# Light-Gauge Steel Framing

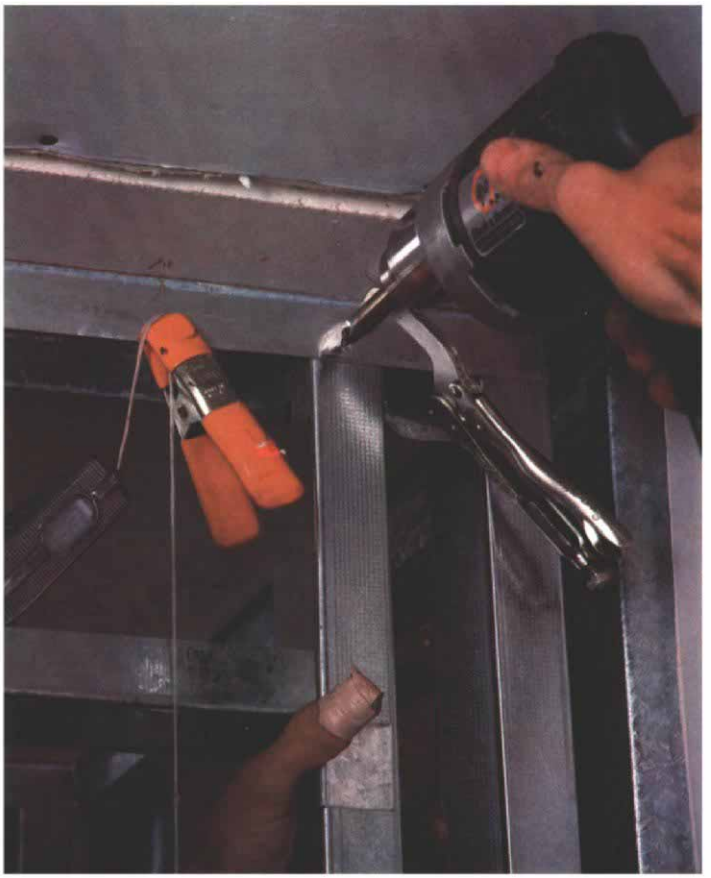
## Inexpensive, stable and easy to install, steel is becoming popular for interior partitions

by Steve Mead

For over a century, wood has been the king of framing materials. But over the past two decades a quiet revolution has been brewing in framing technology. Increasingly, builders, remodelers and even do-it-yourselfers are turning to light-gauge steel for their interior-framing needs. There are good reasons for the switch.

Though versatile, wood framing isn't perfect. Its biggest problem is that it burns, and over the past 20 years fire codes have become increasingly restrictive. New fire-retardant wood framing products are available, but steel has had a pretty good head start in the markets where flammability is an important issue. Steel is king in commercial framing—building inspectors and insurance agents sleep easier knowing that buildings aren't as likely to catch fire as they used to be.

Some communities in the U. S. are so concerned about fire hazards that new single-family homes are required by code to have automatic sprinkler systems. Consequently builders are beginning to pay more attention to fire prevention. And as they discover the reduced fire hazard of steel framing, they are also finding that the material can be installed faster than wood framing, and that it often costs less. It is still rare to find a single-family home framed completely with steel, however.



**The workhorse tool for installing light-gauge steel framing is the screw gun or reversing drill. Locking C-clamps hold stud and track together until the screw is run home, while a spring clamp anchors a plumb line.**

**Why steel?**—Light-gauge steel framing was developed in the 1950s during the huge surge in post-war building. At about the same time, gypsum wallboard began to replace lath and plaster as the industry standard for wall finishes. Builders quickly realized that drywall applied to wood framing had its share of problems. Wood is a dynamic material—it shrinks, warps, checks and spits out nails as its moisture content changes. A truly professional drywall job requires careful attention to installation details. Consequently, the drywall industry developed framing components manufactured from steel. Steel is a static material. You can leave a pile of steel studs uncovered in your back yard for years at a time and they won't warp. Unlike wood, steel stays straight and true.

