

# The Approval of SEAL

After 8 years publishing *Log Home Guide* we have decided to zero in on possibly the greatest problem the industry faces — caulking to prevent air and water infiltration. We have asked the major manufacturers of sealants to contribute articles to this survey. — Editor.

## Caulk Joint Design

By LES BURCH, president, Sashco Sealants

Illustrations by Jeffrey Johnson, chemist, Sashco Sealants

The superior thermal efficiency of log versus frame homes is well understood and accepted by those who live in and work with these solid wall structures. Not only is this conclusion supported by decades of actual experience, but it is borne out by mathematical models which account for mass, heat capacity and unsteady-state conditions.<sup>1</sup>

One by one, building departments are rethinking codes currently based on steady-state R factors alone. The battle to prove what has been known for centuries, that log homes have that "cozy" feeling, is being won.

Yet, if there is an Achilles heel to the energy advantage over frame construction, it is surely air infiltration. Drafts coming through seams, joints and crevices account for the highest energy loss in log and frame structures alike. But in the case of log structures, there is a joint or potential gap every 6 to 12 inches up each wall and around

the entire perimeter. Sealing these seams is essential if full energy efficiency is to be realized.

In discussing caulk joint design, we wish to provide a basis for developing easier and increasingly effective sealing methods. We conclude that a log home well protected from infiltration will indeed provide the superior thermal efficiencies its owner expects.

We wish to look at what might be termed the "Ideal Caulk Joint". There are four simple joint design principles that guide it.

Our main purpose is to acquaint the reader with the four simple principles so that they can be incorporated in future design and application.

There are two assumptions we make in presenting the "Ideal Caulk Joint".

1. The caulk forms a "wet" seal — it actually adheres to the log surface rather than just filling up space.
2. The caulk forms an elastic

*"When Town & Country Log Homes creates a 2,200 square foot ranch style home, our system requires literally one mile of horizontal log. One mile of log joint is exposed to weather. A driving rain pushed by high winds will test every inch in that one mile of log joint. This is a potentially severe problem that must be thoroughly considered and absolutely solved."*

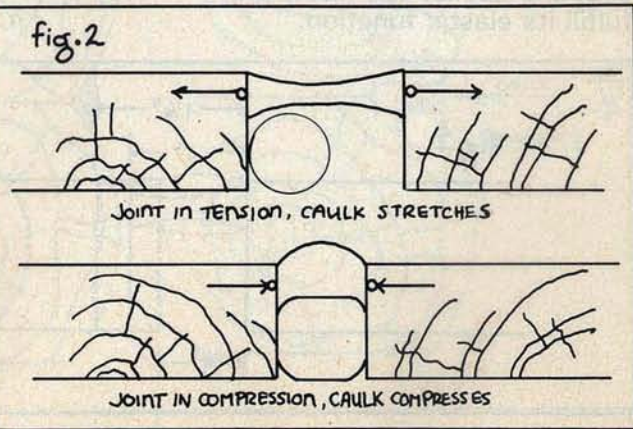
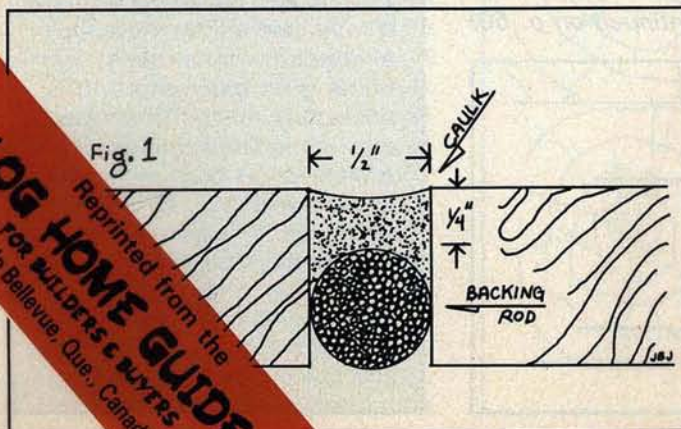
— Stephen Biggs,  
president  
Town & Country Log  
Homes

