for Application and Finishing of Gypsum Board. This is also the case if the framing underneath the resilient channel is wood.

For fire resistive ceilings, the specific design requirements for applicable designs should be investigated. Many designs call for the resilient furring channel to be spaced 12 inches on center.

The following is offered as general notes:

- Channels shall only cantilever a maximum of 6 inches. This will vary with the profile and the manufacturer. The appropriate channel manufacturer should be consulted on all items pertaining to structural capacity, fire and acoustical performance.

- Attach gypsum board to resilient furring channel with 1 inch Type S screws (single layer applications of 5/8 inch gypsum board), 1-5/8 inch for second layer – 2-3/8 inch for third layer of 5/8 inch thick gypsum board.

- Extend resilient furring channels into corners and attach to framing.

- To perform acoustically the channel shall be installed over open wood or steel framing.

- Seal perimeter and any penetrations with appropriate acoustical sealant.

- For outside corner installations with resilient furring channels on that outside corner, it would be advisable to allow for a small gap between adjacent channels. Further, it would be advisable to “stair step” multiple layer gypsum panels on outside corners.

Resilient Ceiling Channel Spacing

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<th>Ceiling Framing Spacing, inches on center</th>
<th>Resilient Channel Spacing, inches on center</th>
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Resilient channels should always be installed perpendicular to the wall or ceiling framing. This implies that the gypsum board should be installed with the long dimension of the board perpendicular to the channels. For partitions, the appropriate spacing of the channels is 24 inches on center. For ceiling applications, the spacing varies based on ceiling framing spacing or if the assembly is meant to be fire resistive. The ceiling spacing is as follows:

Figure 10. Resilient channel – Option 2. Source: SFIA
4. How do you hang wall cabinets off resilient channels?

Resilient channels should be able to accommodate common wall cabinets. At the very least, additional channels must be installed to accommodate those cabinets that are meant to be mounted on the wall. However, an analysis should be done to assure that the resilient channel has the capacity to carry the induced load. The following are considerations to review:

- Does the channel itself have the capacity to transfer the load back to framing?
- Does the fastener(s) (shear and pullout) have the capacity to transfer that same load?
  - Fastener that attaches cabinet to channels.
  - Fastener that attaches channels to the framing.
- Does the framing have the capacity to transfer load back to structure?
REFERENCES

AISI S220 North American Standard for Cold-Formed Steel Framing—Nonstructural Members

ASTM C11 Standard Terminology Related to Gypsum and Related Building Materials and Systems

ASTM C754 Standard Specification for Installation of Steel Framing to Receive Screw-Attached Gypsum Panel

ASTM C840 Standard Specification for Application and Finishing of Gypsum Board

ASTM C954 Specification for Steel Drill Screws for the application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

GA 600 Fire Resistance and Sound Design Manual

ABOUT THE AUTHOR

Robert Grupe is General Manager, Architectural Services at the Steel Framing Industry Association (SFIA), managing the SFIA’s Architectural Services Team nationwide. Grupe is a 40-year-plus industry veteran and popular seminar and webinar presenter. He spent over 38 years with United States Gypsum Company in various technical and management positions, including product and system design and technical consultation to the AEC community.