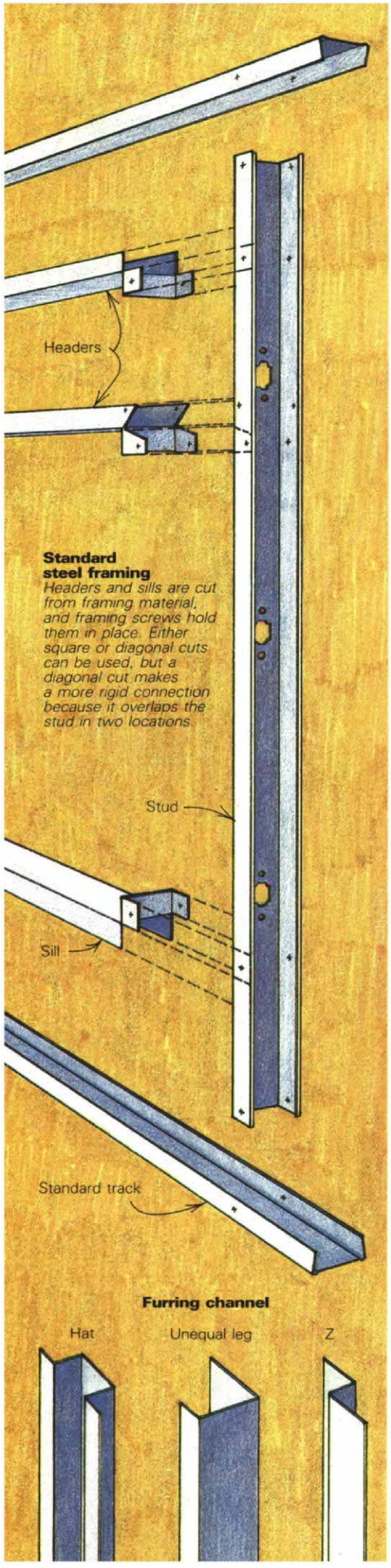
What about sound transmission? Some people think that metal-framed partitions will transmit more noise between rooms than wood-framed partitions will. Not so. The company I work for has done a lot of work for corporate clients and lawyers who are leery of sound transmission—they're not anxious to have secrets overheard in the adjoining offices. When we checked with acoustics experts, we learned that it isn't the studs in a wall that transmit sound; it's the spaces between the studs that cause the problem. Like a drum, the skins on both sides of the wall vibrate slightly, and the air-filled stud cavity between them transmits the sound. So when we want to build a quiet wall, whether of wood or metal studs, we just pack the stud cavities with fiberglass insulation. It fills the hollows and cuts the sound.

Though the use of light-gauge steel framing is increasing, it's still unusual to find steel framing components at a local building-supply store. They're usually sold at drywall-supply outfits (sidebar, p. 69). Considering the early development of steel framing, this isn't so odd. As the use of steel studs becomes more popular among home builders and do-it-yourselfers, steel framing will probably become readily available. I don't think this will take too long—light-gauge steel framing is now 20% to 25% cheaper than wood in our area. Steel prices are more stable, too. You don't see the wild fluctuations spawned by periodic gluts and shortages, as you do with lumber.

**Light-gauge basics—**The most common residential use of light-gauge steel is for framing non-load-bearing interior partitions, although heavier-gauge material can also be used for load-bearing walls. The system is quite simple to understand and install. It consists of galvanized metal studs and track, screwed together to form walls, soffits or ceilings. Instead of specifying species and width as you would with wood studs, metal studs are specified by gauge (the thickness of the metal) and width. The lower the gauge number, the thicker the material. Light-gauge studs are squarish, C-shaped in section, and roll-formed from 24-ga. steel (drawing, next page, left). Stud edges are lightly textured to prevent screws from skidding off the steel during installation. Prepunched holes in the wide portion (sometimes called the web) of the studs allow the passage of wiring and plumbing runs, and horizontal reinforcing where necessary.

