



THE NUTS & BOLTS OF TIMBER FRAMING

INNOVATIVE FASTENERS COMBINE THE STRENGTH OF STEEL WITH THE GOOD LOOKS OF TRADITIONAL TIMBER JOINERY

Post and beam structures are still in demand by owners and architects who like the look of heavy exposed timbers. Subcontractors specializing in traditional hand-tooled mortise-and-tenon joinery are scarce, however, and the method is so labor-intensive that costs are often prohibitive. One option is a pre-cut kit. But most of these won't provide a partial frame, so contractors looking to add an exposed beam roof or ceiling to a standard home are out of luck. Those tempted to do the work themselves are often unsure of their ability to handle the large timbers and hand joinery. For most, it's a risky business.

Peter Ferick and Richard Becken recognized the problem and applied their building and manufacturing experience toward the development of a system they think will make timber framing accessible to the rest of us. Ferick and Becken teamed up in 1987 to found Green Mountain Precision

Frames. As its sole employees, they designed and patented the *Timberlok* fastener, the heart of a total framing system that speeds site assembly of timbers and makes connections between engineered wood beams without unsightly and expensive exposed steel plates.

A Precision Fastener

Most modern timber framers and kit manufacturers use traditional mortise-and-tenon joinery while taking advantage of the speed and accuracy of modern power tools. But the stability of the joints is still limited by the characteristics of wood. In fact, the dwindling supply of quality mature timbers has prompted the Timber Framers' Guild of

North America to describe solid-sawn timbers as "the Achilles heel for timber framing." Ferick and Becken set out to remedy this situation. Working out of a garage at first, they experimented for several months with a number of steel plate and pin prototypes before they struck upon the Timberlok.

The Timberlok itself is a machined steel cylinder tapped in one or more places to receive a standard $\frac{5}{8}$ -inch machine bolt (see Figure 1, next page). Structurally, the joinery in a Green Mountain Precision frame is an improvement on traditional joinery. Ed Cundy, of Swift Engineering in Norway, Maine, occasionally performs design review for Ferick and Becken. "Timberlok has an advantage, especially with

collar ties and balloon frames," he says. "The Timberlok has a different geometry. It can use half of the rafter thickness to pick up the forces." Traditional joinery is limited because the deep mortises, on several sides of a post, for example, remove a lot of wood. Timberlok fasteners, however, can be tapped to handle complex intersections without sacrificing strength. The shallow mortises and tenons also make it easier to fit a timber between two fixed points, since the tenons at each end add only 2 inches to the overall beam length; traditional tenons would add 6 to 8 inches. And, unlike exposed steel plate connectors, Timberlok fasteners are completely concealed.

Every timber produced by Green Mountain Precision Frames is predrilled to receive bolts at the joints, and every joint has a Timberlok fastener inserted and locked into place before it is shipped. "Lots of people call, asking if they can buy just the Timberlok

BY SAL ALFANO

The Geometry of a Timberlok Fastener

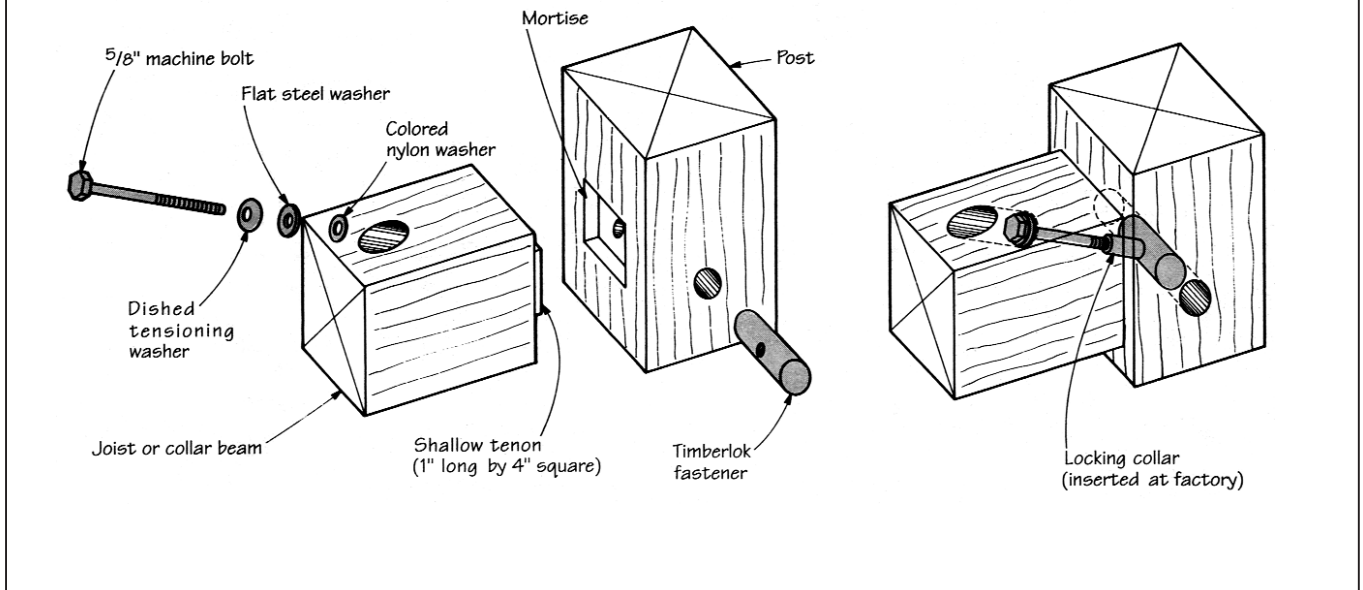
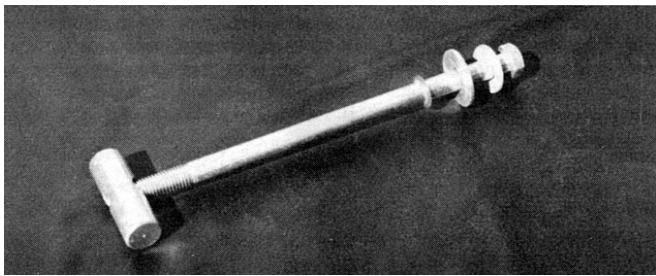


