Effective Practices & Methods

for

Handcrafted Log Home Construction

SAMPLE

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By the International Log Builders Association

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Effective Practices & Methods
for
Handcrafted Log Home Construction

Scope
This document describes methods, practices, materials, and techniques for building handcrafted log homes that are made from logs that largely retain their individual and natural shapes. Construction methods include: walls constructed of horizontally-laid logs, with interlocking overlapping notched corners, and with full-scribe-fit long grooves.

Effective Practices are Based on Experience
"Effective" practices and methods are defined as having proven themselves over time for large numbers of experienced and skilled log home builders. In preparing this publication, the International Log Builders Association (ILBA) has relied upon the experience of the hundreds of ILBA Members, who are log home builders, designers, and engineers. The *Effective Practices & Methods* (EP&M) provides reliable advice to help you make informed decisions.

Handcrafted log construction is a centuries-old craft, and has different expressions in diverse cultures. Our members have personally witnessed many important improvements in the years since our Association was founded in 1974, and therefore we do not call this publication "Best Practices" (a commonly used term in other industries) mostly because that term implies that future advances may be rare. Instead, the methods, materials, practices, and techniques described here are good, useful, practical, and effective—they have been demonstrated to work over time at least as well as, and usually better than, other methods.

Intended Use of this Publication
The *Effective Practices & Methods for Handcrafted Log Construction 2010* is intended to provide construction guidance to inform customers; to educate apprentices and employees; to assist carpenters and subcontractors who complete log homes; to assist log home designers and architects; to provide insight and background to inspectors; and to share the vast accumulated log-construction experience of skilled log home builders.

The International Log Builders Association is dedicated to the principle that there are techniques, methods, processes, materials, and activities that are effective at helping to deliver positive results. If these effective methods and practices are used, then an outcome may be delivered that has fewer problems and fewer unforeseen complications.

The EP&M is not a building code for log construction, it is not an engineering or industrial standard, and it is not an addendum for construction contracts. ILBA members are not required to comply with the EP&M. This is not necessarily a guide for restoring historic log structures, since it tends to favor more recent techniques, materials, and tools.

Building codes identify themselves as being minimum standards for construction to provide public safety. The EP&M, in contrast, describes practices and methods that often go beyond a legal minimum. To help you decide whether each particular Practice should be applied to your project, the Commentary of the EP&M explains *why* it is recommended. The goal is to provide you with insight into why conforming to a minimum may be all right for some Practices in your project, but may not be advised for other Practices.

Alternative Practices & Methods
This publication is not intended to prevent the use of a material or a method of construction. New materials, and new construction methods, practices, and systems are not restricted. This document is founded on performance principles, which means that alternatives that are effective can be considered and used. Practices that have unproven or unknown results should be carefully evaluated and considered before being used. Our advice is that any alternative should be safe and effective.

Liability Disclaimer & Legal Disclaimer

EP&M Relationship to Building Codes

Those undertaking a log construction project must consult local authorities about building codes or regulations, and comply with them. The EP&M does not replace, supplant, or supersede any governmental or regulatory authority. You may, however, decide to build to a higher standard than the minimum standard found in a building code.

Some of the Practices and Methods found in this document advise you to refer to, and comply with, local or regional building codes. If you are building in a location that has no building code, then we advise you that you should find a nearby jurisdiction that has adopted a code, and use that code to help guide your construction. That is, we feel that it is an effective practice to abide to a nearby building code if there is no code that legally regulates your construction.

Consensus Document

The ILBA reviews and approves the EP&M through a consensus process.
This **2010 EP&M** was adopted by ILBA Members at the Annual General Meeting held on April 10th, 2010.

For further information please contact:

The International Log Builders Association

PO Box 775
Lumby, British Columbia, Canada V0E 2G0
+1-250-547-8776 Phone
+1-250-547-8775 Fax
www.LogAssociation.org

ILBA Mission

The ILBA is dedicated to educating both our members and the public. The Association has a mandate to research, develop and share techniques relevant to the construction of superior handcrafted log buildings.

The International Log Builders Association, which was founded in 1974 as the Canadian Log Builders Association, is a worldwide not-for-profit organization devoted to furthering the craft of log construction. The Association produces educational material on log construction that it distributes to individuals, institutions, and industry. The ILBA is dedicated to the advancement of log builders, and to promoting the highest standards of their craft.

ISBN 978-0-9878395-1-0 *Effective Practices & Methods for Handcrafted Log Construction 2010* (digital version)

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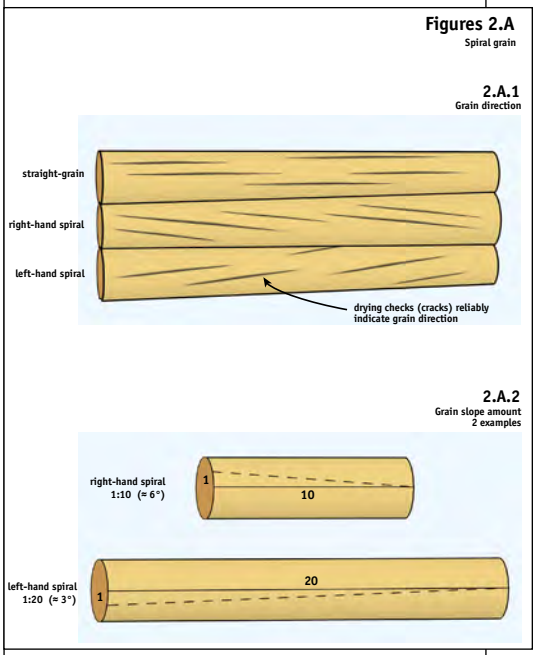
PRACTICES

2.A.5. Spiral Grain: The following practices apply to green logs, which are more likely than drier logs to twist as they dry. When wall logs twist they can create gaps in corner notches and in grooves, and this can affect appearance and perceived quality. If gaps are in exterior walls, then air and water infiltration is a concern. There are several ways to help restrain the twisting of spiral-grain logs, including weight, corner notches, and steel reinforcement. Refer to Table 2.A and Figures 2.A.1 and 2.A.2, for descriptions of each of the spiral grain categories.

