BY ROB PICKETT

Log Fastening Solutions

Everything you need to know about the fasteners that hold your logs together

A log wall system relies on the interaction of several components for stability — joinery methods, fasteners and the logs themselves. Basically, wherever two structural components join, there is a connection; wherever there is a connection, chances are there is a fastener holding it together.

Many types of fasteners are used for log homes. Each log home producer chooses a fastening system based on traditional construction methods, formal structural engineering, on-site handling convenience, availability and cost. The type of fastener used is ultimately based on the type and size of the wall logs, the joining method, the number of openings in the wall (windows, doors, etc.), type of corner system and geographic influences.

WHAT ARE FASTENERS?

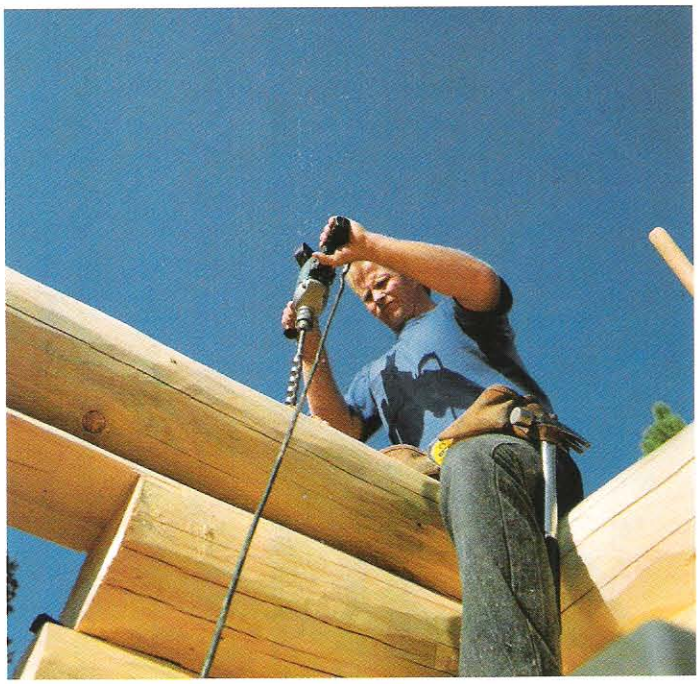
Fasteners do more than hold logs together. They are used for alignment during assembly of the log wall and they hold joints and corners together to restrict the twisting of logs as the wood seasons (dries).

There are two types of fastening techniques used to connect wall logs — **mechanical fastening** and **adhesive bonding**. Mechanical fasteners include bolts, drift pins, lag screws, log/timber screws and spikes. Adhesive bonding is accomplished by placing a bead of mastic or sealant product along the length of the log. Some log builders use a combination of mechanical fastening and adhesive bonding.

Mechanical fastening is the predominate method for fastening lumber, timber, sheathing or wallboard. Since ancient times, wooden pegs have been used to pin timber connections. Today a variety of alternatives serve that purpose.

Categorized as "dowel-type" fasteners, they may be threaded (bolts, lag screws, log/timber screws) or steel wire/rod products (nails, spikes, drift pins).

Most "dowel-type" fasteners are required by code to be installed using lead holes pre-drilled through the log being connected and into the log that will hold the tip of the fastener. The strength of the fastener is predicated on how far the tip of the fastener extends into the holding log. Unless the specific fastener is designed for use without predrilling, drilling this lead hole is a required step. Predrilling is necessary with fasteners such as bolts and drift pins.



Pre-drilled holes are necessary with most mechanical fastening applications. Dotted lines along illustrations on page 36 indicate where pre-drilling is required. *Photo Courtesy Rocky Mountain Log Homes*

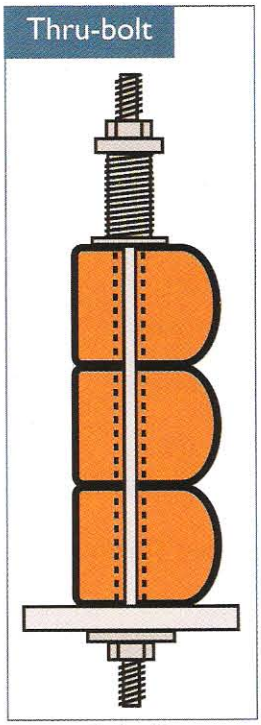
Mechanical fasteners are available in plain steel or coated for rust resistance (either galvanized or coated with a polymer or epoxy.) Coated fasteners are advisable for the exterior walls of most log wall systems.

BOLTS

Bolts are used in two basic areas of log construction. One application joins logs in a wall; the other joins logs that form a beam or header. In the latter application, bolts are used to improve the structural capacity of logs stacked together. Merely stacking the logs forces them to act independently. By installing a specified pattern of threaded rods with nuts and washers on

each end, the logs act collectively to form a strong beam.

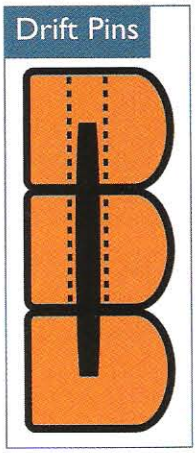
The second — more common — application of bolts used in log wall assembly is called "thru-bolt" fastening. A thru-bolt runs the full height of the log wall, through all log courses and is held by a nut and washer on each end (under the subfloor or sill log and above the top log course). Pressure is maintained on each end of the thru-bolt by occasional manual re-tightening or by using springs or other specially designed mechanisms, which creates a compression force to keep the log wall tight. This same fastening system acts as a tension rod, limiting log separation during high wind or earthquakes.



