chapter 6. LUMBER SIDING

6.1 TYPICAL CONSTRUCTION PROBLEMS AND FAILURES

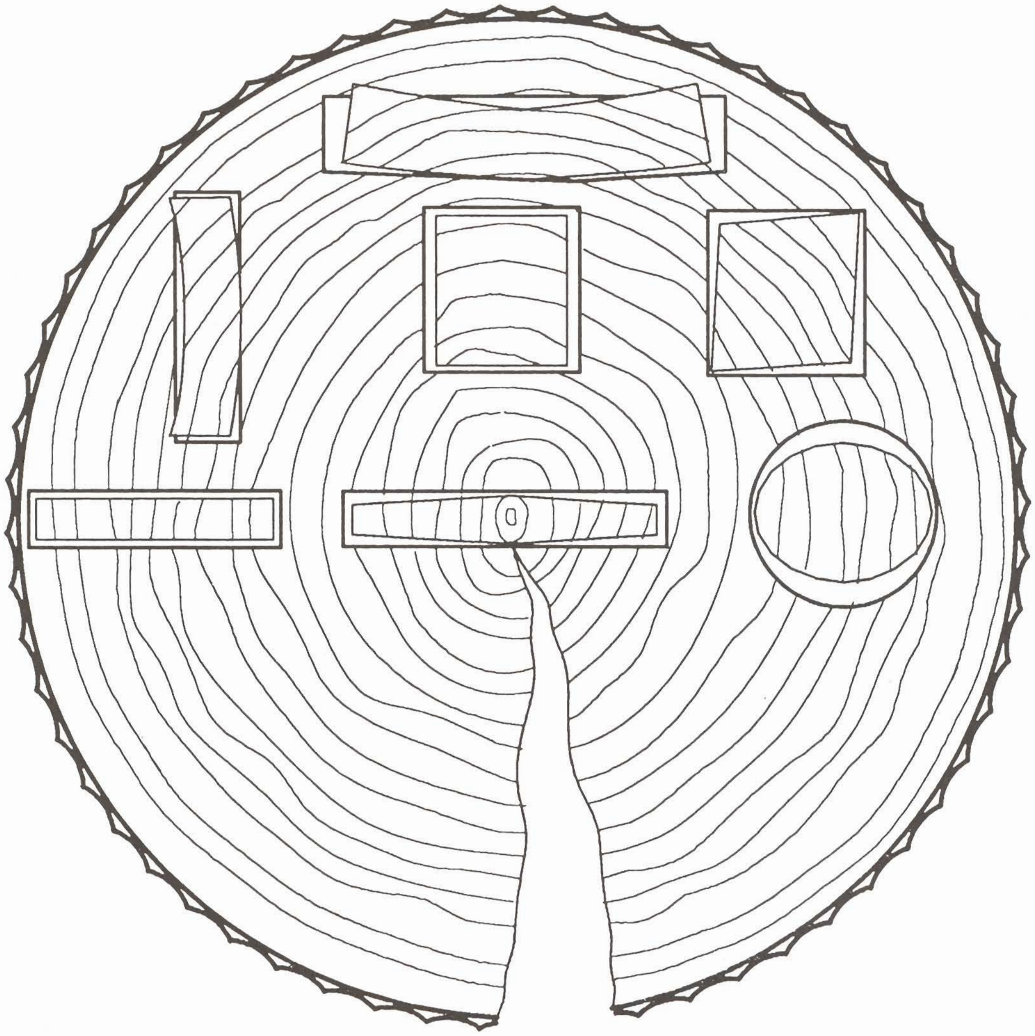
Sawn boards have been used as siding in the United States since colonial times. The white pine boards on Paul Revere's Massachusetts home are still performing after more than 200 years. The white pines, redwood, and several cedars from slowly grown older trees are excellent for siding: They are dimensionally stable, moderately to highly durable, uniform in texture, and provide a base for superior finish performance. However, if manufacturing and installation quality control are not maintained, wood siding will not approach the life expectancy of those early colonial homes.

6.1.1 Siding, Cupping and Warping

These problems are triggered by changes in the moisture content of wood, but are caused by several underlying factors. Most important is the character of the wood itself. The grain pattern in siding is a primary factor affecting the warping tendency. Traditionally, the best siding is made from vertical-grain wood. Flat or slash grains, or the grain variation in a single piece of wood siding, are the most likely to warp, because of the differential shrinkage of wood in the tangential and radial directions (see **Figure 6-1**). Species is extremely important; different species have different rates of change in size for a given change in moisture content. **Table 6-1** provides data on shrinkage rates for woods that are used, at least occasionally, for siding. A high shrinkage rate and a large difference between radial and tangential shrinkage rates both indicate warp-prone material. These are average values; individual pieces can vary by a factor of two or more.

Warping also occurs from insufficient expansion space provided during installation. Wood siding is normally kiln dried and may, unlikely but possibly, arrive at the job site drier than the environmental equilibrium; if so, it will expand after installation. If not enough clearance is provided, the siding will be pushed together and can buckle. Data in **Table 6-1** can be used to identify the problem species; high shrinkage rate equals high swelling rate. Pattern thickness is another important factor. Thinner pieces are not as stiff, and are more vulnerable to both cupping and buckling.

Cupping often occurs when siding that is inadequately attached to the wall is exposed to changing weather. This cupping is usually not related to initial moisture content. It appears more rapidly and is more severe with thin sections, and is less likely with the more stable woods such as redwood. Adequate attachment is very important. Even the most stable boards that are properly dried and otherwise well manufactured still are likely to cup from weather exposure when nailing is inadequate.



Wood shrinks as it dries. The difference in shrinkage rates between the radial and tangential directions in wood will result in distortion of the cross section of pieces, depending on where they were located in the log, resulting in the changes in shape illustrated.The average of shrinkage rates for a large number of species is about 1.8 times greater in the tangential than in the radial directions.