Table 2.A

	RIGHT HAND	LEFT HAND
STRAIGHT	**< 1:20**	**< 1:30**
MODERATE	**1:20 to 1:10**	**1:30 to 1:20**
SEVERE	**> 1:10**	**> 1:20**



Figures 2.A.1 and 2.A.2. - Click on drawing to see the full-page version.

Methods that use wall weight to help reduce in-service twisting of wall logs:

a. Left-hand severe spiral logs—may be used as wall logs as cut-in-half sill logs. However, left-hand severe spiral logs may be used

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2.A.4, continued . . . .
flattened ("hewn") on both sides. Dovetail homes often use hewn logs. Sometimes, logs are flattened only on one, not both, vertical sides. The EP&M refers to logs that are naturally-shaped on top and bottom surfaces.

2.A.5. *Spiral Grain*
Spiral grain is the condition in which the alignment of wood fibers at the cellular (microscopic) level is at an oblique angle to the long axis of the log. Spiral grain is expressed as the slope of the direction of fiber alignment to the length of the log—this slope is shown in Figure 2.A.

To determine fiber alignment, examine the log for surface checks caused by drying—surface checks are parallel to fiber alignment (Figure 2.A.1). Another option is to use a sharply pointed timber-scribe instrument that is available for sale, and is effective for indicating grain slope in green logs and timbers that are completely without checks.

To determine whether a log has left-hand or right-hand spiral grain, refer to Figure 2.A.1.

Spiral grain can affect appearance, and air or water infiltration through notches and grooves. The EP&M recommends that when tight-fitting log joinery is desirable, then spiral grain logs should be used in places in the building where they have a better chance of staying tightly fitted over time. Tightly fitting notches and grooves are often considered to indicate quality craftsmanship.

Scientific studies and the experience of log home builders have shown that lefthand spiral grain logs undergo more severe distortions (twisting, and checking) during drying than do right-hand spiral grain logs, and this is one reason why greater restrictions are advised when using lefthand spiral logs (Table 2.A), when tight fits are preferred.

Spiral grain logs are also weaker in bending (MOR) than straight grain logs. ASTM Standard D-3957-09 provides guidance for the amount of strength reduction to be expected for different amounts of the slope of grain (ie spiral grain) of round logs. Refer to 4.5.1.2 of that document for specific guidance for the strength reduction amounts. Logs with steep grain slopes have less strength (ie they have larger strength reduction) than logs with gentle grain slopes. Also, D-3957 uses just one table of the strength reduction for both lefthand and righthand grain slopes, rather than permitting less strength reduction for righthand than for lefthand spiral wood. Note that ASTM D-3957 also constrains elasticity (E, MOE), and other engineering values (shear, compression) for spiral grain logs, and these are not discussed here.

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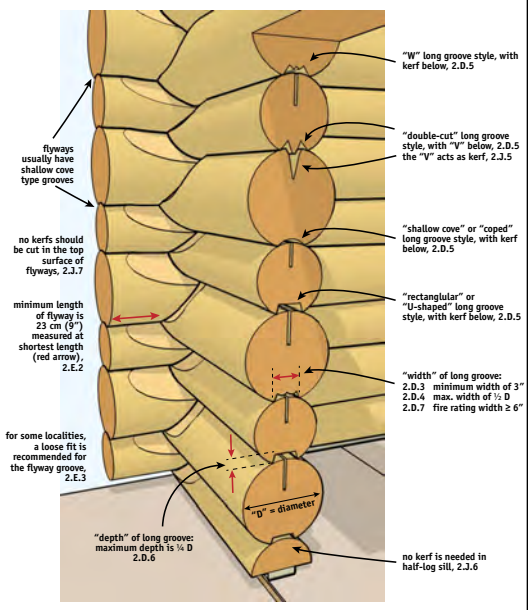
2.D. Long Grooves

Figure 2.D
Groove shapes and dimensions



Notes:
1) For clarity, gaskets and insulation are not shown in this figure.
2) All groove styles touch the log below ***only*** on their two scribed, long edges (2.D.1).

Fig. 2.D. - Click on drawing for full-page version.

2.D.1. Logs in walls should have a continuous scribe-fit long groove along the length of each log. A long groove is needed wherever a log wall separates unheated from heated space, or heated space from the exterior of the building.

Local area, and site-specific, conditions (snow, ice, rain, wind, exposure, roof overhang, etc) should also be considered, and the minimum height above grade increased so that it is effective at protecting sill logs from becoming wet frequently, or remaining wet for periods of time.

2.D. *Long Grooves*
Also known as "lateral," "lateral groove," "cope," "Swedish cope," "cove," and "long notch." The long groove is cut into each wall log to create a fitted joint between two logs along their length. In handcrafted, scribe-fitted, log construction the width of the long groove varies along the length of the log, and corresponds to the natural shapes of the two logs that are sealed by the groove. At some location (or locations) along the length of the long groove it has a minimum width, and at another location (or locations) it has a maximum width. Long groove "width" means the distance, measured approximately horizontally and about 90° to the wall centerline, from the inner edge of the groove to the outer edge of the groove—in most cases this means measured from the interior scribe line to exterior scribe line.