Steel studs come in standard widths of 1⅝ in., 2½ in., 3⅝ in. and 4 in. Non-standard widths from 1⅝ in. to 6 in. can usually be manufactured on special order. Studs can either be ordered in specific lengths, cut to length at the job site or spliced together to form longer pieces.

A U-shaped track, or runner, holds the studs in place. Two basic kinds of track are used for




interior partition framing: standard and deep leg (drawing, left). Standard track is 24 ga., just like studs, but its flanges, or legs, bend inward slightly. As a stud is slipped into the track, this inward bend grips it, holding it in place until it can be fastened with screws driven through the track flanges. The web of the track doesn't have prepunched holes, but can be easily drilled with a hole saw if a plumbing run or wiring chase has to pass through it.

Deep-leg track allows walls to "float," and is normally used only in commercial projects. For example, if a particularly long floor span was expected to deflect more than usual, partitions framed with deep-leg track would be able to accommodate the deflection without cracking. Or if a concrete slab was formed over expansive soil, partitions framed with deep-leg track would accommodate a bit of movement without cracking. Here's how it works. The upper track is screwed to the ceiling but not to the studs. Drywall is screwed to the studs, but the top edge is not screwed into the track. The drywall holds the studs in alignment, and when the studs move with the floor deflection, the drywall can move too. The gap along the top of the wall can be concealed by trim fastened to the ceiling.

**Fasteners**—A key part of any light-gauge steel framing system is the fastener. Not only do screws hold the framing together, but they're also used to attach just about everything that goes on the framing. Because they provide an extremely solid attachment, nail pops in drywall are completely eliminated. And screws allow the builder to reuse drywall or paneling, if necessary, and remove the -studs with relative ease—try that with wood framing. Three types of screws are used in light-gauge work:

***Bugle-head screws.*** Sometimes called drywall screws, these fasteners come in various lengths and are used to secure drywall or plywood to steel framing. For applying ½-in. drywall or ⅝-in. drywall, a screw about 1¼ in. long is used. They're usually driven with a Phillips-head bit in a screw gun. Because they're hardened, bugle-head screws hold up well to power driving, but you can drive them by hand, too. Their sharp point makes them easy to start in many materials. With just a little pressure, they'll drive right into light-gauge framing without a pilot hole. As it's tightened down, the bugle-shaped head of the screw creates its own dimple; in effect, the screw slightly countersinks itself. When tightened against drywall, the screws create dimples that can be mudded with no problem.

***Framing screws.*** These short, pan-head screws are used to fasten light-gauge steel framing members to each other. They're only about ½ in. long, since only two thicknesses of metal are usually joined. On some brands, the underside of the head will have a sawtooth pattern that acts like a lock washer against the metal framing. For use on heavier-gauge metal like structural framing, there's a self-tapping framing screw with a hex head. It's driven with a special attachment chucked in a standard screw gun.

***Trim-head screws.*** Trim-head screws are similar to drywall screws, but have a very small head that can be countersunk and filled with wood putty for finish work. Most trim-head screws have a No. 1 Phillips head, which is pretty small and strips easily. But there are other head types for trim-head screws. Most carpenters prefer the ones with an inset square head because more torque can be applied to the screw without stripping the head.

**Tools**—Some specialized tools are required for steel framing, but few of them will be unfamiliar to carpenters used to wood framing. The key tool is a durable reversing screw gun. Screw guns are equipped with a clutch that keeps the screw stationary while the drill is running. When pressure is applied to the gun, the clutch engages and the screw is driven into the material. Screw guns have a control head that can be adjusted to drive each screw slightly beneath the surface of the drywall for finishing. During framing, though, it's best to remove the control head completely. You'll want to keep the screw perpendicular to the work surface while making attachments, and it's easier to see the screw if the control head is removed. If you don't have a screw gun, any good reversible drill chucked with a Phillips bit will do a decent job.

Cutting metal studs is no problem. A good pair of compound-leverage metal snips will cut studs up to about 20 ga. I've found that the spring-loaded type used for sheet metal is all I need for cutting light-gauge studs. Weiss (The Cooper Group, 3535 Glenwood Ave., PO Box 30100, Raleigh, N. C. 27622) is one brand.