Figure 1. The shallow mortises and tenons in a Timberlok joint support compression loads only, and leave more wood in the timbers. The Timberlok fastener and machine bolt have a deeper bearing surface to resist the spreading action of the forces in tension. The most common connection in a Green Mountain Precision frame uses a 1-inch diameter Timberlok fastener tapped to receive a standard 5/8-inch machine bolt (left). Between the flat washer and the bolt head is a dished steel washer that keeps tension on the bolt. The small nylon washer is colored to correspond to four different bolt lengths, and matches the color-coding at each joint.



fastener," says Ferick. "We don't sell them separately because you can't drill accurately enough in the field." After Timberloks are inserted into the joints, the holes are filled with tapered, flat-grain plugs. Properly sized plugs are provided for the exposed bolt holes as well, and are inserted by the installer after the frame has been erected. Beams are sealed at the factory with Watco clear finish (Minwax Company, 1500 Mercedes Drive, Montvale, NJ 07645; 800/526-0495), and the ends are treated with wax-based Anchorseal (U.C. Coatings Corp., P.O. Box 1066, Buffalo, NY 14215; 716/833-9366) to retard evaporation.

A Partial Frame

Recently, I had an opportunity to visit a couple of job sites where the Timberlok framing system was being used. The first one, a 4,000-square-foot home currently being built by Sheppard Construction in Windsor, Vt., incorporates a partial timber frame in a dramatic central room with vaulted ceilings. When price quotes from timber framing subcontractors all came in too high, Sheppard's owners considered using their own framers for the job. They got as far as pricing the material, but were worried about estimating the labor, since their crew had never done

any timber framing. Then Charlie Bacon, house engineer for Sheppard, went to visit Ferick and Becken. "When I saw how the system went together," he said, "I knew we couldn't miss."

Since the job was too small to justify a crane, the hardest part for site foreman Roy Coley and his three-man crew was lifting the timbers into place by hand. They used a couple of lifts of pipe staging on wheels to assist with the "high-wire" work. The Timberlok fasteners sped the process. As Coley put it, "When you're up in the air with a heavy timber, the last thing you want to do is fool around with a joint. We didn't have any of that."

One reason installation goes smoothly is the coding system used to mark the joints and timbers. Before any actual milling begins, Ferick and Becken prepare a CAD printout of the complete frame. A grid system overlays the floor plans and identifies post and beam locations with letters and numbers at grid intersections. These labels are indelibly marked on every timber in the frame for easy cross-referencing in the field. In addition, the four different lengths of bolts are coded with nylon washers that match the color of the lumber crayon used to mark each joint. The colored washer also holds

the flat and dished steel washers in place up near the head so they don't get lost and can't get in the way while inserting the bolt. According to Coley, the color codes contributed to the short total erection time of two and a half days.

A Complete Frame

The Gaherty house, in Grantham, N.H., is a full Timberlok frame structure with a stress-skin shell. When I visited the site, Becken was providing technical assistance to the crew,

something he and Ferick like to do on local projects. Most of the frame was already in place, and they were preparing to install the Timberlok rafters. Bob Cole, who had the labor contract to erect the shell, wanted a crane at the job to set the stress-skin panels, and decided to use it to help with the frame (see Figure 2). He's glad he did ("the operator was amazing"), but said he wouldn't shy away from installing Timberlok frames by hand.