There are a variety of cross-sectional shapes of long grooves. And because long grooves are not cut by automated machines, there is also some variation in their shape along the length of each log. In general, however, the long groove is cut on the bottom of each wall log, and it has an approximately concave shape—which means that adjacent wall logs touch each other along the scribed edges of each long groove, and do not touch each other at locations inside the groove.

It is not effective to cut long grooves so that a continuous flat surface touches a flat surface on the log below ("flat on flat") because such a flat is not generally concave on the upper log, does not touch the log below along an inner and an outer edge, and because the log below may have a shape that is not self-draining (see Section 2.D.8). Long grooves are "scribe-fit," which generally means that a hand-held scribing tool was used to mark where the logs are to be cut (shaped) so that they fit together.

2.D.1. *The long groove should be continuous between notches or between openings, such as doors and windows. Other styles of log construction do not have a long groove, or they may have a groove that is not continuous—and then the gaps between logs are chinked. Full-scribe-fit logwork, in contrast, has a continuous long groove, and no chinking is used during construction because there are no gaps to fill. "Chinking" is commonly an elastomeric material manufactured for the chinked log home industry that is applied to the gap that is purposefully created lengthwise between adja*
2.D.2 continued . . . .

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5.B.3. A vapor barrier should be installed on the heated side of the space-filling insulation and within the settling space.

5.B.4. An air barrier (house wrap) should cover the exterior (unheated side) of the insulation.

5.C. Trim at jambs should not restrict settling.

5.D. Both sides of each opening should be keyed vertically to withstand lateral loads and should allow unrestricted settling.

Figure 5.D
Window and door installation

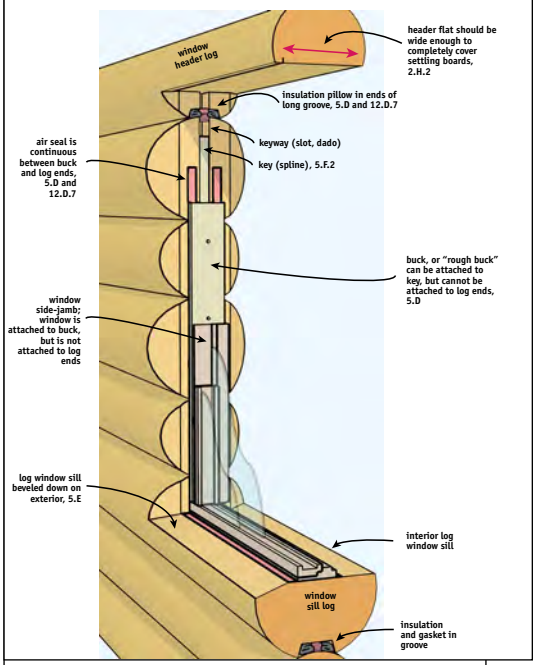

Fig. 5.D. - Click on drawing for full-page version.

5.E. An exterior window sill that is cut in a wall log should be beveled (sloped) to encourage water to drain to the outside face of the log wall and away from the window (Practice 12.D.2).

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5.B.3. *Polyethethylene film, with its perimeter sealed to log and framing members with an acoustical sealant (a special type of non-hardening, flexible rubber caulk) or a flexible, adhesive elastomeric film, are effective, but are difficult to remove if periodic access to the settling space is needed to adjust screwjacks or throughbolts. Fiberglass or sheep's wool in plastic bags (pillows) allows for easier removal of insulation, if needed.*

5.C. *The side jambs of doors and window has trim that should allow for logs to settle un-hindered. This means that the jamb trim cannot be attached to the log wall. Jamb trim should be attached to the window or door jamb and to the buck.*

5.D. *Openings in log walls for door and windows need special framing to install doors or windows; and this framing is often called a "buck." A buck allows for logs to shrink and settle, and this typically means that the height of a buck is less than the height of the opening, and the difference in these heights is equal to, or greater than, the settling allowance for the opening. (See Section 6 for help calculating settling allowances.)*

The buck is usually attached to a key or spline that may be steel angle iron, wood, or fiberglass. The key or spline is installed into a vertical slot ("keyway") cut in the log ends of the opening so that it has a snug fit, and will still allow unrestricted settling. Condensation on steel angle iron may be a possible concern in some cold-winter climates. A spline of wood is effective if it is set into, and is adequately attached to, a dado in the back of a 2x buck ("2x" means 2x4, 2x6, etc). See Figure 5.D. The key holds the buck in place in the log opening, and can also act to stabilize, or strengthen the log wall laterally by restricting log movement towards the interior or exterior of the wall. The key helps restrict horizontal movement of wall logs, and does not restrict vertical (downward, settling) movement of wall logs.

An air infiltration seal should be installed on the back of the buck, and between the log ends and a buck. The copes or coves (long groove cavities) that are exposed in the log ends of openings should be filled in a way that provides a continuous surface for the buck gasket to compress against. Spray foam or insulation pillows are effective for this purpose. After settling, the exterior joint between log ends and buck should be caulked or chinked.

5.E. *Where a log has been cut to create an exposed exterior window sill, it should shed water and slope so that it drains away from the window. A sheet metal flashing that covers the checks in a window sill log is effective at shedding water, and avoiding decay (see Figure 2.H).*

PRACTICES

7.B. If constructed of log or timber, roof systems should conform to the following practices:

7.B.1. Be constructed only of straight grain, or moderately right-hand spiral grain material *(see Practice 2.A.5 for definitions of spiral grain)*.

