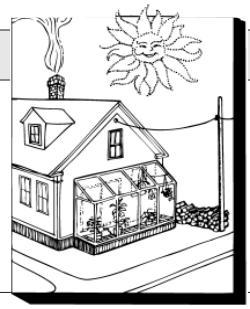

Steel Framing: Thermally Challenged?

by Bruce Sullivan

Given the housing industry's reluctance to adopt new technology, its rapid move to embrace steel framing seems remarkable. In 1991, virtually no steel framing was used in residential construction. By 1993, over 10,000 homes (about one percent of new starts) used steel framing components, and the steel industry has set a goal of having steel framing in 25% of newly built homes by 1997. A big problem with steel, however, is that it loses heat much faster than wood.

Heat Loss

Here's an example of how serious thermal penalties can be. A group of energy professionals recently tested a steel-framed home in western Oregon. The house had been framed with 2x8 steel studs, 24 inches on-center, and the walls insulated with R-30 fiberglass batts. Despite the high insulation levels, however, the researchers found cold spots on the interior wall surfaces over the metal studs. With the outside temperature at 42°F, the drywall between studs measured 61°F, while the drywall over the studs themselves was only 51°F. One corner measured 43°F — just one degree warmer than the outside temperature.

Given typical indoor humidities, cold temperatures like these almost guarantee condensation. Water vapor will tend to condense on these cool spots, attracting dust and mildew in the process. The result is what I call "the striped wall syndrome," in which a vertical band of discoloration appears on the face of the interior drywall over each stud.

Thermal Bridging

The culprit behind these problems is thermal bridging through the metal frame. Steel conducts heat more than 300 times faster than wood. When steel studs are placed 16 inches on-center, the wall's insulating value is only 40% that of the insulation material's nominal R-value. For example, putting R-19 batts between steel studs gives you a wall that's only about R-7.6.

One solution is to add rigid foam insulation to the outside of the wall. Be aware, however, that this only reduces the problem by adding the foam's stated R-value to the whole wall. So if you add one inch of R-7.2 per inch foam to the above wall, you'll still only get an overall insulating value of R-14.8. Even the fasteners become a heat loss issue. A recent issue of *Energy Design Update* newsletter reported on a study done by Dow Corp., the makers of Styrofoam brand rigid foam. Dow found that the screws used to fasten the foam to steel studs in a wall reduced the foam's R-value by 39%. The screws and the metal studs combined to provide a direct path for heat to escape from the living space to the outside of the building.

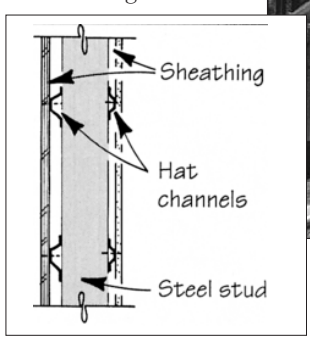

Figure 1. *This pre-engineered frame, made by Advanced Framing Systems, uses hat-shaped horizontal channels to reduce thermal bridging through the wall.*

Thermal bridging across a wall is bad enough, but imagine what happens in attics. Metal roof trusses extend like radiator fins from the interior gypsum to the exposed attic. There's no easy fix for this problem.

Short-Term Solutions

If you still want to jump on the steel-framing bandwagon, try the following:

- Use steel studs for interior walls only.
- Buy full-width insulation. The insulation batts used in most wood framing are 15 or 23 inches wide. But steel studs are often "C" shaped, so batt insulation should be the full 16 or 24 inches. Unfortunately, most high-density batts, such as the R-21 wall batt, aren't available in full widths. One solution is to use blown-in insulation.
- Forget about thick wall cavities. The fact that steel studs can halve the R-value of cavity insulation means that adding more cavity space can be a waste of money. Instead, frame 4-inch-thick walls, and hang as much rigid insulation on them as possible.
- Use foam core panels over a steel frame. These put all the insulation outside the frame, minimizing heat loss.
- Avoid the "stick for stick" approach. Replacing each wooden member with a steel one may be simple, but it may also create an energy hog. If you're serious about steel, investigate the various engineered framing systems. Some of these use structural supports spaced 4 to 8 feet apart, reducing the number of thermal bridges through the insulation. One such system, shown in Figure 1, is made by Advanced Framing Systems (1118 W. Spring St., Monroe, GA 30655; 800/633-8600). The studs

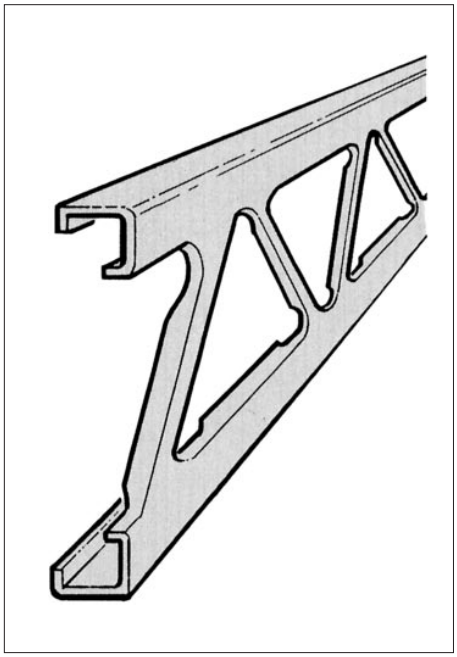

Figure 2. *Newer products, like the Delta stud, go together like standard steel framing yet lose no more heat than wood studs.*

are placed 4 feet on-center, while the sheathing and siding attach to horizontal "hat sections" that reduce the amount of thermal bridging even further. A similar system is made by Tri-Steel Structures (5400 S. Stemmons Freeway, Denton, TX 76205; 800/874-7833).

Eye to the Future

In the long run, steel framing will probably become a sensible alternative to "stick-built" homes. But the industry will have to develop products with fewer thermal liabilities. At least one such product is on the horizon. The "Delta stud" (see Figure 2) is "thermally improved," in that its web contains more air than steel. The manufacturer claims that the stud has the strength of a solid-web steel stud and the thermal characteristics of a Douglas fir 2x6.

The Delta stud was developed 12 years ago in Canada. A South African concern called Macsteel bought the patent soon after and is in the process of trying to reintroduce the product to North America. The firm expects to have something on the market within the next few years. ■

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