Sheet-metal snips come in left-cutting, right-cutting and straight-cutting versions; use the straight-cutting type for cutting studs. A motorized miter box or radial-arm saw equipped with an abrasive cutting wheel (like those made by Oldham Saw Co., Burt, N. Y. 14026) can also be used to cut studs to length. In a pinch, track can be cut by scribing the web with a sharp razor knife, then cutting the flanges with snips and bending the track back and forth until the metal breaks along the scribe mark. The web of the track doesn't have to be cut perfectly square because it's the flanges that hold the stud in place.

Other important tools are small spring-loaded clamps for holding tape measures and string lines, an 8-oz. plumb bob and line, a powder-actuated fastener (nail gun) if track has to be attached to concrete (I generally use a #3 load with either a ½-in. or a ⅝-in. pin), and locking C-clamps for holding framing pieces in place while they're being screwed together. It's easiest to mark cutlines on metal framing with a fine grease pencil or a felt-tip marker—ordinary pencil marks are hard to see on the smooth, galvanized surface of the metal.

Working with steel may seem a little awkward at first, in part because it bends more than wood does. If a stud doesn't fit, you can't pound it into place as you sometimes can with wood studs. Beginners are often tempted to wear gloves because the edges of cut studs can be sharp. A pair of leather gloves may eliminate some of the nicks, but gloves make it difficult to

Drawings: Frances Ashforth

operate tools safely. The best way to reduce cuts is to work carefully at all times and watch out for sharp edges.

**Framing a room**—One way to get an idea of how to work with steel framing is to frame out a small room. The angular closet and shower room shown in the photographs on the next page presents most of the challenges you're likely to find in basic light-gauge work.

As in any job, a materials estimate is the first order of business, and estimating procedures for metal studs and track are very similar to those used for wood framing. To get the number of studs you'll need, multiply the total lineal footage of wall by .65 if studs are to be on 2-ft. centers, or by .85 for 16-in. centers. To estimate track, simply double the total lineal footage, then add 10% to account for waste.

You'll need about 850 screws per 1,000 sq. ft. of drywall with studs on 24-in. centers, and 1,000 screws per 1,000 sq. ft. of drywall if you are framing on 16-in. centers. The U.B.C. calls for spacing the screws 8 in. o. c. at edges and 12 in. o. c. in the field.

