Framing With Light-Gauge Steel

by Brad Caspari

Common in commercial framing, steel studs provide straight and sturdy fire-rated partitions

The company I work for in southern Wisconsin specializes in commercial construction. Many of our jobs see us partitioning the interiors of office buildings, manufacturing facilities, and other professional spaces. Fire codes require the use of noncombustible materials in commercial spaces, so light-gauge steel framing is the way to go. While steel currently represents only a tiny percentage of residential framing, the rising price of lumber may yet change that equation. In this article, I'll limit the discussion to nonbearing interior partitions; structural steel framing typically requires engineering and is a separate focus.

A Case for Steel

Most residential carpenters have little experience with steel framing and may be leery of adopting an unfamiliar material. However, if you're thinking about testing the waters, the good news is that little is required in the way of specialty tools — you probably already own most of them. The framing techniques are somewhat different, but with a little training, production rates can be comparable to wood framing.

Steel studs are rot- and termite-proof and are galvanized to resist corrosion. They're also about 60 percent lighter than their wood counterparts, which reduces installer fatigue. The studs are uniformly straight and dimensionally consistent, making plumbing and lining walls a snap. Walls framed with steel are flat and true and they stay that way. And since the studs don't shrink, twist, or hold moisture, drywall screw pops are unlikely. The studs come with prefabricated knockouts, which simplifies horizontal wiring and plumbing runs. Finally, steel is an endlessly recyclable material; steel studs typically contain at least 25 percent recycled steel.

Studs and Track

Metal studs are available in sizes to match wood framing and in a range of gauges

for various applications. The basic nonstructural C-channel stud is made from 25-gauge steel and is suitable for nonbearing partition work (**see Figure 1**). For a stiffer wall or one taller than 10 feet, a heavier 20-gauge stud can be substituted. (You can find wall height tables for nonbearing walls at the Steel Stud Manufacturers Association Web site, ssma.com, and more extensive information in Section R603 of the IRC).

Studs are specified by size and minimum thickness. The web and flange dimensions are expressed in hundredths of an inch, followed by a "STUF" letter describing the component section ("S" for stud, "T" for track, "U" for U-channel, "F" for furring) and then the metal thickness, expressed in thousandths of an inch. Thus, a 3⅝-inch 25-gauge stud with a 1¼-inch flange may be designated "362S125-18."

Note that gauge numbers don't match thickness numbers, as in this example, where 18 is used to designate a 25-gauge stud. Furthermore, the thickness within a gauge designation is allowed to vary within a certain range, and thicknesses can vary considerably from one manufacturer to the next. Specifiers typically refer to thickness, not gauge, when selecting steel framing materials.

Standard U-channel — which we call "track" on the job — has 1¼-inch flanges and serves in place of the top and bottom plates used in wood framing. Studs fit inside the track, which is nailed or screwed directly to the floor and the ceiling. Deep-leg track gives a little more coverage for special applications.

Ordering steel. Calculating quantities is really no different from doing a wood framing takeoff. There are distinct wall types, some extending to the roof deck, some to the bottom of the bar joists, and others only to the existing suspended ceiling grid (**Figure 2, page 3**). Specifications should provide the appropriate size, gauge, and stud spacing — typically 16 inches on-center — for any given job. Most supply houses stock 8-, 9-, 10-, 12- and 16-footers, with special-order lengths taking only a few extra days to obtain. If you need custom lengths, or if you need 100 studs of a particular length, you can order them precut, saving time and labor on site. I once ordered precut 26-foot-tall 20-gauge studs to partition a factory interior; we were dividing a painting area from open office space.

Figure 1. Getting the hang of framing with light-gauge steel studs just takes a little experience. Steel and lumber have different structural properties, but stud sizes and layout are the same (above). Deep-leg U-channel can compensate for out-of-level conditions — allowing all studs to be cut to a common length — or contain square-cut studs on raking walls (left).

Tools for Steel Framing

When it comes to cutting studs heavier than 25-gauge, a dedicated metal-cutting chop saw is a must (**Figure 3, page 3**). A decent 14-inch model will set you back only about $200. (It's not safe to use a wood-cutting miter saw to cut steel, because of its high rpm.) There are two types of blades used to cut steel: abrasive blades and the newer carbide-tooth blades specifically made for cutting ferrous metal. Abrasive blades throw more sparks than toothed blades do, but at $9 apiece versus $130 for a carbide blade, we use them exclusively. With a 14-inch chop saw, you can cut a full bundle of studs to length before cutting the banding — a considerable time saver. When an abrasive blade is worn to the point where it can no longer cut completely through a bundle, we toss it.