7.B.2. Be designed to resist loads according to applicable building codes and accepted engineering practice.

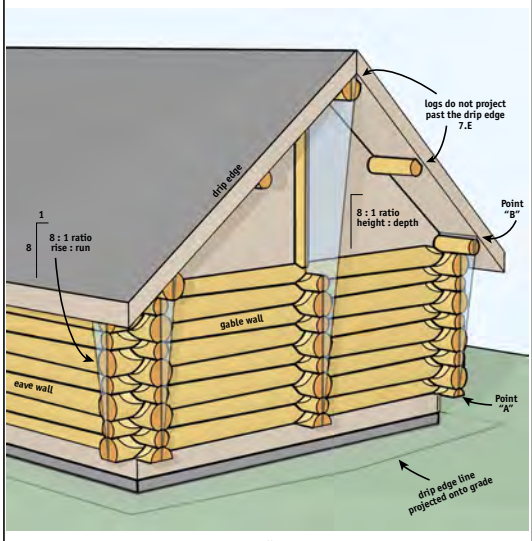
7.B.3. Where beams are notched at an end, on their bottom face, the depth of the notch should not exceed one-fourth (25%) the beam depth at the location of the notch, and should be less than this only if engineering calculations indicate.

7.C. The distance from the bottom of roof beams to the finished floor should conform to applicable building codes after settling is complete.

7.D. Roof overhang should help protect log walls from the weather at the site of the building. Figure 7.D illustrates how to calculate the minimum roof overhang.

Figure 7.D

Minimum roof overhang to create adequate weather protection for logs



Note:
Light blue triangles represent an 8:1 ratio of rise to run (height to depth), which provides the minimum roof overhang that is effective at protecting log walls from weather. This practice applies to all logs walls: eave and gable. Smaller ratios (*eg* 8:1.3 or 6:1) provide more protection.

Fig. 7.D. - Click on drawing for full-page version.

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7.B. *Log roof systems include, but are not limited to, log posts and purlins, ridgepoles, log trusses, and log common rafters. In Section 7, "log" also means "timber."*

7.B.1. *Severely spiral-grained logs are significantly weaker in bending strength and should be avoided (refer to ASTM D 3957, and EP&M Commentary 2.A.4.). (See Practice 2.A.5 for more on spiral grain.)*

7.B.2. *All log roof members should be designed to sufficiently resist all expected loads. If there is no building code to regulate a project, then it is an effective practice to use the adopted code of a nearby jurisdiction to guide your construction decisions and practices, or have a structural engineer specify all beams.*

7.B.3. *Notches cut into, and wood removed from a log beam will weaken the beam. One example of this is at the ends of a simply-supported log beam, no more than one-quarter (25%) of the depth of the beam, and less if calculations so indicate, should be removed for a notch. (Figure 4.C.) It is best to consult a structural engineer who is familiar with wood structures for help designing log roof systems, and especially for complex roof systems.*

7.C. *Consider the original height of the beam, the involved settling height and the settling allowance (6% for green logs) to calculate the height of roof beams after settling is complete. If there is no building code to regulate a project, then it is an effective practice to use the adopted code of a nearby jurisdiction to guide your construction decisions and practices.*

7.D. *Roofs for log homes should protect log beams and log walls from degradation caused by the weather. An excellent way to protect logs and keep them in good condition is to use wide (deep) roof overhangs, or roofs on attached decks and porches. The effectiveness of roof overhangs also depends upon the height of the wall and the height of the roof drip-edge. Figure 7.D shows an effective method for calculating the amount of minimum roof overhang.*

Note that the log home building code ICC-400 does not require a minimum roof overhang. But, in our experience, a short roof overhang is not an effective practice, and will contribute to, or cause, the decay of logs. Our experience is that sufficient roof overhang is an essential part of good log construction. Figure 7.D is the minimum overhang that is effective. In some locations, and depending upon local weather, local sunlight, and local wind, the minimum overhang shown in 7.D is not sufficient.

Notes for 7.D.*:The criteria set forth in Figure 7.D is a minimum. This approach to calculating roof overhang is*

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10.B.1. After settling is complete (see Section 6), then the spaces for ceiling penetrations should be closed to decrease air infiltration.

10.C. Flashing should conform to applicable codes, and accommodate settling (*Figure 10*). See also Section 6.

Figure 10
Chimney and flashings

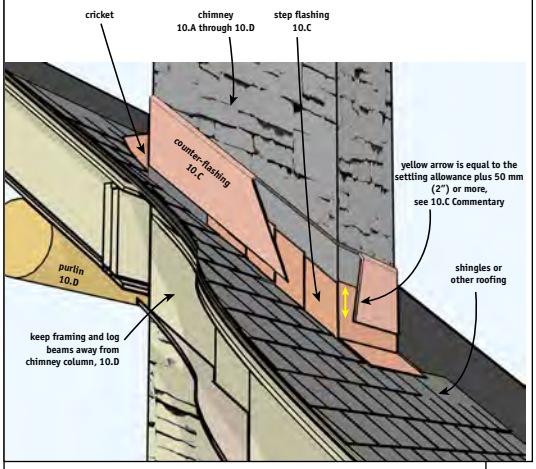

Fig. 10. - Click on drawing for full-page version.

10.D. No portion of the building should come into contact with a masonry column unless the assembly is specifically designed to accommodate structural and settling considerations.