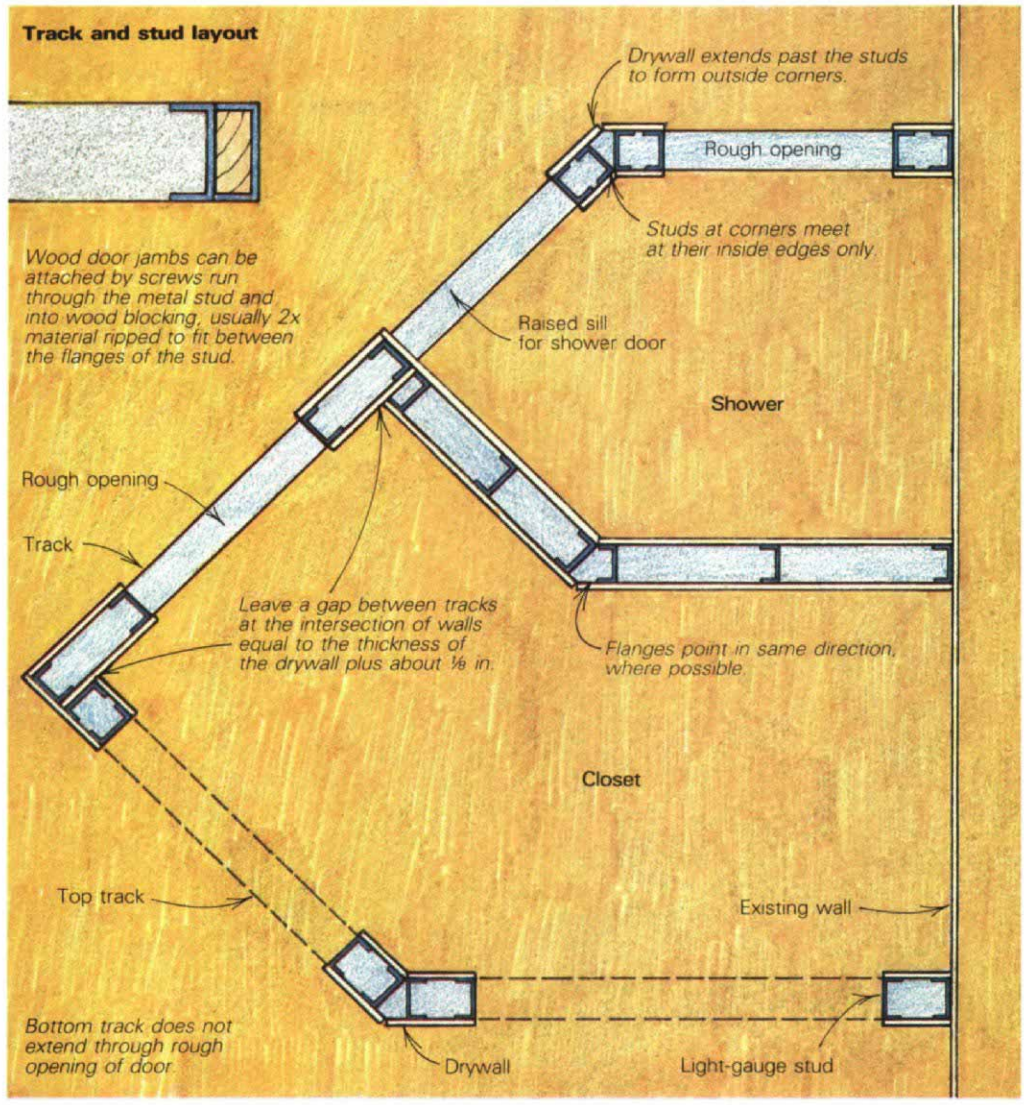
For finish wall materials, you can use whatever estimating technique you're used to because coverage will be the same on a metal-framed room or on one framed with wood.

Now for the layout. Mark lines on the floor representing both sides of the track to make sure there's no confusion about where the wall will be. Use a plumb bob and transfer key points from the floor layout to the ceiling. Snap a chalkline to connect the points. I have found that it's usually easiest to do layouts with two people. One marks the ceiling while the other guides the plumb bob. But you can do it alone if you're patient.

Next, identify the position of wall openings—doors, windows and the like—on the floor layout, using tick marks outside the track lines so you can see them once track is down. It's best to note the width and height of each opening, especially if someone else is to do the work—that way there will be no confusion. The ceiling track won't be broken by wall openings, so you don't have to transfer these points.

Where one wall intersects another, stop the intersecting track short of the other wall by the thickness of the drywall plus ⅛ in. or so (drawing, above right). If you're using ½-in. drywall, for example, leave the intersecting partition about ⅝ in. away from the other wall. This allows the drywall to be slipped through the intersection, and minimizes cutting. As an alternative, you can leave the last stud in the intersecting wall loose as a floater until the drywall is slipped through the gap between the walls. Then you can push it against the drywall and screw it in place. The rocking has to be planned carefully. The longest walls are usually rocked first, and the shorter walls are butted to them. Keep this in mind as you're laying out the job.