EFFECT OF DRYING SHAPE

Figure 6–1

Table 6-1
Shrinkage and Density of Lumber Siding Species
Green to Oven Dry Moisture Content

Radial Species	Relative Performance Tangential (%)	Rating (%)	Specific (1=best)	Gravity
Cedar:				
Alaska	2.8	6.0	2	.44
Incense	3.3	5.2	1	.37
Western red	2.4	5.0	1	.32
Douglas-fir:				
Coast	4.8	7.6	4	.48
Int. north	3.8	6.9	4	.48
Int. west	4.8	7.5	4	.50
Hem-Fir:				
Hemlock	4.3	7.5	4	.45
Fir	4.0	7.4	4	.38
Hem-Fir	4.1	7.5	4	.40
Pine:				
Ponderosa	3.9	6.2	3	.40
Radiata*	3.2	5.8	2	.--
Southern	4.7	7.4	4	.52
Sugar	2.9	5.6	2	.36
Western white	4.1	7.4	4	.38
Redwood:				
Old growth	2.6	4.4	1	.40
Young growth	2.2	4.9	1	.35
Spruce:				
Sitka	4.3	7.5	4	.40

Average of species in commercial marketing groups -- extracted from Wood Handbook: Wood as an Engineering Material (USDA Forest Products Laboratory, 1987).

* From New Zealand Forestry Service.

6.1.2 Shrinkage

All wood sidings will adjust to the equilibrium moisture content at the job site. The shrinkage or swelling that results is due to change in moisture content. Shrinkage produces a tensile stress in the wood between nailing points. The wood will stretch (technically known as "creep") if the stress remains below the wood's ultimate tensile strength perpendicular to the grain. If the tensile strength is exceeded, splits or checks will develop.

The amount of shrinkage is affected in part by the wood characteristics, as previously discussed. Equally important for check and split potential is the nail spacing across the board. Further, thin pieces are more prone to splitting than thicker boards. Recommended nailing and detailing for the common siding patterns are given in **Figures 6-2** to **6-7**. Recommendations on the different combinations of width, thickness, pattern, species, and grain are given in **Table 6-2.**

6.1.3 Stapling

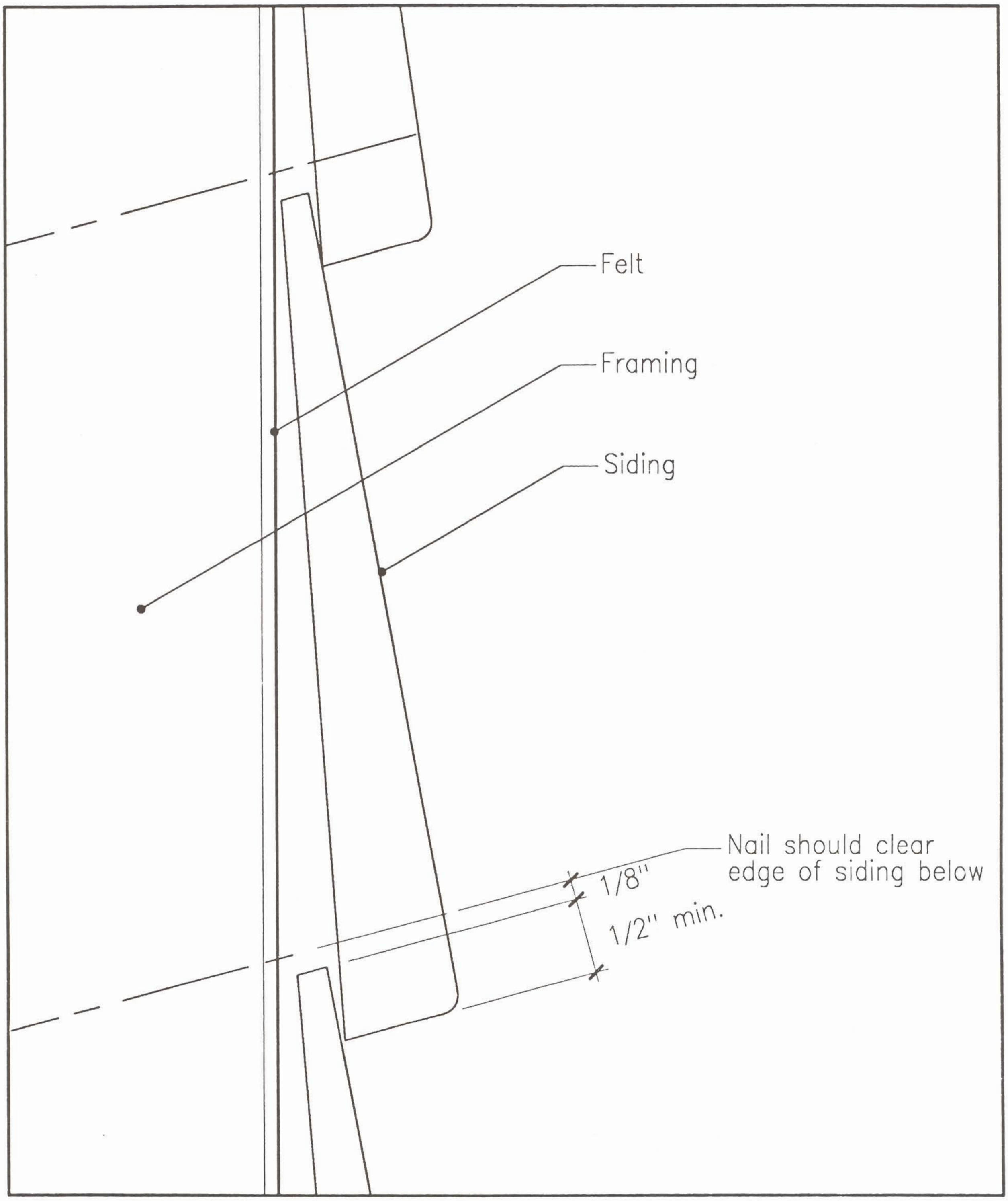
Tongue-and-groove sidings are sometimes attached to the framing by power-driven blind staples at the root of the tongue. When staples are driven at an angle, they often will not penetrate the studs deeply enough to provide sufficient anchorage. Staples are relatively flexible compared to nails, so they tend to bend and deflect off the sheathing or the framing surface instead of penetrating into the framing. If a staple is applied with the crown parallel to the grain direction, the staple legs cut the ends of the fibers under the crown, leaving the board held in place only by rolling shear, an exceedingly weak wood property. If staples are used, they must be driven perpendicular to the plane of siding and must be driven with the crown perpendicular to the grain. Finally, they should be stainless steel and of sufficient length to adequately penetrate the framing member. (See additional discussion in Chapter 14).

6.1.4 Insufficient Overlap

The water-shedding overlap between adjacent boards is limited in most siding patterns, especially tongue and groove. If species and grain angle, board width, and initial moisture content are not balanced, the joint may disengage as the siding adjusts to the equilibrium moisture content. Each of these factors is important in determining the total adjustment in size that will occur. When any combination of these factors leads to more shrinkage than can be accommodated by the joint detail, water infiltration and major damage can occur.