Gloves. We always wear them. Cut channel edges can be razor sharp. Lightweight

Figure 2. In commercial framing, nonbearing partitions may extend to the underside of the roof deck (above left) or only to the bottom of the bar joists (above right), each of which calls for a different fastening method.

cloth gloves with a rubberized coating on the palms are best (**Figure 4**).

Snips. A good pair of straight-cutting sheet-metal snips sees routine use on our jobs, trimming studs and cutting flanges to make tab-style header and blocking connections (more on this later). The going gets rough in steel heavier than 20-gauge; in fact, 20-gauge steel will wear out a pair of snips pretty quickly. I like the yellow-handled pro-series Wiss snips (618/654-2184, cooperhandtools.com).

Also, while you don't really *need* them, it's still nice to have right- and left-cutting pairs handy in your toolbox for the rare occasion.

Clamps. Vise-type locking C-clamps, commonly used in metal fabrication, are indispensable in steel framing. They're used to temporarily hold a stud or section of track in place during leveling and can prevent materials from shifting while you install a screw. Irwin locking C-clamps (800/464-7946, irwin.com) are smooth-acting and reliable and are sold in various throat depths, including a long-throat model that sometimes comes in very handy (**Figure 5**).

Screw gun. One tool most steel-framing experts recommend is a 2,500-rpm clutch-drive VSR screw gun. It's used both to connect framing members and to fasten the drywall. Using drywall guns — which run at 4,000 rpm and higher — is generally not advisable, since they spin too fast and will strip a screw before it fully penetrates the steel.

Figure 3. A 14-inch metal-cutting chop saw is handy for gang-cutting bundled studs and mandatory for cutting heavier 20-gauge steel members.

Figure 4. Inexpensive rubberized cloth gloves keep hands from getting sliced on razor-sharp cut edges. Here, a short slit in the end of one track prepares it for mating with another length.

Figure 5. A fundamental tool collection covers most steel framing tasks.

Figure 6. Various fasteners are needed to connect steel to itself and to building surfaces. Clockwise from left: Self-drilling screws are the standard for framing-to-framing connections. Self-piercing screws are effective in light, 25-gauge materials. Powder-actuated pins — typically 1/2-inch and 3/4-inch sizes — connect framing to hard concrete decks and structural steel beams. Tapcon concrete screws anchor steel door frames to concrete floors, and mushroom anchors serve in applications where pins may not hold as well.

If you don't like dragging a cord around, cordless screw guns run at a suitably low rpm and can do the job. For 25- to 20-gauge framing, any 14-volt or higher tool is adequate, but an impact driver provides a slight advantage in helping the screw to penetrate the steel.

Laser. For laying out, plumbing, and straightening walls, a self-leveling rotating laser is essential. The self-leveling feature ensures that if the laser is jostled, the line will recover its accuracy rather than provide a false reference.

Fasteners

Usually, the stud supplier will also supply the screws used to connect steel framing members (**Figure 6**). These are self-tapping 1/2-inch pan-head sheet-metal screws, the type with an integral drill tip that can penetrate 20-gauge steel. We use self-piercing coarse-thread drywall screws to connect 25-gauge steel studs to existing walls, screwing them right into the drywall. Once drywall is hung on the new framing, there's no danger of lateral movement and so no need to connect to the existing framing. Of course, we also use drywall screws to attach the drywall to the studs. As a rule, you want to use a screw long enough to leave a minimum of three threads protruding through the steel.

Hard-surface nailers. We do a lot of fastening to steel beams, masonry walls, and concrete decks. On big jobs, our primary tool for this is a TrakFast TF1100 (800/241-5640, ramset.com), basically a high-powered cordless nail gun capable of shooting 1/2-inch to 1 1/2-inch pins into steel and concrete (**Figure 7**). The TrakFast is much faster than a powder-actuated tool (PAT) and holds 42 pins in the magazine, four times that of most PATs. It costs about $475, including a battery and charger; pins come in boxes of 1,000 along with a fuel cell for about $60. If we need to drive longer pins or need more power to penetrate hard concrete or thick steel beams, we use a Hilti PAT (866/445-8827, hilti.com).