Thru-bolts are installed near the ends of walls, at openings and often spaced along the log wall 4 to 8 feet apart. Bolt diameters range from ½" to 1½" and are available with thread at both ends, full-length thread (called all-thread), or thread at one end and a head at the other.

An advantage of thru-bolt fastening is that it allows logs to move along the bolt as wood seasons, accommodating settlement (considering the drilled holes in the logs are equal to the diameter of the bolts).

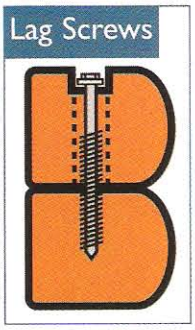
A disadvantage to thru-bolt construction is the assembly process. As bolts are set in place, each log is drilled to match bolt locations, then lifted over the bolt and set in place. To ease the difficulty of lifting a heavy, pre-drilled log over a tall bolt, shorter lengths of bolt (typically 30" or 36") are joined with threaded couplings. Where couplings are required, the log(s) must be drilled to accommodate the larger coupling diameter. And, unless a compression device is incorporated, the thru-bolt system involves periodic manual tightening of the nut above the top log course over the first couple years as the logs settle.



DRIFT PINS

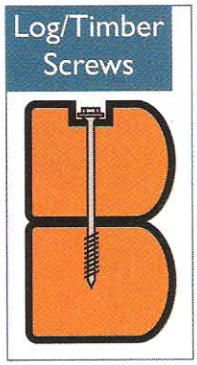
Drift pins are not as commonly used for log wall assembly, but they are a viable technique. Drift pins are long, unthreaded steel rods (typically ½" to 1½" in diameter) designed to pass through two or more log courses. As with thru-bolts, logs move down the drift pin as they settle. Drift pins typically connect three or more logs in a wall, increasing the rigidity of the log wall. They are installed near the end of each log and are intermittently spaced over the log length.

LAG SCREWS



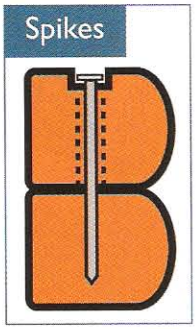
Lag screws (a.k.a. lags) are basically pointed bolts. They are typically ¼" to 1¼" in diameter and from 3" to 16" in length. Lag size can be increased to resist greater forces such as high winds. They typically have a hex-style bolt head and threads encompassing approximately two-thirds of their length. The threaded shank of the lag provides improved holding over unthreaded fasteners. Since logs don't move along the threaded shaft of the lag screw, an oversized lead hole is drilled in the top log to allow for settlement.

LOG/TIMBER SCREWS



Although they have been around since the mid-1990s, **log/timber screws** are relative newcomers when it comes to log fastening systems. Unlike the lag, the log screw is designed to eliminate the need for predrilling. The threaded portion of the screw is totally embedded into the holding log. The log above is still able to slide along the smooth shank as the wood seasons. The fastener length is chosen by adding the stack height of the log to the length of the threaded portion. With a smaller diameter than lags (log screws are typically less than ¼" in diameter), log screws may be placed closer together in a fastening pattern.

SPIKES



Spikes are essentially large nails. Before power tools were used on job sites, spikes were the most common log wall fastener. Those used in log assembly are typically 5/16" to ⅜" in diameter and 8", 10" or 12" in length. Still used today, spikes are inexpensive but labor intensive.

ADHESIVE BONDING

Adhesive bonding uses a structural adhesive rather than a mechanical fastener. Recent advances in structural adhesives have made them a strong and durable alternative to mechanical fasteners for wood connections. Their use, however, is

Illustrations by Nathan Winter

still highly controlled. Code and inspection agencies generally only rely on the quality of the bond when construction is performed under controlled circumstances such as in-plant process.

Wood surfaces must be clean and reasonably dry. Depending on the type of adhesive, surface temperature may be as important as the size and placement of the bead. These conditions are difficult to satisfy on site. Code may demand the presence of a full-time, certified inspector during erection or the visible presence of adhesive which has been squeezed out of all joints as the logs are set in place.

Beyond quality control, it's important to recognize that structural adhesives actually bond wood cells together stronger than the bond of the wood itself. Therefore, if pushed to the limit, the wood cells just beyond the bonded surfaces will break apart before the adhesive bond will. This is important to note because the location of fiber separation is unpredictable, uncontrollable and often invisible.

In the second installment of this two-part series on log fastening, we will cover evaluating fastened connections, forces acting on walls and factors affecting log wall connections. Watch for it in our March issue, on sale February 10.

Rob Pickett is a technical consultant, specializing in log building systems. He dedicates this article to Bill Moffatt, who co-wrote "Fasteners For Log Walls" with Rob for the Log Homes Council. This expanded presentation is written in Bill's memory. "He was a great friend and contributor to the log home industry and the Log Homes Council." — Rob Pickett.

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