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Ensuring Acoustical Performance with Resilient Channels

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FOR THE PAST 50 YEARS, RESILIENT CHANNELS HAVE PROVIDED MANY COST-EFFECTIVE SOLUTIONS FOR MINIMIZING SOUND TRANSMISSION. THESE RELATIVELY SIMPLE METAL CHANNELS ACT AS AN ACOUSTICAL BARRIER BY DISRUPTING THE PATH OF SOUND WAVES ATTEMPTING TO PASS THROUGH WALL AND FLOOR ASSEMBLIES AND INTO ADJOINING ROOMS. IN ORDER TO ACHIEVE THE DESIRED SOUND RATING, HOWEVER, IT IS CRITICAL THAT THE RESILIENT CHANNELS AND GYPSUM WALLBOARD COMPONENTS BE CORRECTLY INSTALLED.

The resilient channel was first introduced to the building and design community in the 1960s. The original intent was to prevent cracking on walls and ceilings wherever framing direction changed. However, after its noise-dampening properties were realized, drywall contractors began using resilient channels to improve the sound transmission loss in walls and flooring.

This article covers the history of resilient channels, their function, common installation errors, and industry test methods to rate their acoustical performance. Properly installed resilient channels, paired with standard batt insulation and gypsum board, can lead to assemblies with optimal sound attenuation at a lower price than many of the walls built with newer acoustical building products.

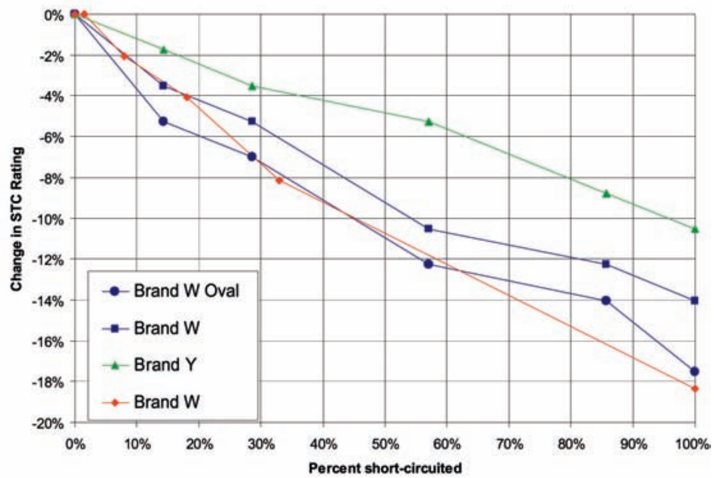
Basic specifications

The average resilient channel is 12 mm (½ in.) deep and constructed from 25-gauge steel. Most of them are manufactured in a cross-section shape, appearing like half of a standard hat furring channel with the one leg attached to the framing members—the gypsum board attached to the channel face—and the other edge floating freely. Many resilient channels contain holes in the leg for the insertion of screws for fastening to the framing members. Those following the original design typically feature a long, slotted hole with circular ends wider than the middle portion. Due to this unique shape, these holes are commonly referred to as 'dog bones.'

Dog-bone slots are 76 mm (3 in.) long and nominally 9.5 mm (3/8 in.) wide in the center and are spaced 102 mm (4 in.) on center (oc) along the sloping side of the resilient channel. This allows 25 mm (1 in.) of steel between adjacent holes. A screw-mounting hole is centered along the length of the 76-mm dog-bone slot. The face of the channel to which the gypsum board is attached is larger than most other resilient furring channels, and the material itself is thicker than the traditional 25-gauge material most other manufacturers use to make their products. Over the years, there have been resilient channels that have employed various oval or circular hole patterns and spacing that yield lesser results.[1]

The resilient channel functions as a de-coupler—a means for attaching gypsum board to the studs without actually allowing the board to touch them. This separation of the gypsum board from the studs impedes the transmission of airborne sound waves through the wall assembly by breaking their path. With their elongated dog-bone holes, the resilient channels are less rigid than the other wall assembly components, allowing them to dampen the vibrations of the sound waves. Since the resilient channels only have one attachment leg, they also make less contact with the studs than a normal two-legged hat furring channel. The less contact the resilient channels make with the studs, and the less their rigidity, the better the de-coupling effect.

Figure 1



The effects of short-circuiting on a wall assembly's sound transmission loss.[1]

Preventing common installation errors

As stated earlier, it is important to ensure resilient channels and the gypsum board are properly installed for optimal performance. There are some common resilient channel installation errors that must be watched out for and prevented.