Mushroom-head anchors. In hard, brittle concrete, a mushroom anchor provides better holding power than a 1/2-inch pin. The anchors come in nylon and lead versions; lead definitely holds better in concrete. On smaller jobs, hammer-drilling the necessary holes is fast enough, so we skip the pins.

Stud crimper. This tool isn't mandatory, but it can come in handy for fastening studs where a screw gun can't go. Malco's model PL1 (800/328-3530, malcoproducts.com) is the best one we've tried. It's rated for 22-gauge steel and runs about $60.

Crimping can't completely replace screwing, however, since the connection isn't as secure. When the drywall is hung, the screws briefly deflect the stud flange

Figure 7. A TrakFast gas-powered nailer can outshoot a PAT in many applications, and it handles pins up to 1 1/2 inches long. The author's crew relies heavily on this tool when fastening bottom tracks to the floor.

Figure 8. Self-tapping screws provide a fast, secure connection to steel roof decking. If the decking is capped with concrete, the author shoots pins instead.

and can force the crimp apart. And with heavier-gauge studs, the crimper simply isn't capable of penetrating the steel.

It's a good idea to check local building codes, too. Some inspectors require 100 percent screwed connections.

Running Track

The first step in framing walls is to snap the layout on the floor. Spraying it with clear lacquer preserves the chalk lines. To avoid walking or driving over the bottom plate while fastening the top plate, we install all of the top plates first. (The technique of framing a wall on the deck before standing it up is rarely used with steel. Unless you weld the studs to the track, you can't attach both sides of the studs while they're lying down. Even if you could, metal studs are not rigid like wood studs, so the assembly would still be twisty and likely to collapse on itself when lifted.)

Because the ceilings are typically complicated by ductwork, beams, and bar joists, we don't lay out stud locations on the tracks before installing them.

To place the ceiling track, one worker moves a vertical laser along the floor lines while another fastens the track. If we're fastening to corrugated-metal roof decking, we use self-tapping stud screws (**Figure 8, page 4**). If the deck is poured with concrete (as in multiple-story buildings), we shoot pins. If the walls are over 12 feet tall and we're working from a scissor lift, we put all of the track, fasteners, and other supplies right in the basket.

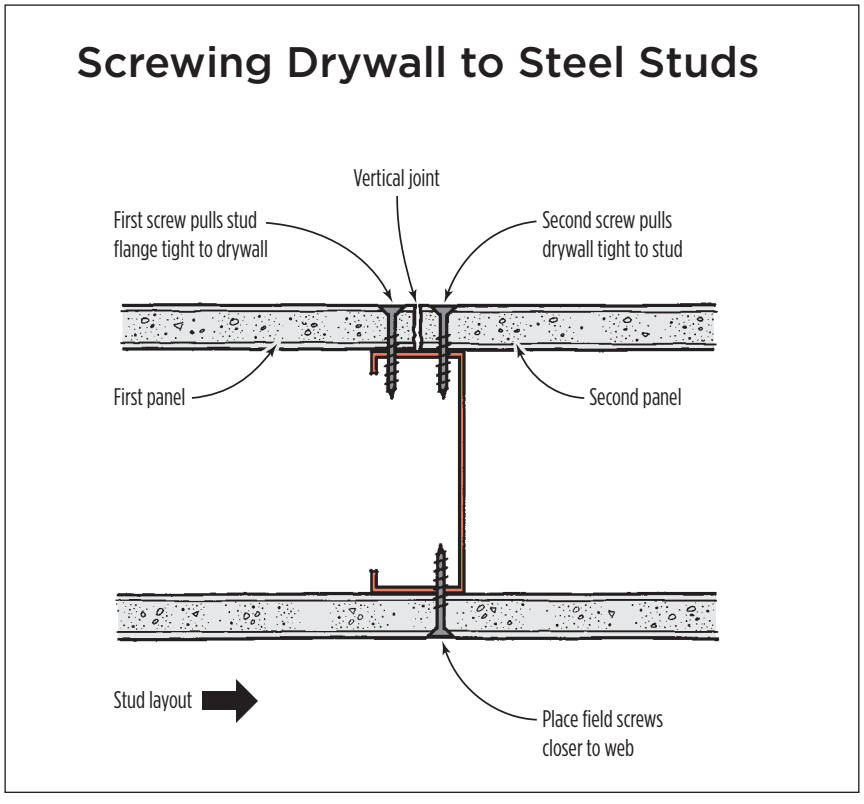
At corners, it isn't necessary to cut the track to exact length. Just run the first piece a little long, then snip the inside flange at the return point and hammer the excess flat. The return track can then overlap the first and complete the corner (**Figure 9**).