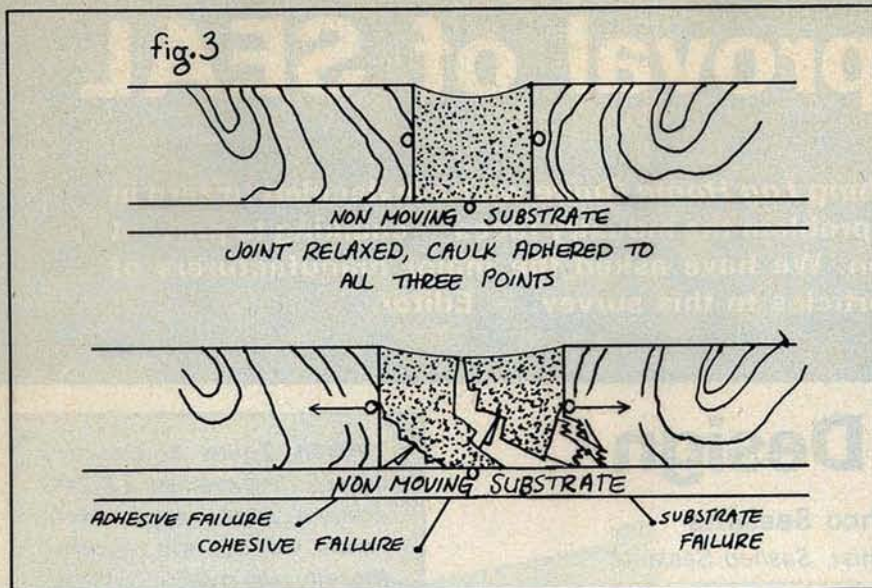
seal — it will stretch and compress with log movement. It has "memory."

### The Four Principles

#### 1. Depth is 1/2 Width

This is a general rule aimed at balancing the two factors of adhesion — how well caulk sticks to the log, and cohesion — how well it holds itself together. Since most elastic caulks are cohesively strong, the thinner cross section at mid-joint provides less resistance to





movement and therefore less stress on the adhesive bond (See figure 1). However, the better caulks have good adhesive/cohesive balance. It is better, therefore, to fill a joint "too deep" than "too thin" since sufficient caulk mass is required to absorb movement. Practically speaking, caulk joints do not need to be greater than 1/2" deep nor should they be less than 1/4" deep, regardless of width.

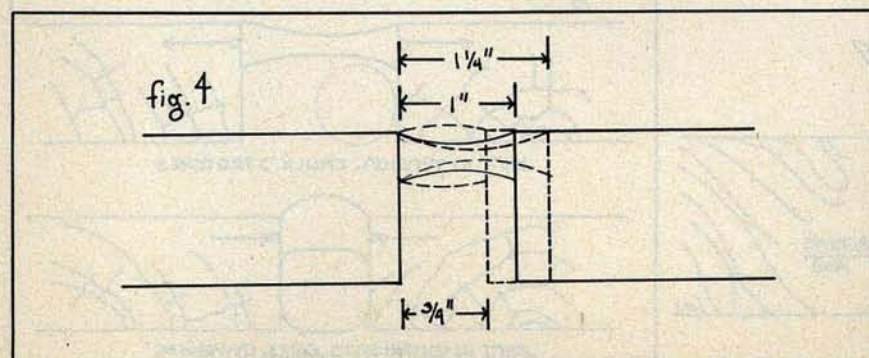
## 2. Two Point Adhesion

Caulk must be free to move when the logs do. Whether the joint is in tension or compression, the caulk should only be adhered to the moving elements at two points (Figure 2). If it is adhered to three or more points or a non-moving element, the seal will likely break (Figure 3). The job performed by backing materials is not only to take up space but provide a "third" surface to which the caulk will *not* adhere. It is then able to move over the backer rod freely and fulfill its elastic function.

## 3. Provide a Caulk "Well"

Most elastic caulks are rated as to the total joint movement they will absorb. The better ones are rated at 25% to 50% total movement. This means that a caulk "well" or space must be created which is two to four times larger than the anticipated movement. If a 1/4" movement is anticipated, a 1" caulk well is needed (Figure 4). The good news is that these ratings are tied to federal specifications and caulks with good log home performance records are usually absorbing movement well above their specified rating. The lesson here is to provide as large a caulk well as practical and realize that in instances where movement is 100% or more of original joint size, some recaulking will probably be needed. There is great leverage gained in going, for example, from an initial joint design of 1/8" in width to 1/4" wide. A 200% movement would increase from 1/4" (for a 1/8"

(Continued on p. 50)