After the layout is complete, cut sections of track to fit the floor and ceiling layouts, and screw them in place (photo next page, top left). At door openings, stop the track at the rough opening and continue it on the other side. Where the run of the layout is too long for a single




## *Supplies and information*

**Most towns of any size have at least one drywall-supply house, and this is where you'll find materials for steel framing. Check the Yellow Pages under Gypsum, Wallboard, Drywall, or Drywall Contractors. Though these folks are usually willing to sell small quantities of materials to do-it-yourselfers—a bucket of joint compound or a few sheets of drywall, for example—they're more accustomed to working with builders and contractors. They're also the ones to contact if you're looking for drywall in long lengths. Most drywall-supply houses stock 10-ft. and 12-ft. sheets in several thicknesses. Some carry a full line of drywall tools and will give you pointers on how to use them. Even if you've done a fair amount of drywallmg, you'll probably find some specialized trowels or a long-handled swivel sanding block or carbide-grit sandpaper that will make the work go a little easier.**

**If you have a fair amount of drywall to order, a drywall supplier will generally deliver it. And though you may have to pay extra, you can request that they use a truck-mounted "cherry picker" for the job. This is an articulated boom arm that can pick up multiple sheets of drywall and slip them into the structure near where they'll be installed. If you've ever muscled 20 or 30 sheets of ⅝-in. rock up two flights of stairs, you'll appreciate the cherry picker.**

**Some of the best information on light-gauge framing is put out by the drywall manufacturers themselves. United States Gypsum Co. (101 S. Wacker Drive, Dept. 122-ZZ, Chicago, Ill. 60606) has several publications on the subject, and they're packed with information. For example, "USG Steel-Framed Drywall Systems" (20 pp.) includes data on the physical and sectional properties of steel studs, design information, construction details and installation guidelines.**

**Georgia-Pacific has a well-designed free booklet filled with section drawings of various steel-stud wall configurations. Write "Metal Products Catalog," c/o Georgia-Pacific Corp., PO Box 48408, Atlanta, Ga. 30362.** ***—Mark Feirer***

***Installing light-gauge wall partitions.*** **First, a layout for the walls is marked on the floor, and transferred to the ceiling using a plumb bob. Metal track is cut with sheet-metal snips to fit the layout, and is screwed in place (top left). Then 24-ga. wall studs are cut to length and snapped into place between the two tracks (left). The track holds the studs securely in a friction fit, and when all the studs are in place they're fastened with short framing screws. To check the alignment of studs framing window and door openings, a plumb bob is hung from the top track near the stud to be checked. By measuring the distance between the string and the stud, an accurate determination of plumb is made, as shown above.**

piece of track, track sections can be spliced together. To do this, make a lengthwise cut about 2 in. long in the web of one piece of track, then slide a second piece into the first. Track doesn't need to be spliced under a stud the way wood plates do.

When the upper and lower tracks are in place, mark the stud spacing on each one. It's easiest to mark the top track first, then transfer the spacing to the bottom track. The small spring clamp can be used to anchor one end of your tape measure while you're marking the tracks. For interior partitions, the stud spacing is usually 24 in. o. c., but 16 in. o. c. is also fairly common. Of course, you can use other spacings, depending on the requirements of the particular job.

Wall openings are framed with single studs except where heavy doors are expected; use two studs on each side in that case. To determine the stud length, measure the distance between the tracks and cut the studs about ¼ in. to ⅜ in. shorter than this length. This allows room to tip them into place. In light-gauge framing, the tolerance for error in stud length is greater than it is with wood studs, and metal studs can be as much as ½ in. shorter than the track-to-track distance without causing any problems in the frame.

**Installing the framing—**Installing the studs between the top and bottom tracks is a snap—literally. Just set a stud between the tracks at a slight angle (to clear the flanges of the tracks), straighten it up and give it a half-twist so that it snaps into place (photo above left). The flanges of the tracks will hold the studs firmly in position until you are ready to fasten them. Make sure that the open sides of the steel studs all face in the same direction.

After you snap all the studs in place, fasten them with framing screws. Sometimes it's helpful to hold a stud in place with spring-loaded clamps while a screw is being run home. Good steel framers put four screws into each stud, one at each corner.