Slip track. Snow loads on large commercial roofs can cause the ceiling to

Figure 9. Outside corners are simply snipped and overlapped. Corner studs are connected only to the track flanges — not to each other.

Figure 10. The author drills holes for mushroom anchors to secure a hollow metal door frame. Note the magnetic level at the head jamb (above). Plastic shims under the side jambs are used to level the head (above right). Integral tabs in the frame's side jambs provide connection points for the trimmer studs (right).

Figure 11. The bottom track is installed after all door frames are set. If shooting pins, the author uses a closer on-center schedule than when using mushroom anchors, which have better holding power in brittle concrete.



deflect within its design tolerance. Nonbearing partitions must be designed to accommodate this movement. A slip track is a deep-leg track that allows the studs to be cut shorter than full height to accommodate periodic ceiling deflection. Since the studs can't be screwed to the track, they are crimped. The crimp will fail before the wall buckles. (You can use screws to temporarily hold the stud in place until the drywall is installed and secures the studs.) You also have to leave about a 1-inch clearance gap between the drywall and the underside of the ceiling. The gap can be concealed by a piece of trim attached to the ceiling only.

Hollow Metal Door Frames

In our work we install more hollow metal Ceco (888/264-7474, cecodoor.com) door frames than any other type. These frames are installed before the bottom track and the studs. Once the frames are anchored in place, you run the bottom track and attach the steel studs directly to the door frame (**Figure 10, page 5**). Welded frames ship with temporary tack-welded steel angle spreaders that keep the jambs aligned during installation. After the

Figure 12. Always face the open side of steel studs toward the origin of the layout. This ensures that at butt joints screws driven into the first panel will pull the flexible stud flange tight to the board, resulting in a flat wall finish (top). In the field, place screws closer to the stiffer web face of the stud (bottom).

drywall's installed, you chop them out with a cold chisel.

First, we stand the frame on layout and level the head, inserting plastic shims under either leg as needed. The side jambs have welded anchor tabs at the base for securing the frame to the floor with Tapcon concrete screws (877/489-2726, tapcon.com) or mushroom-head anchors. Coarse-thread wood screws work on plywood decks. A frame will stand on its own once it's anchored to the floor, so we don't add temporary bracing. Later, when the drywall's installed, we plumb the frames. I'll explain this later.

Installing Studs

Once the top track and the door frames are set, we cut and fasten the bottom track to the floor (**Figure 11, page 6**). I typically use mushroom anchors placed 4 inches in at either end and on 4-foot centers. If we're shooting ¾-inch pins, we space them at 2 feet on-center, since they don't have the holding power of the anchors. We make sure the track is fastened down securely at door openings and corners. Then we add the layout marks for stud spacing (typically 16 inches on-center), window openings, and cabinet locations where blocking is required. For marking on steel, which can be oily, a black Sharpie works best.

Steel studs are rotated into position in the installed track and plumbed, one at a time. Always keep the open side of the studs facing the origin of your layout; this ensures that at vertical joints, the drywaller screws the first panel to the more flexible open leg of the stud (**Figure 12, page 6**). This is important because drywall screws push the flange away before piercing it and pulling it back snug. If a panel has already been attached to the stiffer web edge of the stud, the screws driven into the floppier open end may not fully retrieve the flange, leaving a misaligned

Figure 13. Nonstructural headers are made quickly by snipping channel flanges at the desired distance and folding the ends down (left). The channel tabs are then screwed to the trimmer studs (above).