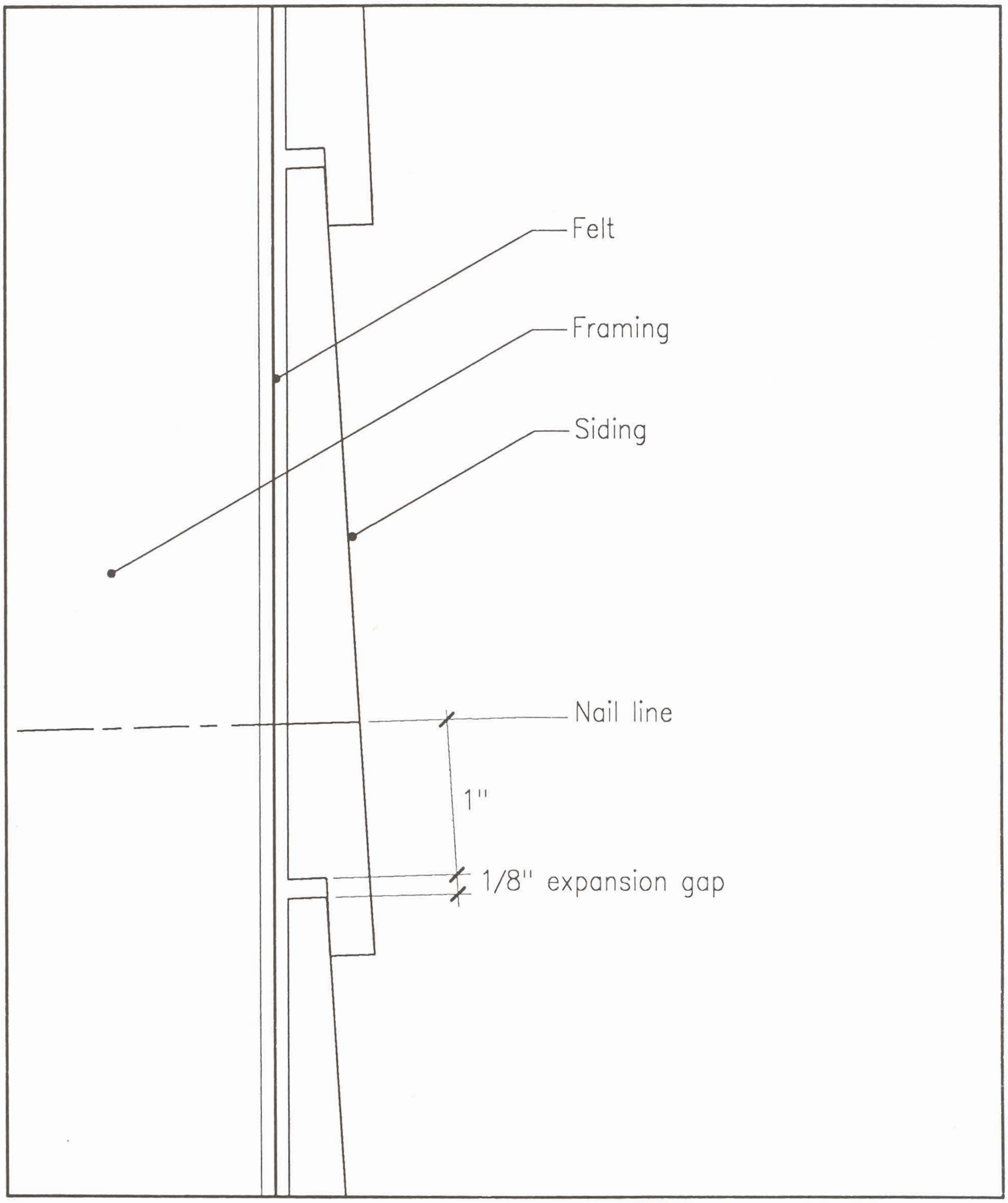
6.2 APPROPRIATE APPLICATION

Siding is often attached directly over a felt membrane and onto the studs. In general, horizontal sidings consist of overlapping boards,and water is shed by the shingle effect. Common patterns include bevel, rabbetted bevel, shiplap, and tongue-and-groove sidings. Depending on thickness, wood sidings of different qualities warp at different points, with the newer, thin material being unstable in many conditions. **Table 6-2** recommendations are also valid for vertical siding.