Cole and crew easily mastered the system, calling for bolts not by length

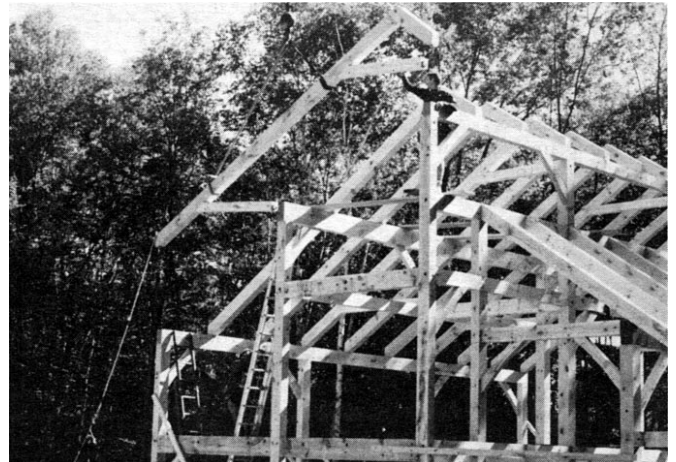


Figure 2. Parts of the wall and rafter systems at the Gaherty house were assembled on the ground and lifted into place by crane. The 32x40 frame was erected by four men in two and a half days.

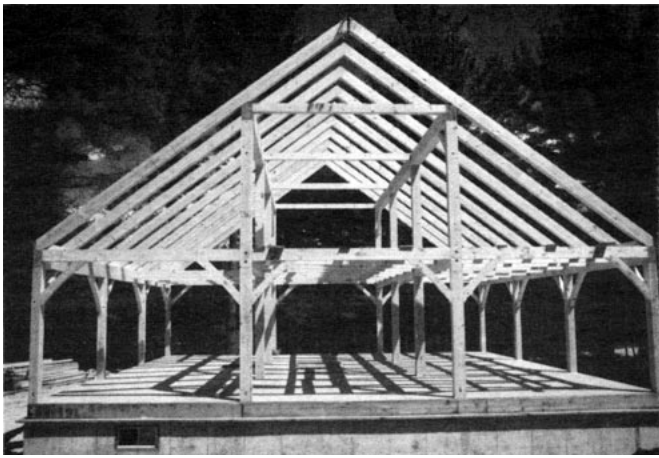


Figure 3. Green Mountain Precision Frames is one of the few timber frame manufacturers who will provide just the frame, a plus for builders who don't need a complete kit.

but by color — “reds” or “blues” — proving how well the color-coding works. They estimated three days to install the frame. I arrived after they'd been working for a day and a half, and before I left, a fifth of the rafters were in place. They finished before noon on the third day.

Making repairs to a timber frame isn't easy, no matter who manufactures it. Unlike conventional framing, where a miscut stick can be replaced with materials on site, a mistake in a manufactured timber frame can mean waiting while a new piece is fabricated and shipped or else laboriously reproducing it by hand. Ferick and Becken rely on careful planning and lots of double-checking to minimize the chance of error. The Sheppard crew had only to deepen a couple of bolt counter-borings; at the Gaherty site, one timber needed to have a mortise retooled. More significant is the ease with which an assembly error can be corrected, an advantage the Timberlok bolt-together system has over others. While I was there, Cole's crew accidentally left out the plywood splines used on the topmost course of horizontal timbers to keep them aligned. To correct the oversight, they unscrewed the bolt from its Timberlok, inserted the splines, dropped the beam back into place, and re-tightened the bolt. The whole repair took less than three minutes.

Fit For Engineered Lumber

Both projects I looked at used eastern white pine timbers, but Ferick prefers to work with engineered wood, like glulams, because it is more uniform in dimension and quality, and makes better use of smaller, second growth trees. “One of the reasons we invented the Timberlok was to eliminate the need for big, ugly steel plates,” he says. Glulams are popular in commercial buildings but Ferick would like to see them used more often in residential applications. The Timberlok has been successfully tested by MacMillan-Bloedel for use with Parallam beams. Ferick believes the Timberlok will work well with any engineered structural

lumber beam. Since glulam or Parallam beams are stronger than solid sawn timbers, using Timberloks makes installation of these larger beams easier and cheaper. “The longer the span, the fewer the connections,” says Ferick. This saves milling and installation costs. And because Timberloks are totally hidden, they don't draw attention to themselves.

Shopping For Price

All Green Mountain Precision frames are produced by Ferick and Becken at their 5,000-square-foot shop in the old Goodyear factory in Windsor. The price is F.O.B., but the company will arrange for shipping and add the cost. Ferick and Becken estimate every frame piece-by-piece, because the cost depends on the size and number of timbers, and the number and complexity of the joints. When customers ask for a ballpark estimate, they use a rough price of \$9 to \$12 per square foot of floor area for the materials package. This held true for both jobs I saw. On the Sheppard job, their original bid of \$18,000 for 1,728 square feet (\$10.42 per square foot) was 38% to 300% lower than the other prices quoted. The 32x40 two-story frame at the Gaherty house cost \$24,000 or \$9.38 per square foot. Erection costs must be added in both cases, but a Timberlok frame goes up as fast or faster than other systems I've seen (see Figure 3).

Timberlok frames are a New England phenomenon for the moment, but Ferick and Becken are working hard to develop a national market. They have shipped complete frames as far as Pennsylvania, and have bid jobs as distant as Colorado. For more information, write Green Mountain Precision Frames, P.O. Box 293, Windsor, VT 05089; or call 802/674-6145. ■

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