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10.B.1. *Fire-rated spray foams can be effective, and can be applied in contact with masonry and wood members at the ceiling after settling is completed.*

10.C. *The flashings used where a chimney goes through the roof should accommodate settling, and restrict water and air penetration, including after the building has fully settled. The roof, if it is supported on or by log walls, will lose elevation during settling, while the chimney will remain at a constant elevation. Chimneys should be flashed* and *counterflashed (see Figure 10) to allow for unrestricted settling of the roof. Further, the flashing should be tall enough, and have sufficient overlap when the logs are green, so that even after all settling is complete the counterflashing still overlaps the flashing at least 5 centimeters (2 inches), or more if local building codes require, or the situation requires. If there is no building code to regulate a project, then it is an effective practice to use the adopted code of a nearby jurisdiction to guide your construction decisions and practices.*

Note: Because very tall areas of flashing can be exposed (30.5 centimeters (12 inches) is not uncommon), it is recommended that the sheet metal flashing material be thicker than normal. The flashing and counterflashing cannot be attached to each other in any way (solder, rivets, or etc.) because they should freely slide vertically past each other to allow settling. If the counterflashing is made of stiff metal, then it will stay in place, and be more effective.

10.D. *This refers especially to the practice of supporting roof or floor beams on the masonry column of the chimney. This should not be done in a log home unless special measures are taken to allow for settling, while structurally supporting all applied loads. It is desirable to position masonry columns during the design process so that they avoid areas in floors and roofs that have structural members. For example, during design, position the chimney so that it avoids the ridgepole and purlins.*

Architects and designers may position a chimney centrally under the ridge thinking that the log builders needs, or would benefit from, this masonry column to support the roof. This is a misunderstanding that can be avoided.

Screwjacks that are installed on masonry columns (chimneys) to accommodate settling of structural roof members such as purlins or ridges are difficult to reach, and difficult to safely adjust for settling. Furthermore, a masonry column that is supporting a load must be designed and engineered for the load that can be expected.

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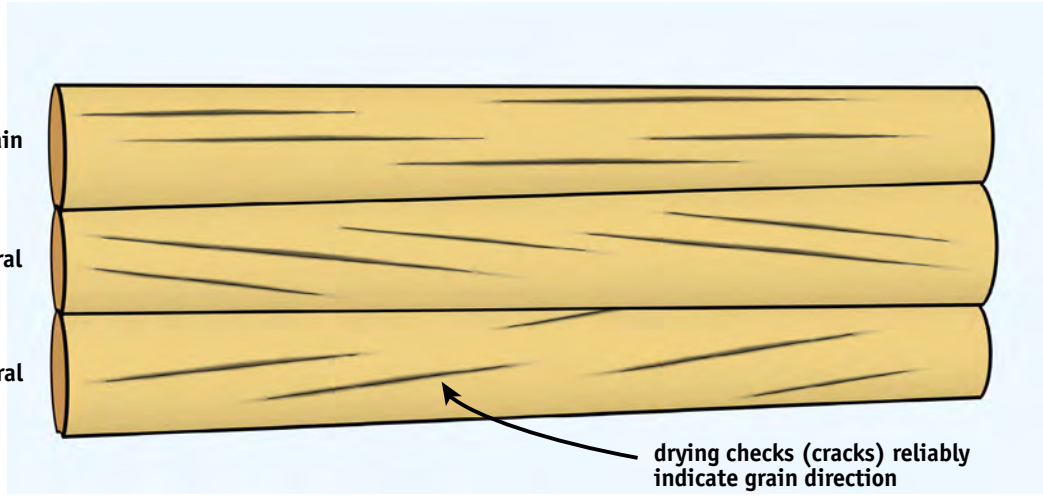
Figures 2.A

Spiral grain

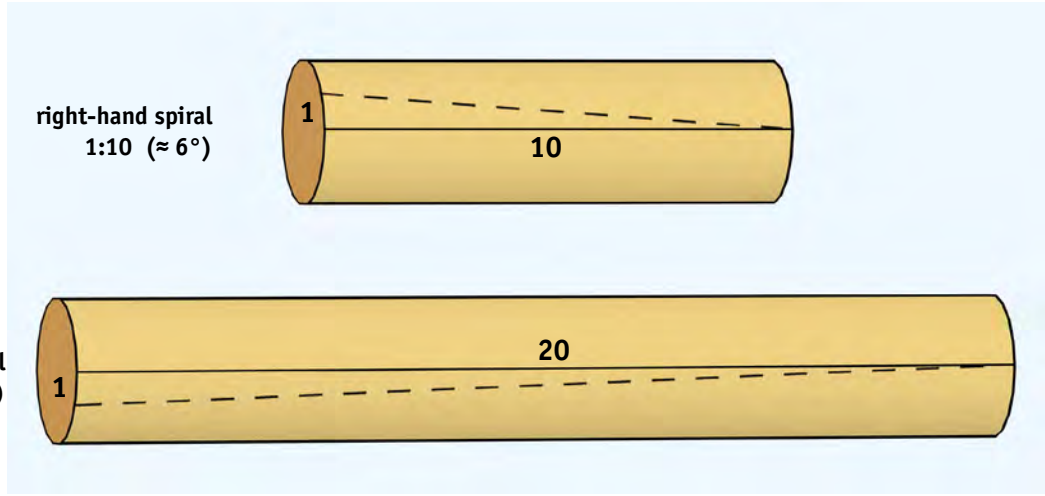
2.A.1

Grain direction



2.A.2

Grain slope amount
2 examples



- dashed line follows the grain on the surface of this log
- solid line is longitudinal (lengthwise) centerline of the log
- any consistent units can be used, for example:
  1 inch in 20 inches is 1:20
  or
  1 cm in 20 cm is 1:20
  or
  1 foot in 20 feet is 1:20