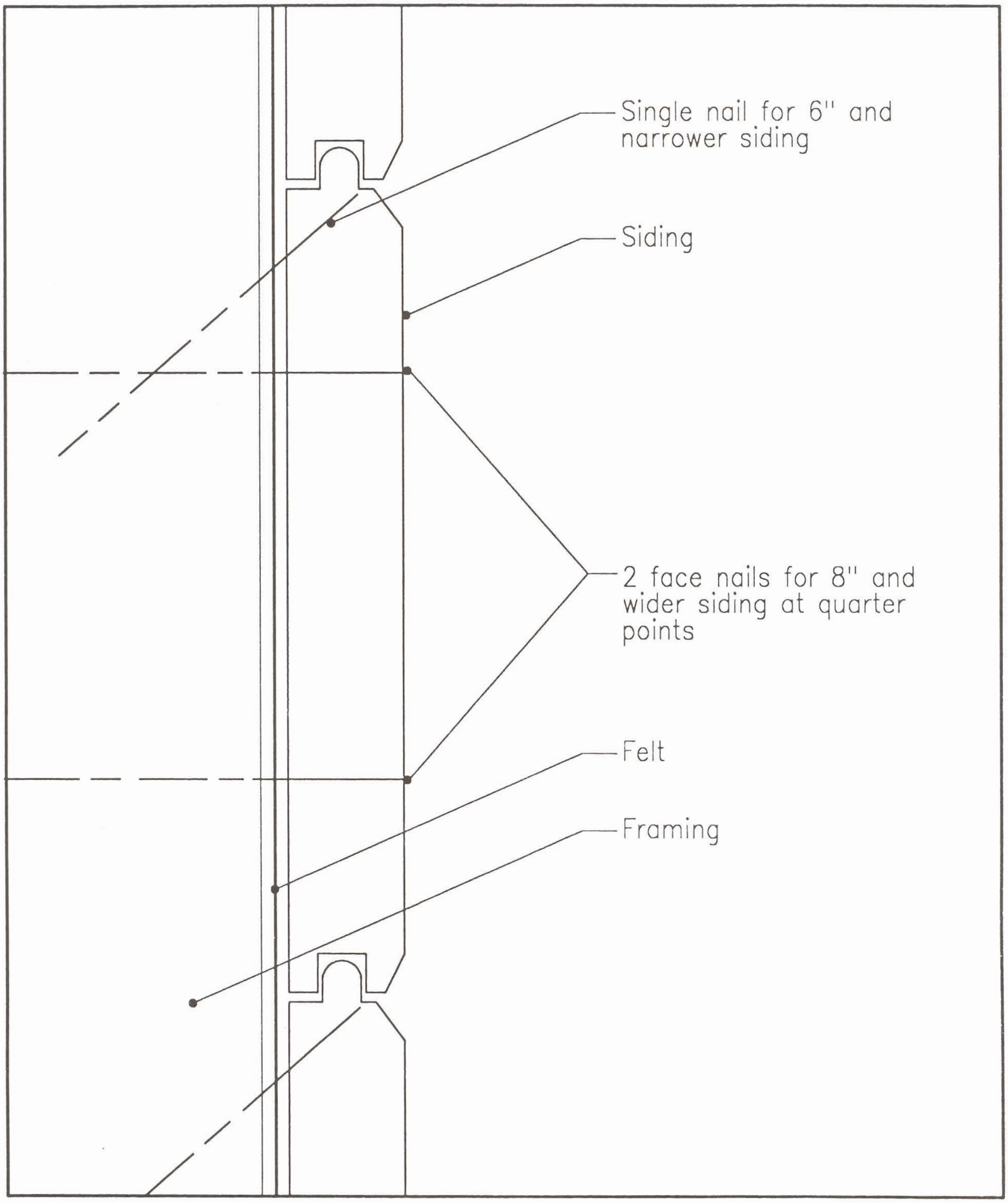
PLAIN BEVEL SIDING
HORIZONTAL ONLY

Figure 6–2



RABBET BEVEL SIDING
HORIZONTAL ONLY

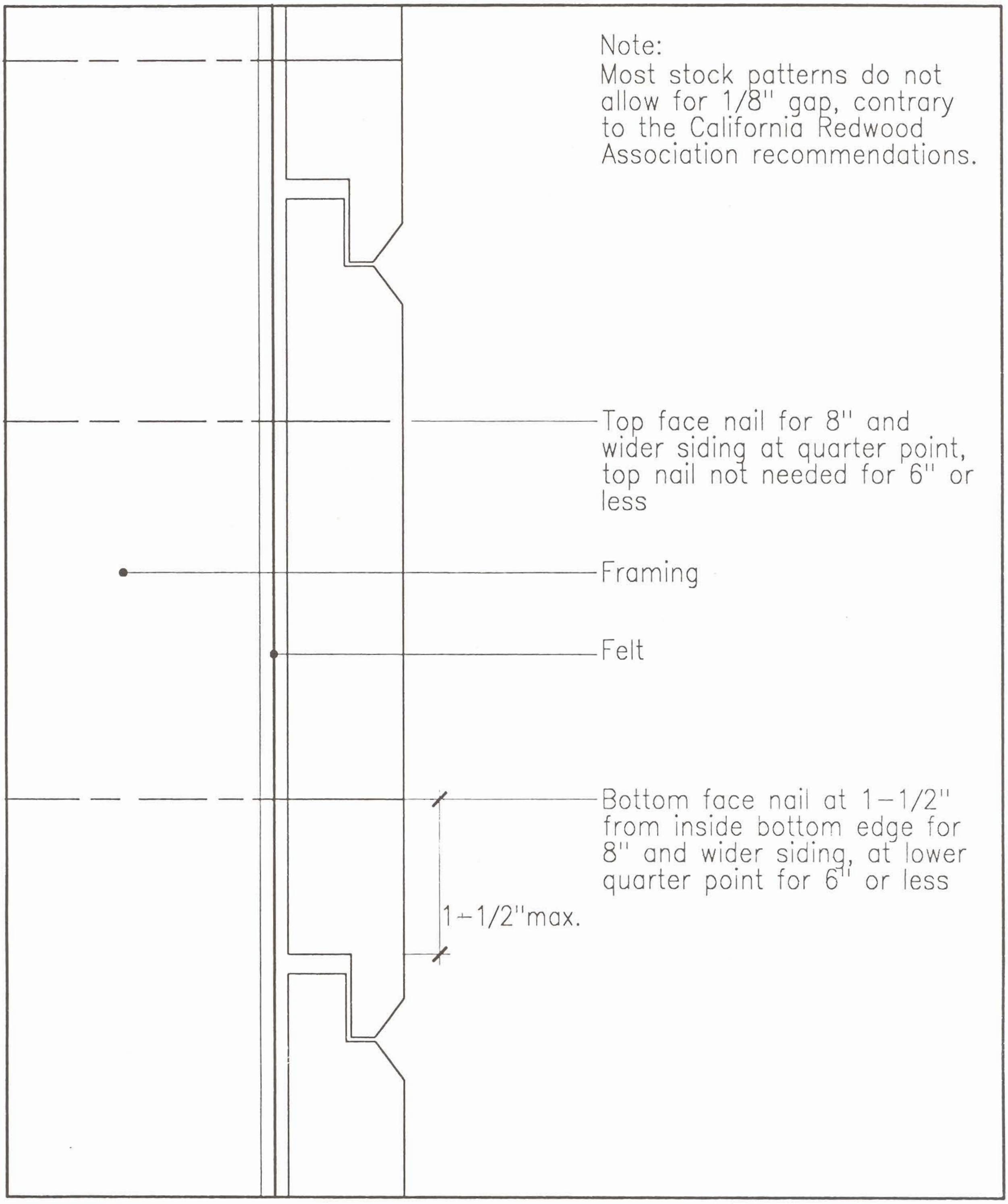
Figure 6–3



TONGUE AND GROOVE SIDING

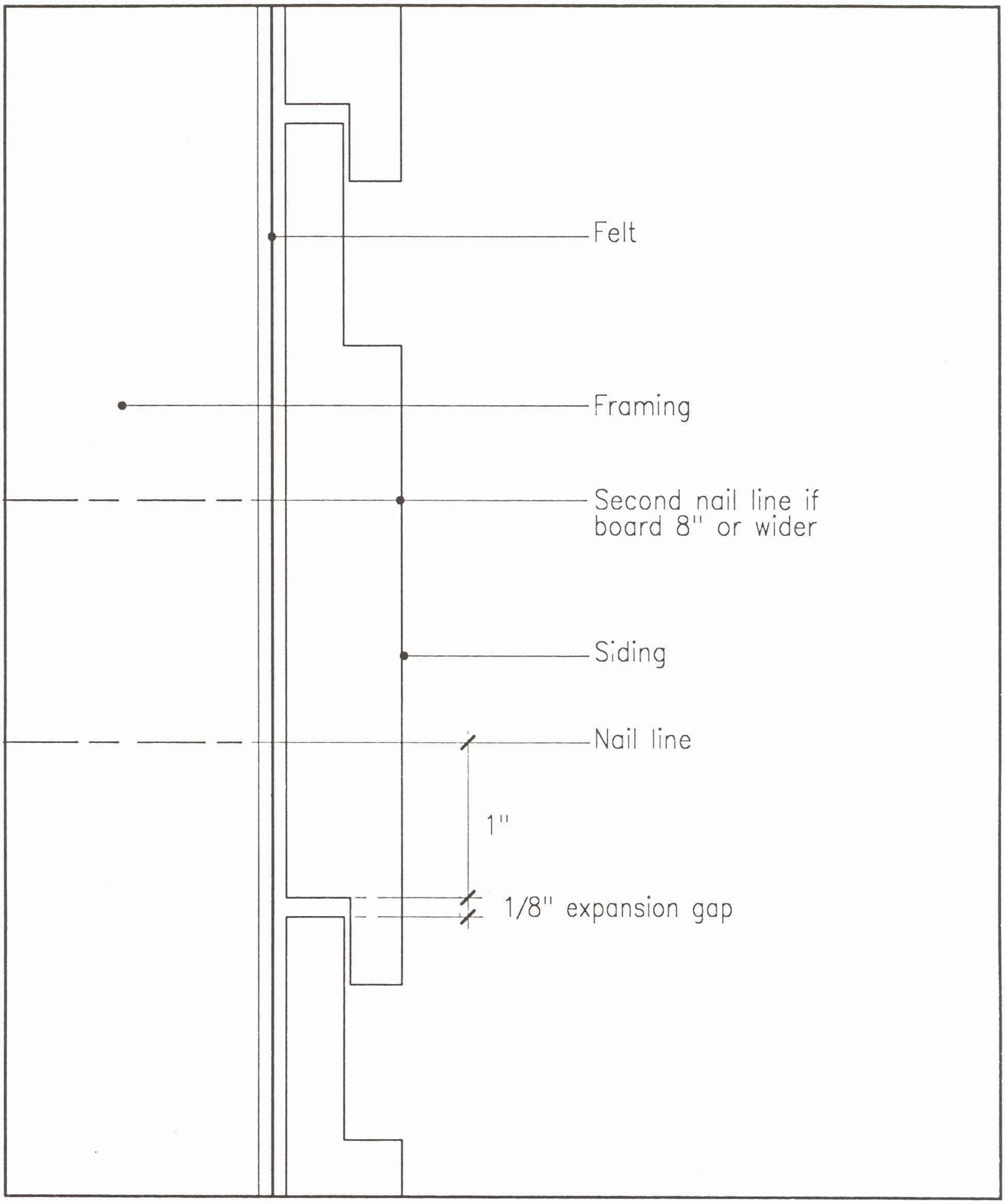
HORIZONTAL OR VERTICAL

Figure 6–4



