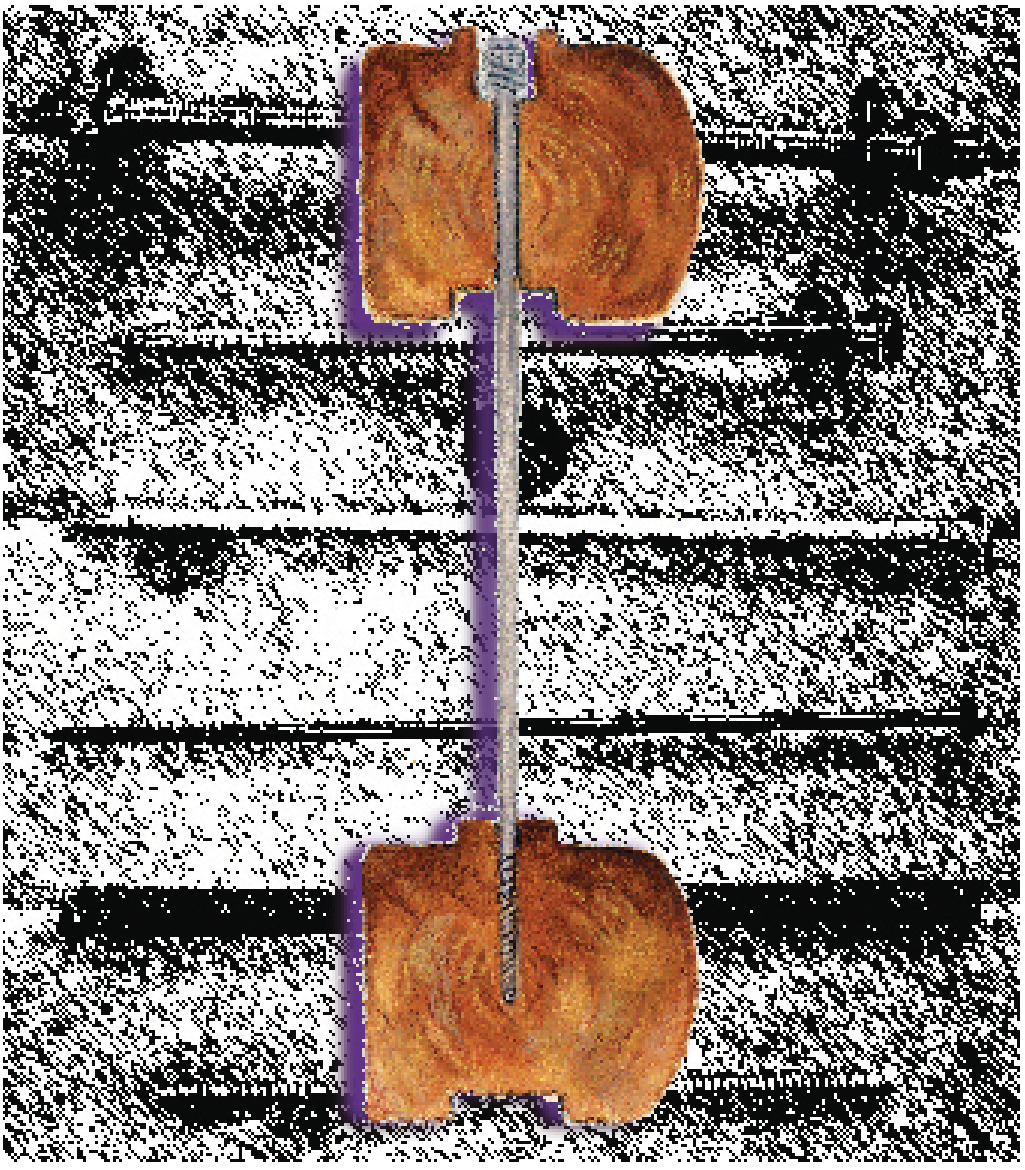
# Tighten Up

## FASTENERS TURN LOGS INTO WALLS



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We've heard the sayings before: "re-invent the wheel," "build a better mousetrap," "think outside the box," etc. But when it comes to stacking logs, has a better mousetrap been invented? Is there really a difference between the fasteners that log-home companies use to put their homes together? A screw is a screw and a nail is a nail, right?

Well, not always.

Most companies agree that some sort of fastener is required to hold the logs together in a modern log home. I haven't personally been able to examine Abe Lincoln's parents' quintessential log cabin home, but I'd be willing to bet it was built without that addition of lag screws, through bolts or even timber spikes. Although meticulously cared for and rebuilt at least once, Lincoln's log cabin is still standing. So why does a new log home require a seemingly mystical combination of fasteners in an even more mystical

arrangement throughout the wall?

Before getting into the details of why fasteners are required let's review the most commonly used fasteners in today's log homes.

Spikes or "giant nails" are one of the oldest methods in terms of modern-day log homes for fastening log courses together. They are generally the least expensive of all the fasteners and offer competitive strengths. The drawback to spikes is the manual labor and large sledgehammers required to install them. Think John Henry pounding in railroad spikes.

Lag screws or lag bolts are in essence giant wood screws but with a hex-shaped head like that of a bolt. They have been used in log homes for decades, and their strengths are well documented. Lag screws are good at "pulling" warped logs into position and providing uplift resistance to the structure. The major drawback to lag screws is the labor required for installation. All the holes need to be predrilled with two different-size drill bits, and unless the builder is into 10-hour days of resistance training for his arms, a strong, electric impact wrench—who doesn't have one of those?—may be required to screw the lag screws into position.