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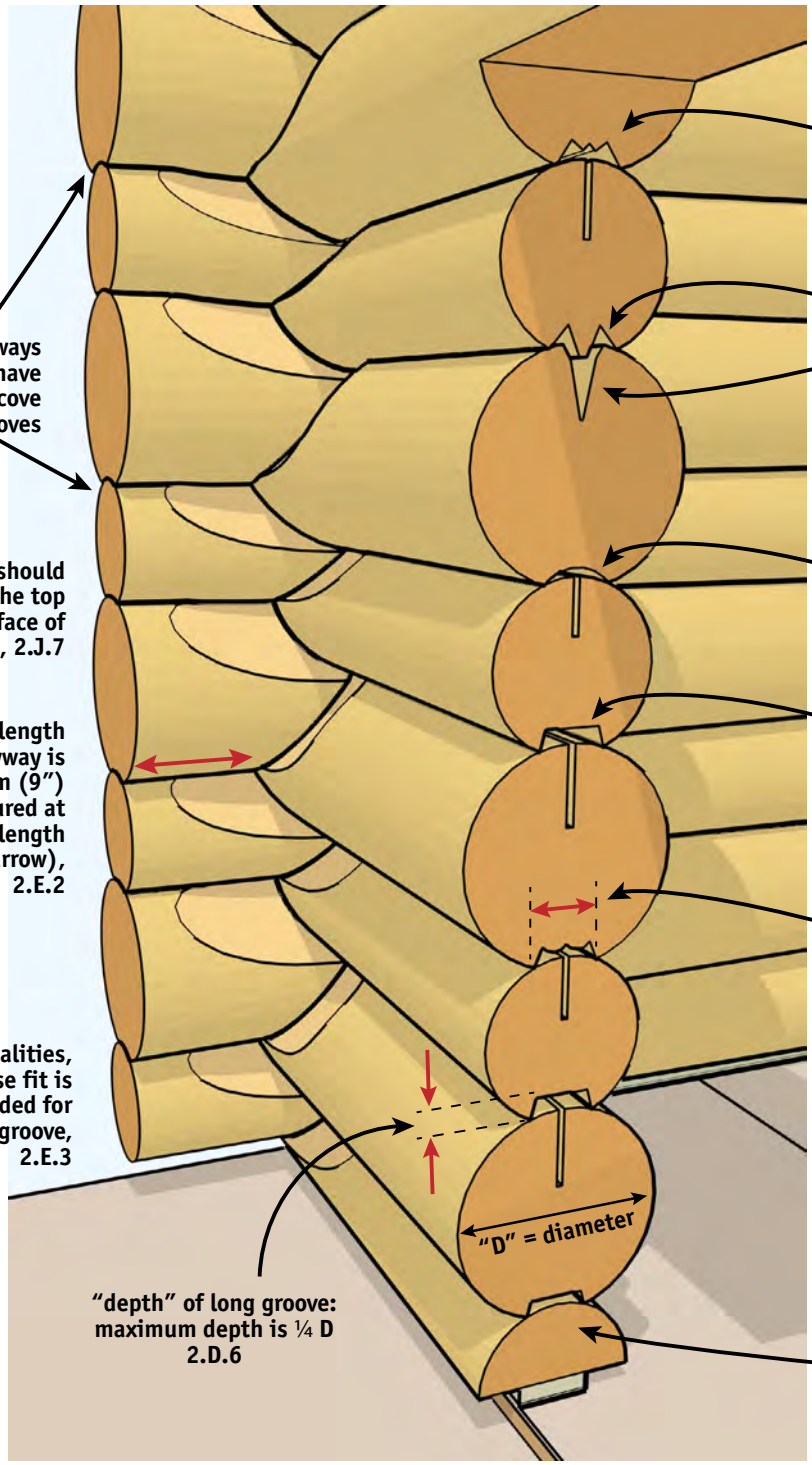
Figure 2.D

Groove shapes and dimensions



Notes:

1) For clarity, gaskets and insulation are not shown in this figure.

2) All groove styles touch the log below ***only*** on their two scribed, long edges (2.D.1).