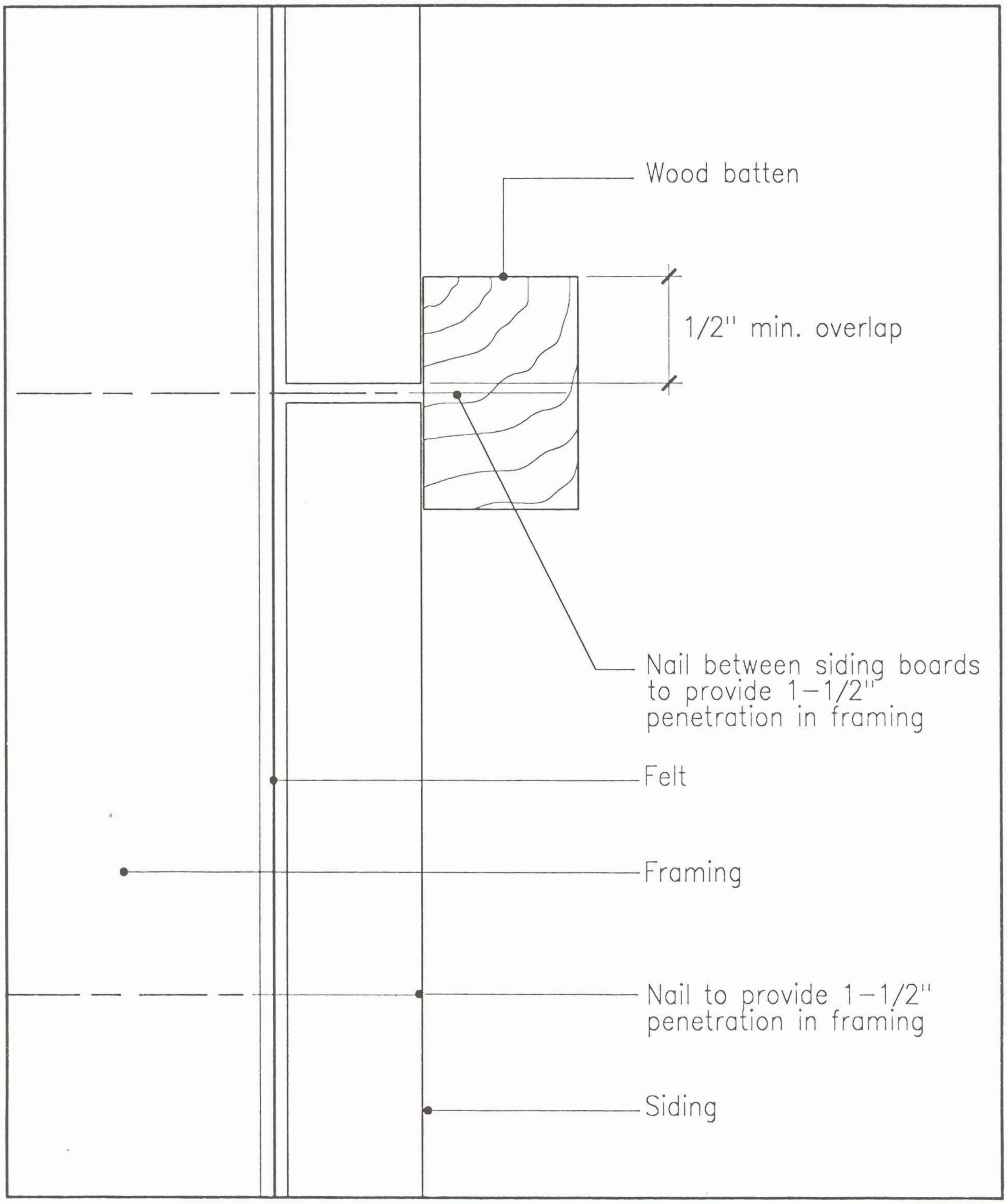
SHIPLAP SIDING
HORIZONTAL OR VERTICAL

Figure 6-5



CHANNEL SHIPLAP SIDING
VERTICAL ONLY

Figure 6–6



BOARD AND BATTEN SIDING
VERTICAL ONLY

Figure 6-7

Table 6-2
Wood Species and Grain Recommendations
by Pattern Width, Thickness and Framing Spacing