GRAVITY HAS THUS FAR DONE A FINE JOB OF ENSURING THE LOGS SETTLE AND REMAIN TIGHT.

Log-home fasteners, typically called "Oly Lags" or "Blue Ox/Max screws," are made specifically for use in log homes. These fasteners are derived from high-tech, heat-treated steel, resulting in similar strength ratings as compared to lag screws and spikes—often twice the diameter of the log-home fastener. Log-home fasteners tend to be slightly more expensive than lag screws or spikes but offer substantial installation savings as no predrilling or sledgehammer is required. A strong, hand-held, half-inch power drill is all that is essential in installing these screws. The screws are self-drilling and self-countersinking. Having personally built two log homes and spent time on numerous job sites, I can attest that these are probably the easiest fastener to install for the do-it-your-selfer.

Reinforcing bar—rebar—offers significant shear strength over other fasteners of the same nominal size because it is a solid bar, and there are no threads to weaken the shaft. Rebar is inexpensive but does require predrilling. Holes have to be very tight to provide any shear resistance. Oversizing the installation holes, as many contractors do, negates any shear strength provided by the rebar. The major con with rebar is that some other threaded-type fastener is often required, as the rebar offers no uplift resistance.

Through, also thru, bolts are probably the most labor intensive of all the fastener options but offer unmatched uplift resistance. As the name implies, this fastener is literally a threaded rod, similar to a bolt but without the head. It comes in lengths measured in feet and can be cut to any dimension. A nut-and-washer is placed on each end and tightened like that of a bolt. Threaded-rod connectors are typically the only option when dealing with high wind loads or seismic conditions. Walls with numerous or large window and door openings typically mandate the use of multiple threaded-rod connections.

In most cases, the rod connects to an anchor bolt in the foundation wall with a coupling nut (a nut meant to join to separate pieces of threaded rod) and then extends all the way through the top course of logs. A large washer-and-nut is placed on the rod and securely tightened. Depending on the engineering requirements, larger-diameter rods or multiple rods may be necessary. Although in theory the rods offer shear strength comparable to other fasteners, the holes used to install the threaded rod are generally twice the diameter of the rod itself, negating any potential shear-strength capacity. Such an oversized hole is necessary to ensure the fastener can be positioned in the wall through 10 or more courses of logs, which may be slightly misaligned.

Some companies install springs on the threaded rod above the top course of wall logs to keep the logs tight. This may be a worthy endeavor if the logs are wet, significant settling is expected and the log profile is such that weather resistance relies on tight-fitting logs. Even in this case, the nut holding the spring in place will need to be tightened on a regular basis—same as if the spring wasn't there.

My experience with these types of systems is limited, and my opinion may change tomorrow, but from an engineering perspective, gravity, which doesn't fade over time, rust or depend on a nut being tight, has thus far done a fine job of ensuring the logs settle and remain tight. If the logs are very dry and little or no settling is expected, forgo the spring and simply tighten the nut.

The last genre of fasteners is a new one. It's the anti-settling fastener. This is not to say other fasteners have not been used in an anti-settling application, but the anti-settling fasteners are specifically designed to prevent a log house from showing signs of settling. These fasteners have two separate sets of threads separated by an

unthreaded shank in the middle of the fastener. The upper thread is positioned in the upper log, and the lower threads are positioned in the lower log with the unthreaded shank in line with the joint between the logs.

Other fasteners have a smooth shank where it penetrates the upper log and as the upper log dries or settles it slides down this shank constantly maintaining contact with the log below it. Unlike other fasteners, this screw has threads in both of the logs it joins. The upper log is not permitted to slide down because of the threads on the upper portion of the screw and as such prevents settling. A caveat of this fastener is that proper sealant between log courses must be used; as the logs dry, they will separate and create a gap between the log courses that otherwise would expose the interior of the house to weather.

These fasteners offer comparable shear resistance to lag screws and log-home fasteners and withdrawal capacities on par with lag screws. (Exact data were not available at the time this article was written.) Installation requires a very strong, hand-held power drill. The screws are self-drilling and countersink themselves. No predrilling is required. Anti-settling screws tend to be the most expensive of all the fasteners described; however, if they are properly engineered and installed, settling may be lessened to a point that other costs associated with a settling-type log home can be eliminated (settling jacks, slip joints, sliding window and door bucks, etc.).

What determines which fastener is used, and does it matter? The forces acting on the structure determine what fastener is specified. And yes, it does matter. Different fasteners have different strengths and weaknesses. Many factors come into play in determining which fastener is selected. In my experience, many companies choose to use a given fastener based on, in this order: tradition (this is the way we've always done it), economics (in our neck of the woods, these are the least expensive to buy) and engineering (without this fastener the house will fall down).

As a future article will detail, fasteners are literally the key ingredients in ensuring the structural integrity of today's log home. Here are a few key things to remember when considering log-home companies or reviewing blueprints.

Since many log-home companies do not actually erect the structure, merely sell you the materials (i.e. "the kit"), selecting a less-expensive fastener, in terms of material cost, brings the package price down. The installation cost—that's up to the consumer to calculate. It's also worthy to note that in many parts of the country, engineering review is not required for residential construction, so that third criteria in the aforementioned list, engineering, may not have been considered.

As for the blueprints, remember these generalities: The more window and door openings in a wall, the more fasteners or stronger fasteners are required. In general, the taller the house, the more fasteners or the use of stronger fasteners are required. If your blueprints show a different pattern, you might want to consider having an engineer review the plans.

Next: Why fasteners matter. **LHI**

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