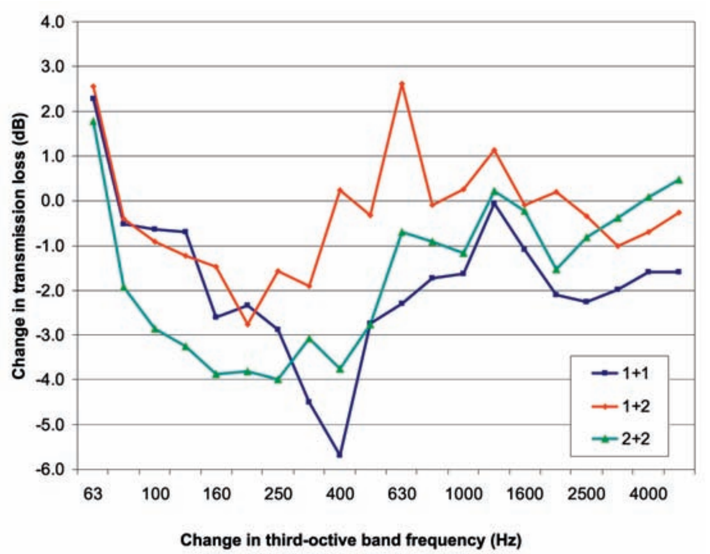
Using the wrong screws

Screws attaching the gypsum board to the resilient channel must be the correct length and should be located within the space between framing members when the gypsum board is attached. The screws should never fall directly over a stud. They should be the gypsum board's depth, plus 9.5 mm (3/8 in.).

One common error is using screws that are too long, locating them directly over a framing member, and/or making contact with the framing member. This gives sound vibrations a direct path to the stud, which then allows vibrations to be transmitted through to the next room. This installation error, known as 'short-circuiting,' nullifies the acoustical advantages of the resilient channel and significantly reduces the wall assembly's sound attenuation (Figure 1).

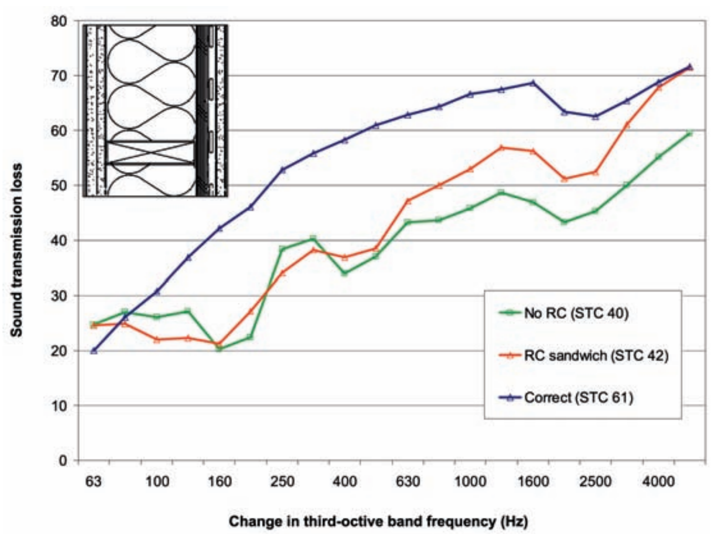
Installers must either use a screw that is no longer than necessary or guard the stud with a steel resilient channel clip, which slides onto the resilient channel and acts as an impenetrable washer between the resilient channel and stud. Screws will not penetrate the clip because it is a heavier-gauge product, adding extra protection from short-circuiting.

Figure 2



Sound transmission problems were caused by improper placement of the resilient channels.[1]

Figure 3



Sound transmission loss when the resilient channel is sandwiched between plywood and gypsum board in the wall assembly.[1]

Improper mounting of resilient channel

The resilient channel should be mounted perpendicular to the stud framing, with care taken to center the elongated holes directly over the stud-framing members as often as possible. This placement helps impede airborne sound vibrations, as the opening slot decreases the area of metal-on-metal contact.

It is also important for the attachment flange to face down. The open side of the resilient channel should face up, toward the top of the wall. This placement allows the weight of the installed gypsum board to lead the resilient channel away from the framing. Since the top of the resilient channel has no direct contact with the stud, sound transmission through the wall assembly is disrupted. Installing the open side of the resilient channel downward will press it into the framing, allowing sound waves to resonate through to the stud.

However, there is one exception to this rule. The first row of resilient channel, starting at the floor level, can be installed with the open side down to facilitate the connection of the resilient channel to the stud. When installing the resilient channel to the wall studs, it should not touch the abutting wall surface, as this would result in a short circuit. The first horizontal piece of resilient channel should be installed so the centerline of the face of the flange to which the gypsum board is attached is 76 mm (3 in.) or less from the floor. The last horizontal row of resilient channel should be no farther than 152 mm (6 in.) from the ceiling.

Figure 2 offers a graphical representation of sound transmission problems caused by improper placement of resilient channels.

Sandwich installation

Another common acoustical design flaw involves a resilient channel that is installed onto a solid surface (*e.g.* a plywood shear panel) in a way that the channel is sandwiched between it and the gypsum board (Figure 3). When tested, this installation is an acoustical catastrophe—it results in a short circuit, negating the value of the resilient channel over the majority of the frequency range.