# One Mile of Log Joint

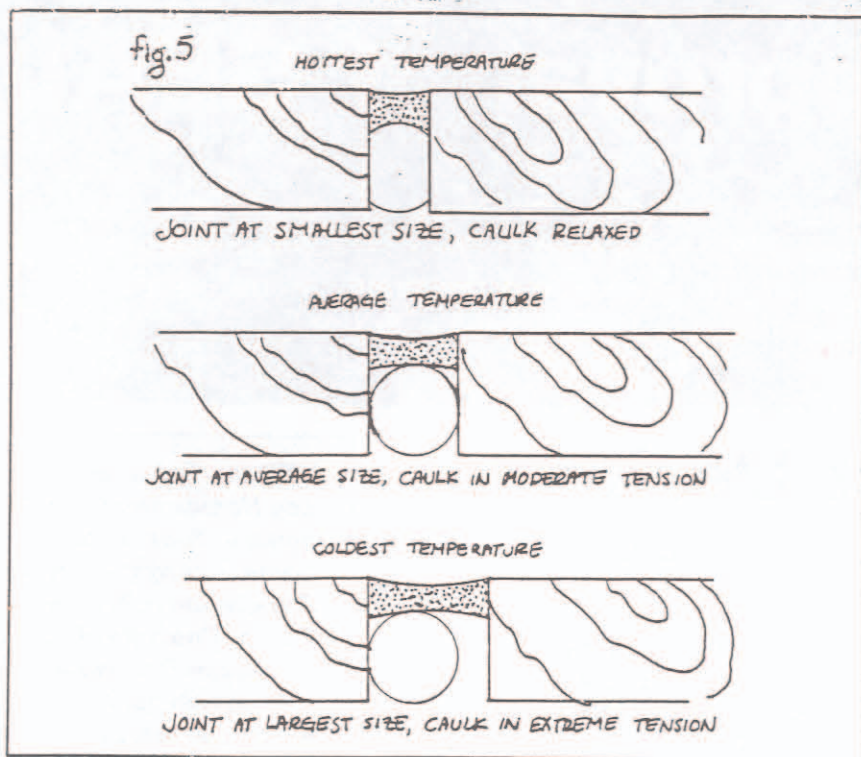
"We are all strong believers in the superior benefits of a properly constructed log home. We create these special homes with pride and a lasting relationship with our homeowners. We would never trade our log system for any conventional method of construction. But, a concern should be published. It is time for a strong caution to manufacturers and homebuyers. There is an inherent weakness to solid log construction that should always be considered.

"When Town & Country Log Homes creates a 2,200 square foot ranch style home, our system requires literally one mile of horizontal log. One mile of log joint is exposed to weather. A driving rain pushed by high winds will test every inch in that one mile log joint. This is a potentially severe problem that must be thoroughly considered and absolutely solved.

"The solution is far from simple. It requires a high level of technical expertise in wood properties, pattern milling, joinery, and sealants. This one mile of joint demands a system of "overkill" that precludes any possibility of failure. It requires sensitive craftsmanship in the manufacturing and jobsite assembly. It requires the close attention of everyone involved.

"This extra care that many builders and manufacturers take, is well worth the effort. It may cost a little more, but a correctly constructed log home is so much more. It is not simply conventional housing — it is fine furniture; it is a work of art that cannot be created with a broad brush. It is a superior way to build a fine home."

Stephen Biggs  
President  
Town & Country  
Log Home



joint) to 1/2" (for a 1/4" joint). The larger the beginning joint size the less likely the log movement will exceed caulk capabilities.

#### 4. Application Conditions

Temperature and humidity (or actual log moisture content) are largely responsible for log expansion and contraction. When logs expand the gap between them gets smaller. A caulk applied at the highest temperature and humidity conditions will be filling the joint at its smallest size. When movement occurs the caulk will be stretched and so will absorb the total joint movement while in tension. Figure 5 shows caulk applied under these conditions. The converse is true if applied the coldest day and the logs are the lowest in moisture. The joint will be at its largest size and with movement the caulk will be in compression. Since we can't control the weather, a caulk must be chosen which will perform well when applied under these extremes. However, by caulking the "cool" side on a hot day and the "sunny" side on a cold day we can help overcome the severe conditions. It is also quite helpful to caulk when the log moisture content is stable relative to the climate.

An example may help the

reader in applying these principles. Figure 6 shows a flat milled configuration with the caulk placed in the triangular space where logs meet. (Practically, this could have almost any interior configuration of tongue and groove, spline, etc.) If we reflect on this design, we see that the caulk is adhered to both logs at the tip of the triangle where the logs are actually touching. This is functionally like three point adhesion since the beginning caulk is theoretically zero in width and even a

small log movement could stretch the caulking 400% or more.

In Figure 7, we have milled a 3/16" by 5/8" notch on the edge of each log to form a 3/8" by 5/8" caulk well. By pre-filling with backer rod we obtain a 3/8" wide by 1/4" deep caulk bead with true two point adhesion. Overlapping the caulk slightly beyond the cut joint will insure that each profile, Figure 6 and Figure 7, will visually look the same when completed.

By this change, we have incorporated the first three design principles which will allow the caulk to better absorb movement and maintain a tight seal. Notice also that in the conventional configuration of Figure 6 we risk removing too much of the caulk mass in tooling the caulk bead (usually done with the finger). In Figure 7, we can use a putty knife or spatula to tool the bead "flat" and insure that caulk fills the entire caulk well.

Remember the four simple principles of caulk joint design:

1. The depth is 1/2 the width
2. Two point adhesion
3. Provide a caulk well
4. Watch application conditions

The gaining of just one might well mean a better seal.

1 McGrew, D. "ASHRAE/DOE Conference on Thermal Performance of Exterior Envelopes of Buildings", Las Vegas, NV, 1982