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Figure 5.D

Window and door installation

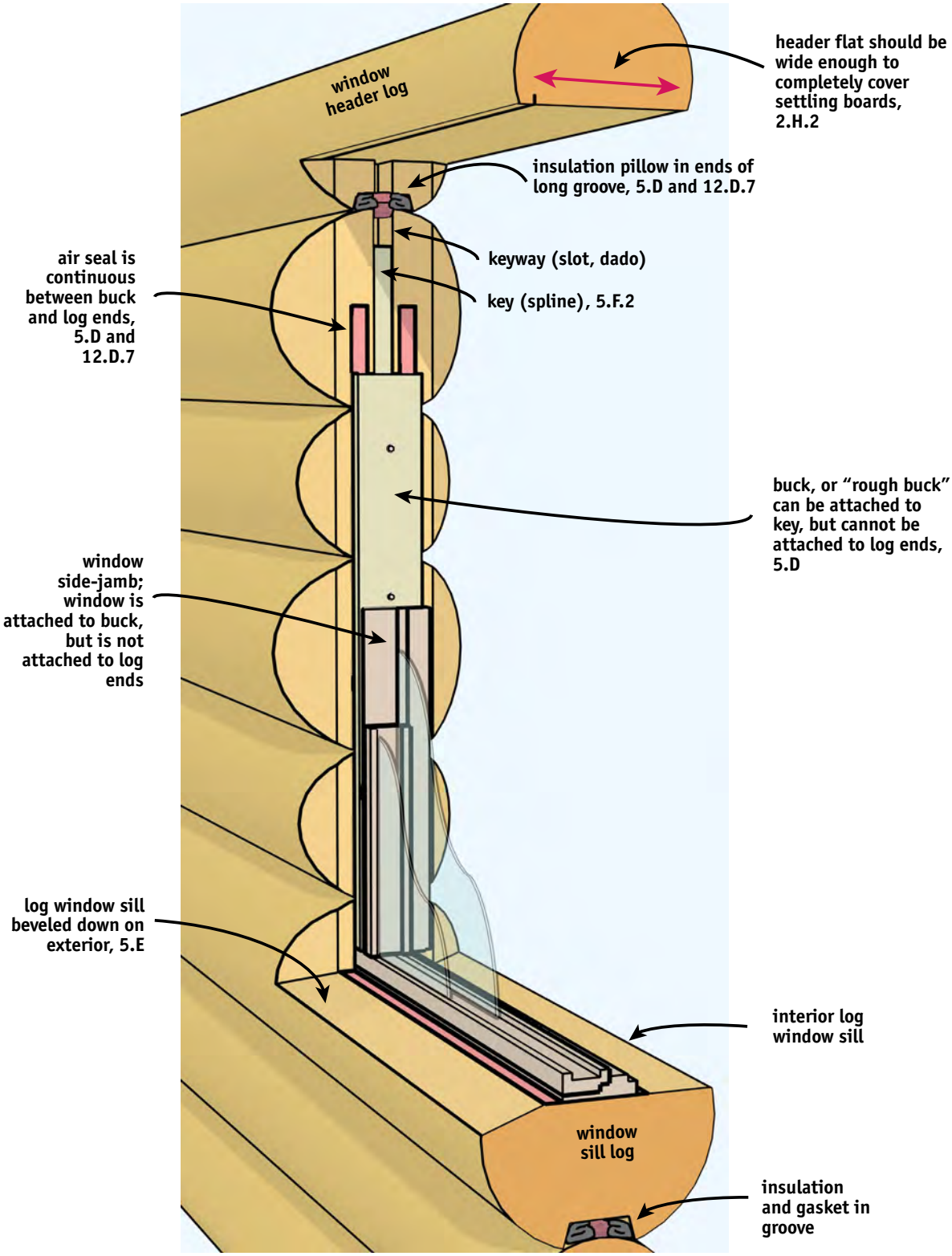

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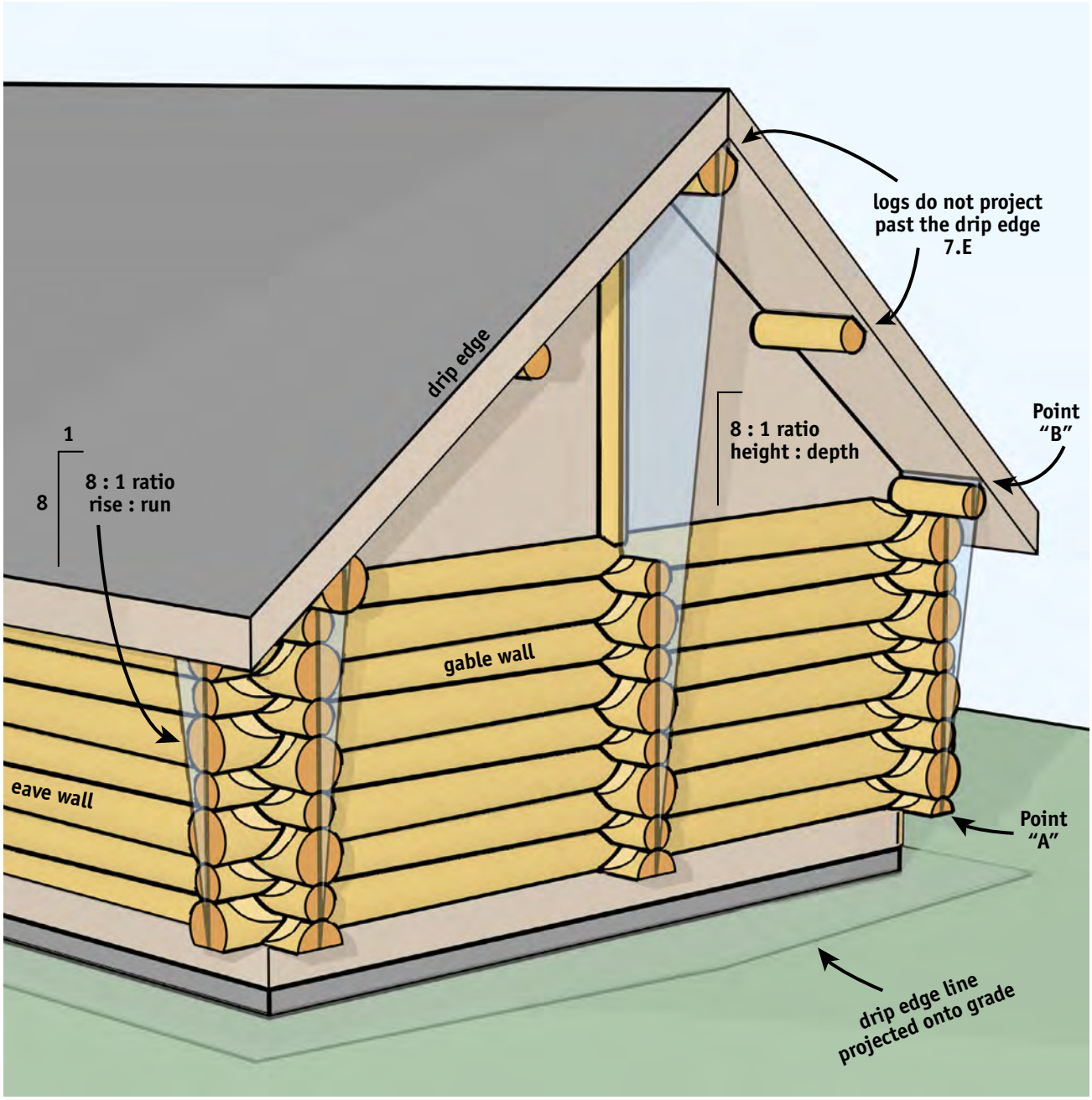
Figure 7.D