Stud or Blocking Spacing	Pattern	Width →	4"				6"				8"				10"				12"			
		Thickness →	3/8"	1/2"	5/8"	3/4"	3/8"	1/2"	5/8"	3/4"	3/8"	1/2"	5/8"	3/4"	3/8"	1/2"	5/8"	3/4"	3/8"	1/2"	5/8"	3/4"
12	Bevel		1	2	2	3	NR	2	2	3	NR	1	2	3	NR	NR	1	2	NR	NR	NR	1
	Tongue and Groove		NR	2	3	3	NR	2	3	3	NR	1	2	3	NR	NR	1	1	NR	NR	NR	1
	Shiplap		NR	2	3	3	NR	NR	2	3	NR	NR	1	2	NR	NR	NR	1	NR	NR	NR	1
	Board and Batten		1	2	3	3	1	2	3	3	NR	1	2	3	NR	NR	1	2	NR	NR	1	2
16	Bevel		1	2	2	2	1	2	2	2	NR	1	2	2	NR	NR	1	2	NR	NR	NR	1
	Tongue and Groove		NR	2	2	3	NR	1	2	3	NR	1	1	2	NR	NR	1	1	NR	NR	NR	1
	Shiplap		NR	2	2	3	NR	NR	2	3	NR	NR	1	2	NR	NR	NR	1	NR	NR	NR	1
	Board and Batten		1	2	3	3	NR	2	2	3	NR	1	2	2	NR	NR	1	2	NR	NR	1	2
24	Bevel		NR	1	2	2	NR	1	2	2	NR	NR	1	2	NR	NR	NR	1	NR	NR	NR	NR
	Tongue and Groove		NR	1	2	3	NR	1	2	3	NR	NR	1	1	NR	NR	NR	1				
	Shiplap		NR	1	2	3	NR	NR	1	2	NR	NR	1	2	NR	NR	NR	1	NR	NR	NR	1
	Board and Batten		NR	1	2	3	NR	1	2	3	NR	NR	1	2	NR	NR	NR	2	NR	NR	NR	2

Based on KD standards for finish grades (12% mc or lower).

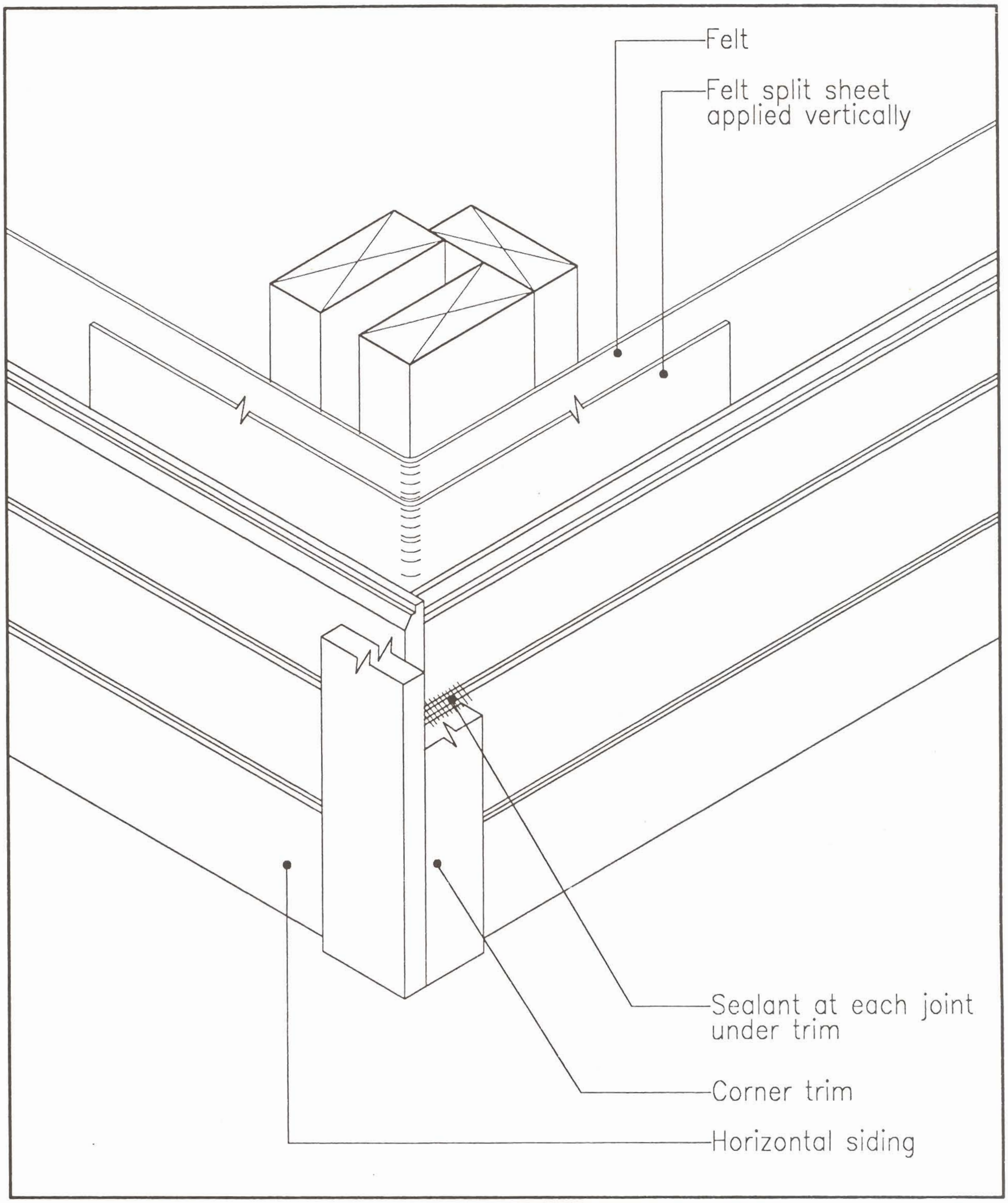
Wood quality: 1. Vert. grain redwood, cedar
2. Vert. grain Douglas-fir and other soft woods, flat grain redwood, cedar
3. Flat grain Douglas-fir and other soft woods

Note: NR means not recommended.