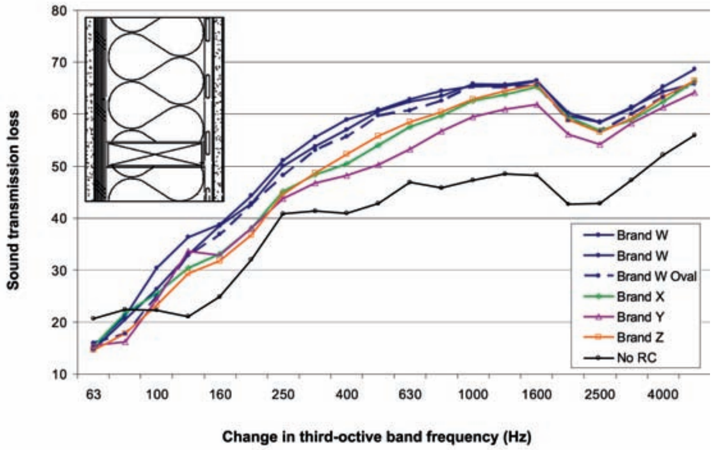
Neglecting to offset wallboard seams

Whenever the project calls for two layers of gypsum board, it is vital to offset the seams on these boards for each layer, as well from the seams on the opposite side of the wall. Vertical seams should also be offset whenever the gypsum board is installed in a vertical position. This blocks any direct sound transmission pathway through the wall assembly.

Insufficient sealing of partition

Once the wall assembly has been constructed, all direct pathways for sound transmission should be blocked. Drywall installers should thoroughly seal any penetrations (*e.g.* electrical outlets, switch boxes, and telephone boxes), which should also be staggered from similar openings on the opposite side of the wall. Whenever possible, there should not be more

Figure 4



Transmission loss testing.[1]

Traditional resilient channels that follow the original design typically feature a long, slotted hole with circular ends wider than the middle portion of the slot. These holes are commonly referred to as a 'dog bones.' They are 76 mm (3 in.) long and nominally 9.5 mm (3/8 in.) wide in the center; dog bones are spaced 102 mm (4 in.) on center (oc) along the sloping side of the resilient channel.

than one penetration in a stud bay. Sealing the perimeter with caulk after everything else is tightened up is also recommended to avoid 'flanking'—sound traveling through gaps located at the wall assembly's perimeter and corners.

Testing and rating resilient channels

There is ample evidence the brand and model of resilient channel selected for a wall assembly can make a significant difference in its overall acoustical performance. Acousticians, such as Veneklasen Associates (Santa Monica, California), have performed tests over the years comparing the sound attenuation of different resilient channel brands and models as components in various wall assembly prototypes. These tests follow the protocols of:

- ASTM E336, *Standard Test Method for Measurement of Airborne Sound Insulation in Buildings*;
- ASTM E90, *Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements*; and
- ASTM E 413, *Classifications of Rating Sound Insulation.*

The sound measurement most often required for wall construction is sound transmission class (STC)—an integer-number rating of how well an assembly attenuates (*i.e.* reduces) airborne sound. Testing to determine an STC rating is conducted on the entire wall assembly and usually includes a range of 16 standard frequencies.

The tested assembly is built and sealed within a wall frame located between two rooms that have controlled climates and are acoustically sealed from external noise. Sound is generated in one room, with the amount passing through the wall measured on the other side. The transmission loss from the frequencies recorded during the test are plotted on a sound pressure level graph (Figure 4), with the results compared to a standard reference curve to determine the STC rating for the tested assembly.

Another way to measure the wall's STC is to not transmit airborne sound. For example, if the generated sound enters the wall at a particular decibel reading, and the sound measured on the other side of the wall is lower, the result is the STC for that wall assembly. The higher the STC rating, the better the wall is at preventing airborne sound transmission.

By installing one brand of resilient channel in a particular wall assembly design and subsequently testing it against another brand installed in the same assembly design, acousticians can get a fairly accurate picture of how the resilient channels affect the STC rating. Before specifying a resilient channel for a project, design professionals should research its performance in such tests.

Conclusion

Several new acoustical wallboard and insulation products have entered the market over the past few years, promising higher STC ratings and a stronger contribution to wall acoustical performance. These new technologies, however, can come at a higher price than traditional wall assemblies with resilient channels, sound-absorbing insulation, and acoustical sealant. This may be an important thing to consider in these trying economic times, when clients may be tightening their belts and demanding a stricter budget be followed.

Common errors involve using screws that are too long, locating them directly over a framing member, or making contact with the framing member. This gives sound vibrations a direct path to the stud.

Resilient channels act as acoustical barriers, disrupting the path of sound waves attempting to pass through walls and floors.

The first row of resilient channel, starting at the floor level, can be installed with the open side down to facilitate the connection of the resilient channel to the stud.

By following the various guidelines throughout this article and properly installing resilient channels, one can provide the client with a high-STC wall assembly at a fraction of the price of those made with newer materials. **CS**

Notes

[1] For more, see the 2009 Veneklasen Associates report by John Loverde and Wayland Dong, "Quantitative Comparisons of Resilient Channel Designs and Installation Methods."

ADDITIONAL **INFORMATION**

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Abstract

For a half-century, resilient channels have served as cost-effective solutions for controlling sound transmission through walls, ceilings, and floors. Properly installed and paired with batt insulation and gypsum board, these relatively simple metal products work as an acoustical barrier by disrupting the path of sound waves attempting to pass through wall assemblies and into adjoining rooms.

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