Minimum roof overhang to create adequate weather protection for logs



Note:
Light blue triangles represent an 8:1 ratio of rise to run (height to depth), which provides the minimum roof overhang that is effective at protecting log walls from weather. This practice applies to all logs walls: eave and gable. Smaller ratios (*eg* 8:1.3 or 6:1) provide more protection.

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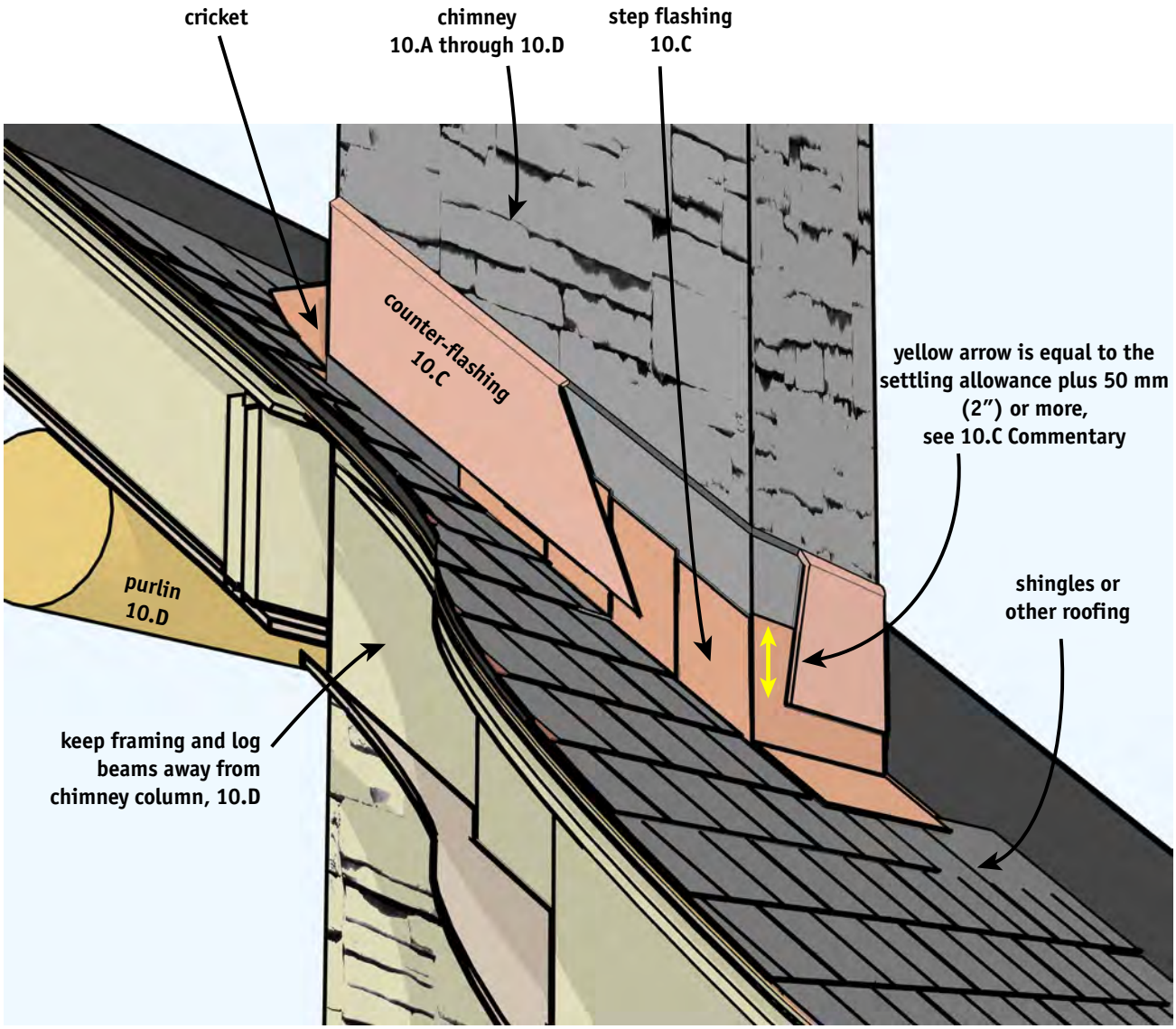
Figure 10

Chimney and flashings



Note:
The counterflashing is not attached to the flashing by any method, at any place. These must be able to slide to accommodate settling. Counterflashing is "cut away" in drawing for clarity.