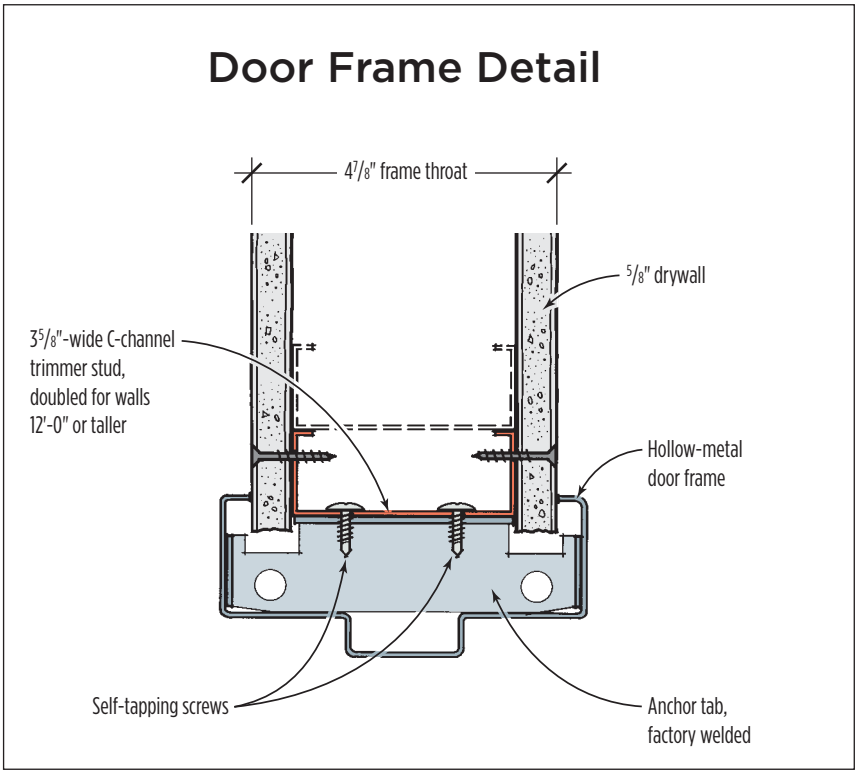


Figure 14. Trimmer studs are connected directly to the hollow door frames with self-tapping screws. The drywall slips between the stud and the frame and holds the door frame plumb.

surface and finishing problems.

When cutting door and window cripples, remember to cut all studs from the same orientation so the prepunched holes will match up. We save offcuts for bracing and patching; at the end of the job, all of the scrap goes to a sorting company for recycling.

The track flanges provide a little play, so it isn't necessary to cut every stud to exact length. If the floor or the ceiling is slightly out of level, you can cut all the studs to the shortest dimension. If there's a large discrepancy in level, a deep-leg top track can cover the difference.

With the top and bottom track installed, we stand all the full studs in the track, skipping over door and window locations and anywhere there's an obstruction, like an overhead beam or hvac duct. These places require a header and cripple studs.

Headers. Nonstructural headers are sections of track cut to the desired length plus 4 inches for an attachment tab. We snip across the flanges 2 inches in from both ends, fold the web back at a 90-degree angle, and slip the flanges over the stud (**Figure 13, page 7**). Then we level the header and hold it in place with locking clamps while we screw the flanges to the stud.

Plumbing door frames. At door locations, we screw the trimmer studs directly to welded tabs on the hollow metal frame, centering the frame in the wall plane and making sure that the drywall can slip between it and the stud on both sides of the wall (**Figure 14, page 7**). On walls 12 feet or taller, we install double trimmer studs. This stiffens the wall at these locations and keeps it from rattling when the door is slammed. When we hang the drywall, it slips past the stud about 3⁄8 inch behind the hollow frame. We then plumb the frame and screw the drywall to the trimmer studs. The drywall holds the door frame plumb.

Figure 15. Wood backers provide holding power for hanging cabinets and heavy-duty shelving (above). For prehung wood doors, rough openings are formed conventionally and lined with framing lumber to supply a nailing surface (left).

Wood Blocking

Interior finish work often requires plywood blocking to provide a nail base for trim or extra holding power for hanging cabinets and heavy-duty shelving (**Figure 15**). If the job calls for prehung wood doors, we frame rough openings and line them with framing lumber to catch the nails.

For applications like coat hooks or small shelving units that don't need extra holding power, it's okay to screw directly into the studs. When running narrow wood base trim, we use light nailing in combination with construction adhesive. You can shoot 16-gauge finish nails straight into single-thickness 20-gauge steel, but steel won't hold nails like wood does. For wide baseboard profiles, we install plywood backers and rely on nails alone.

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