Vertical siding sheds water but not in the shingle fashion, as does horizontal siding because the water runs parallel to the vertical joint rather than down over it. The overlapping of material protects the felt membrane from solar and mechanical degradation rather than positively excluding moisture. Because vertical siding joints are not dependably watertight, a felt membrane behind the siding is absolutely necessary. Vertical siding is normally supported by horizontal blocking. The spacing of blocking required depends on the thickness of the boards.

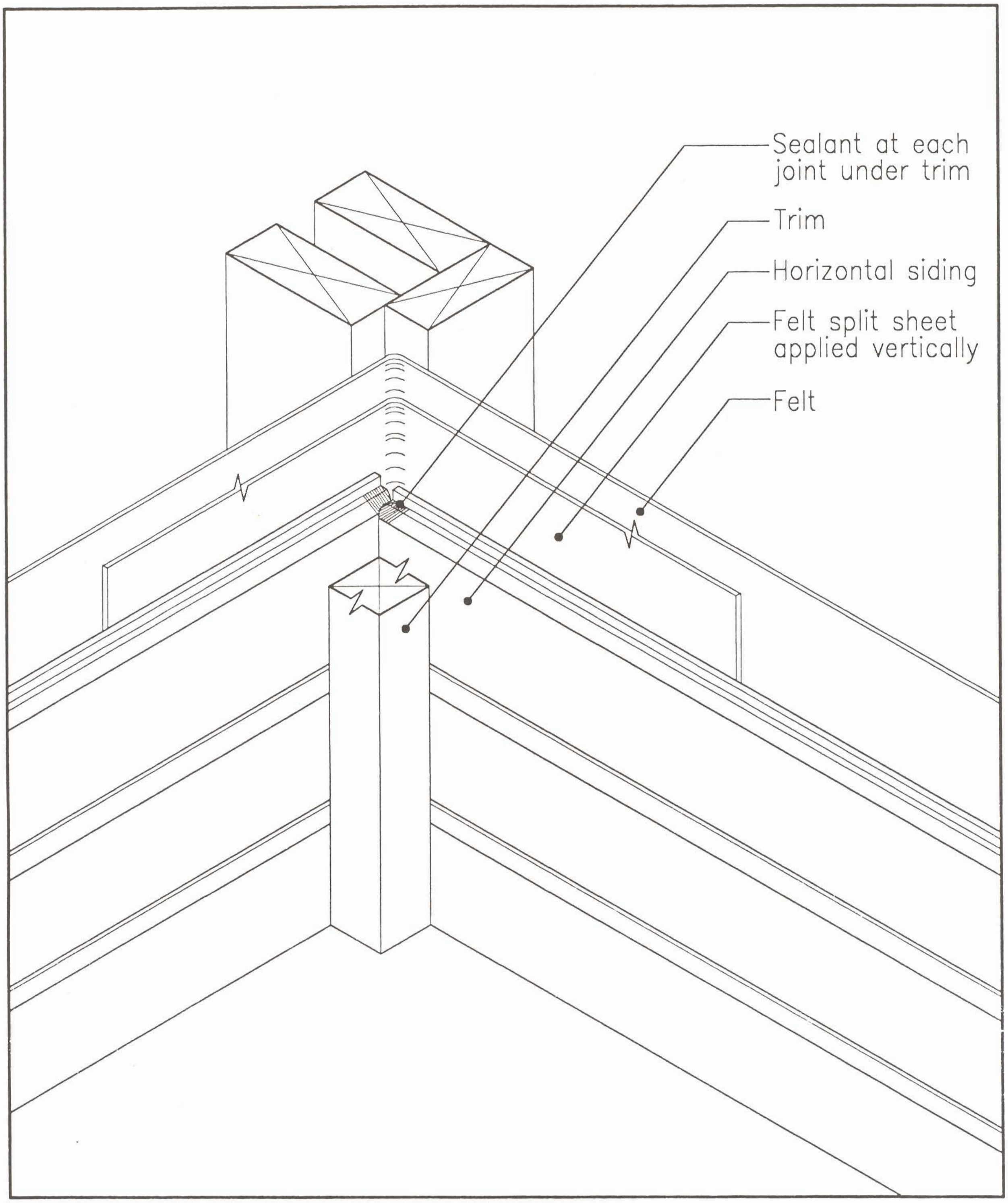
In multistory buildings or where the height of the building is greater than the available siding length, a horizontal joint is necessary. The most effective joint is a butt joint with "Z" flashing; however, bevel splices have been used effectively.

Suggested corner details are shown in **Figures 6-8** through **6-12**.