Corners are easy to stud out (drawing, previous page). The stud arrangement at right-angled corners is the same as in framing wood partitions: a simple two-stud corner. At non-90° corners, just run the studs as close to the angle as possible and stop there. You don't have to bevel the studs for a perfect joint. The drywall will extend past the corner studs to make the corner itself, as shown in the drawing. To protect outside corners where walls meet at odd angles, we use reinforced flex tape. Essentially it's a cross between metal corner bead and regular joint tape—it has a metal edge, bonded to paper edges, and can bend to fit various angles.

Studs at door and window openings have to be square and plumb. A plumb bob suspended from the top track is a handy guide for aligning them (photo above right). If the distance between stud and string is the same at top and bottom, the stud is plumb. You can also use a



Photos: Mark Christensen

level to align studs, but nothing beats the accuracy of a plumb line.

Once all of the full-length studs are in place, mark the rough openings for the height of the headers and window sills. Now you are ready to cut the headers. Remember that these headers are non-structural—they're intended only to provide backing for the drywall, not to support the weight of the ceiling joists. Cut a piece of track 4 in. longer than the rough opening, measure in 2 in. from either end, square across the track, then cut the flanges and bend the ends in 90° (drawing, p. 68). Some framers prefer to cut the flanges at a 45° angle, creating a small tab on the horizontal part of the header that overlaps the stud. With the throat of the track (the open part of the C) facing up, the bent ends can be attached to the trimmer studs with one framing screw on each flange. To form the sill of a window opening, cut an identical section of track, but screw it to the studs with the throat facing the floor. Cripple studs can then be installed above and below the openings by standing them between the tracks and twisting them into place.

**Blocking**—As with wood-framed partition walls, metal walls must contain blocking so things like shelving and plumbing fixtures can be solidly attached. Metal framing can be used for blocking, but wood is the material of choice because of its versatility. I use ¾-in. plywood for blocking because it is fairly inexpensive and can be ripped to whatever size is necessary (for commercial jobs, the only wood blocking allowed is fire-retardant material).

Blocking isn't hard to install in a steel-stud framed wall (drawing, above right). With snips or wire cutters, uncurl the flange of one stud where the blocking will be attached. This will allow the blocking to sit flush with the back side of the drywall. Attach the plywood by running bugle-head screws through the flattened edge of the stud and into the plywood. At the adjacent stud, screw through the web and into the end of the plywood to anchor it.

Wood door frames require blocking to prevent the attaching screws from pulling out, and they also provide backing for the casing. Rip a 2x4 to fit into the throat of each door stud, then screw into the wood stud through the web of the metal stud (drawing, p. 69).

**Wiring and plumbing**—Electrical and plumbing runs can pass through the prepunched holes in each stud, so be sure that the studs are installed with these knockouts aligned. Electrical boxes can be screwed directly to the stud web or fastened with metal stud clips. The clips are available through electrical-supply stores and specialty-fastener distributors, and are spring-loaded to be pushed on to the stud with a hammer. Where no stud is available to attach to, a piece of track can be installed like a header, and the box can then be screwed to the track.

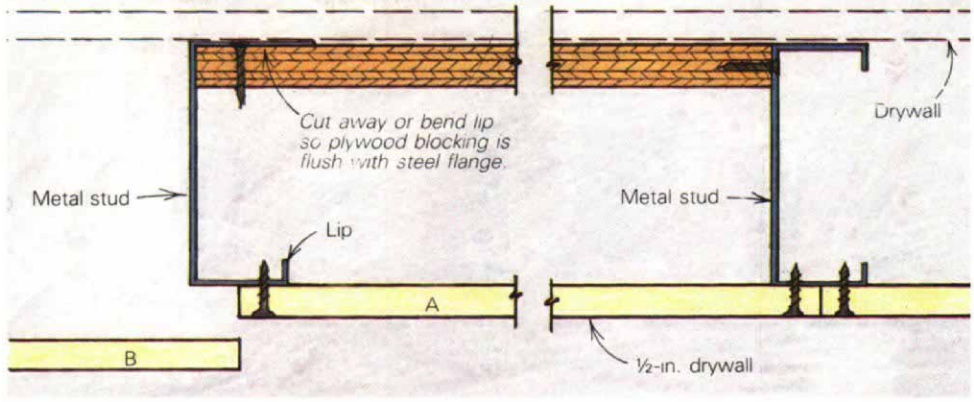
Sometimes the prepunched holes in the studs won't be quite where you want them, so additional holes can be cut with a metal-cutting hole saw in a standard electric drill. Since light-gauge studs are used in non-structural situations, you can use your own judgment in determining the number and size of holes—there's no code guideline as there is with wood studs. Wiring is often run in metal conduit, but standard Romex can also be run if you're careful not to nick or cut the insulation when pulling the cable through openings in the studs. For a really careful job, slip rubber grommets into the prepunched holes to protect the wiring. These grommets are available from the metal-stud supplier.

