

JUST THE FAQs

questions we made up about...
COLD-FORMED STEEL

Holes in CFS Cross Sections

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Although cold-formed steel wall studs and joists are manufactured with pre-punched holes, the trades often modify or create a new hole (Figure 1). The following are two related questions pertaining to the size of a hole that may be drilled, punched or cut into the cross section of a cold-formed steel stud or joist.

Question: *I have a question regarding the installation of non-structural steel studs. Is there a limitation on the size hole that can be cut into the web of a 3½-inch, 20 ga. metal stud?*

Answer

Thank you for your question. Section 2210 of the International Building Code (IBC) references AISI *Standard for Cold-Formed Steel Framing—General Provisions* (S200) which in turn references ASTM C754 *Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products* for installation of non-structural framing. Table 2508.1 of the IBC also references this standard.

ASTM C754 does not explicitly give a limitation on the size of holes; nor does ASTM C645 *Standard Specification for Nonstructural Steel Framing Members*. However, for the design of members, AISI *North American Specification for the Design of Cold-Formed Steel Structural Members* (S100) provides guidance on the size of holes that may be considered when checking member capacity. S100 is referenced in section 2209 of the IBC. Section B2.4 of S100 puts the following limits on C-sections with holes under a stress gradient (i.e. flexural members):

- Holes may be no more than 70% of the web depth
- Hole spacing must be at least 18 inches
- Circular holes must be 6 inches or smaller
- Holes should be centered at mid-depth of the web
- Non-circular holes must not have sharp corners: the tightest radius of a corner must be at least twice the thickness of the steel.

If a hole exceeds these limitations, that does not mean that the member is inadequate, but it must be evaluated by testing rather than using the parameters in section B2.4.

Question: *As you know, the IBC does not provide limitations to allowable holes, nor cutting and notching of steel studs and joists. Researching this, I have not had much luck. I am wondering if you may be able to provide your reference standards.*

Answer

Thank you for your question. The American Iron and Steel Institute (AISI) *Standard for Cold-Formed*

Steel Framing—General Provisions (AISI S200) as well as the AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method for One and Two Family Dwellings* (AISI S230) provide some guidance with respect to this. The Prescriptive Method does not permit holes within 10 inches of bearing or support locations, and provides a detail for patching holes. It also prohibits cuts or notches in flanges or return lips without an approved design.

AISI S200 provides the following design information:

E. MISCELLANEOUS

E1 Utilities

E1.1 Holes

Holes shall comply with the requirements specified in Section B2.1. Penetrations of floor, wall and ceiling/roof assemblies which are required to have a fire resistance rating shall be protected in accordance with the *applicable building code* or in accordance with the requirements as stipulated by the authority having jurisdiction.

B2.1 Web Holes

Holes in *webs of studs, joists* and tracks shall be in conformance with an *approved design*, AISI S100 [CSA S136], or an *approved design standard*. *Webs* with holes not conforming to the above shall be reinforced or patched in accordance with an *approved design* or *approved design standard*.

B2.2.1 Cutting and Patching

All cutting of framing members shall be done by sawing, abrasive cutting, shearing, plasma cutting or other *approved methods*. Cutting or notching of *structural members*, including *flanges* and *lips of joists, studs, headers, rafters, and ceiling joists*, or the patching of those cuts shall not be permitted without an *approved design* or in accordance with an *approved design standard*.

Section A4.5 of AISI S230 gives a method of hole patching, as well as limitations on the size of the hole.

A4.5 Hole Patching

Web holes violating the requirements of Section A4.4 shall be patched if the depth of the hole does not exceed 70% of the flat width of the *web* and the length of the hole measured along the *web* does not exceed 10 inches (254 mm) or the depth of the *web*, whichever is greater. The patch shall be a solid steel plate, *stud* section, or *track* section in accordance with Figures A4-3 or A4-4. The steel patch shall be of a minimum thickness as the receiving member and shall extend at least 1 inch (25.4 mm) beyond all edges of the hole. The steel patch shall be fastened to the *web* of the receiving member with No.8 screws spaced no greater than 1 inch (25.4 mm) center-to-center along the edges of the patch with minimum edge distance of ½ inch (12.7 mm).

For engineering solutions to reinforce a hole in a cold-formed steel member, CFSEI Tech Note TN-G900-08 *Design Methodology for Hole Reinforcement of Cold-Formed Steel Bending Members* should be consulted. ■