Plumbing can also be installed with special clips. Be sure to wrap the copper pipe with electrical tape at each stud location to prevent the corrosion that occurs between dissimilar metals. With plumbing and electrical systems, it's a good idea to check all runs just before applying the drywall to be sure nothing has been damaged.

**Installing the drywall**—Applying drywall to metal studs is a lot like applying it to wood studs. The main difference is that you screw it to the walls instead of nailing it. Before starting, check the framing one last time to be sure everything is square and plumb.

Drywall can be installed horizontally or vertically, but horizontal application is better. This method ties more framing members together, creating a stronger wall and reducing the finishing time by 25% or so. Usually it's easiest to put the long walls up first, sliding the rock through partition intersections and corners. Special planning may be required in tight situations—nothing is more frustrating than cutting a sheet of drywall and then realizing that it won't fit around the corner. As you hold each sheet up, tack it in place with bugle-head screws set at least ½ in. from the edges. As you encounter intersections and corners, attach the adjacent floater studs with at least four screws. Place the drywall so that the leading edge of each sheet is attached to the open or unsupported edge of the stud (drawing, above). This prevents the flange from deflecting and prevents the board from binding and causing an uneven surface. Once all the sheets are tacked in place, finish screwing down each one. Drywall manufacturers recommend that screw spacing be no more than 16 in. o. c., but the spacing may vary with local codes, so check with your building department. The drywall should then be taped and mudded in the usual fashion (see *FHB* #8, pp. 52-57, and *FHB #23,* pp. 60-65).

**Installing drywall and blocking**
*Drywall sheets should always be installed in the order shown below. When sheet A is screwed into place, it will strengthen and align the stud flange so that B will align with A. When blocking is required, it can be screwed into place as shown.*




**Trim**—Wood trim can be installed with trim-head screws. A certain feel must be developed when using them to be sure that the stud or track doesn't strip out while making attachments. Drill pilot holes in hardwoods to prevent splitting. Because steel framing uses fewer studs than the conventional approach, you will probably find situations where there will be nothing to screw into. These problems can be overcome by fastening the trim to the drywall itself with toggle bolts, screw anchors or plastic shields. When all else fails, try construction adhesive.

**Other uses of steel framing**—Light-gauge steel can be used for more than just framing interior partitions. Soffits can be erected quickly with a minimum of materials, and the light weight of steel makes the job go quickly. Various types of ceilings can be built, including dropped ceilings and suspended ceilings.

Many furring problems can be overcome using light-gauge steel, too. Furring channel (drawing, p. 68) can be used with other steel members, or attached directly to concrete or wood. Like other steel components, lengths of furring channel can be nested together, eliminating awkward splices. Hat channel is another type of furring, and is used to space finish materials away from the surfaces beneath them. Of special importance is the Z-channel. It's used for the installation of rigid foam insulation, and is an alternative to adhesive fastening of rigid panels. One leg of the Z is bent slightly, which allows it to grip the insulation as it is being installed. This saves the costs and mess of gluing and fitting rigid insulation between existing framing members. Unequal-leg channel is used much like Z-channel, except it can be used to install insulation up to 3 in. thick. In section, the shape of unequal-leg channel is like a U with one leg longer than the other. □

*Steve Mead is project manager for a Denver-based developer, and has worked as a carpenter and superintendent on metal framing jobs.*