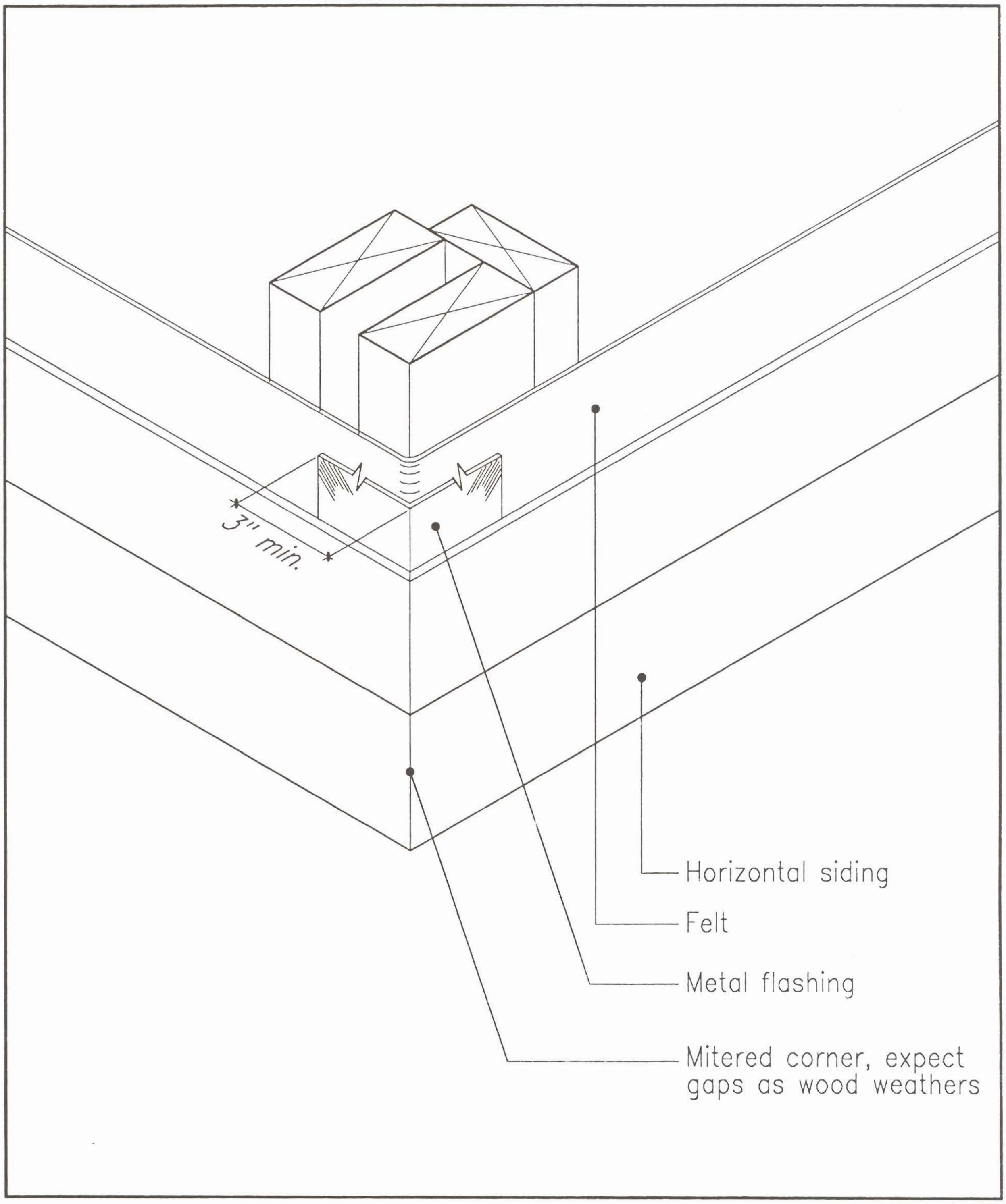
LUMBER VERTICAL JOINT
EXTERNAL CORNER DETAIL

Figure 6–8



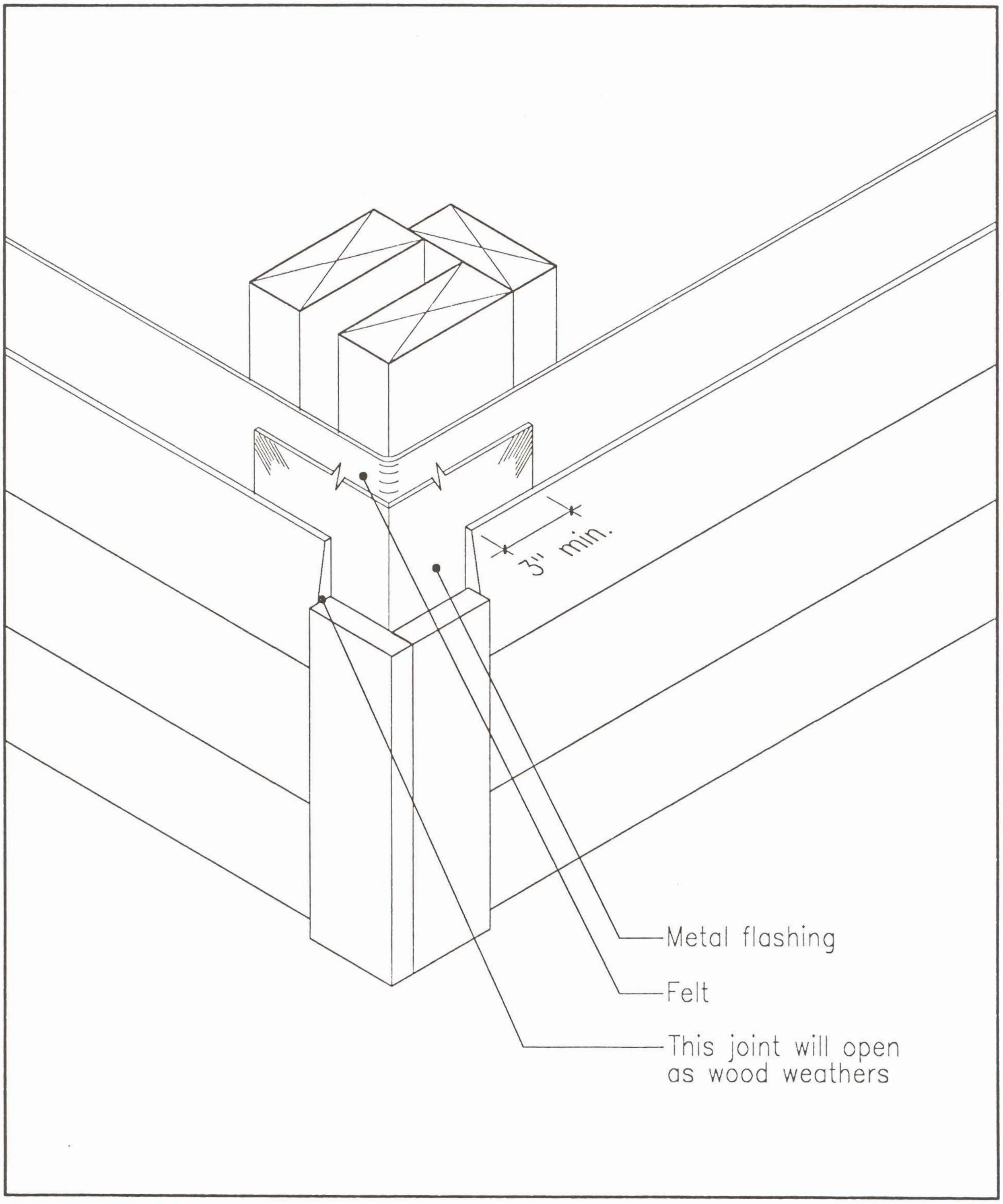
LUMBER VERTICAL JOINT
INTERNAL CORNER DETAIL

Figure 6–9



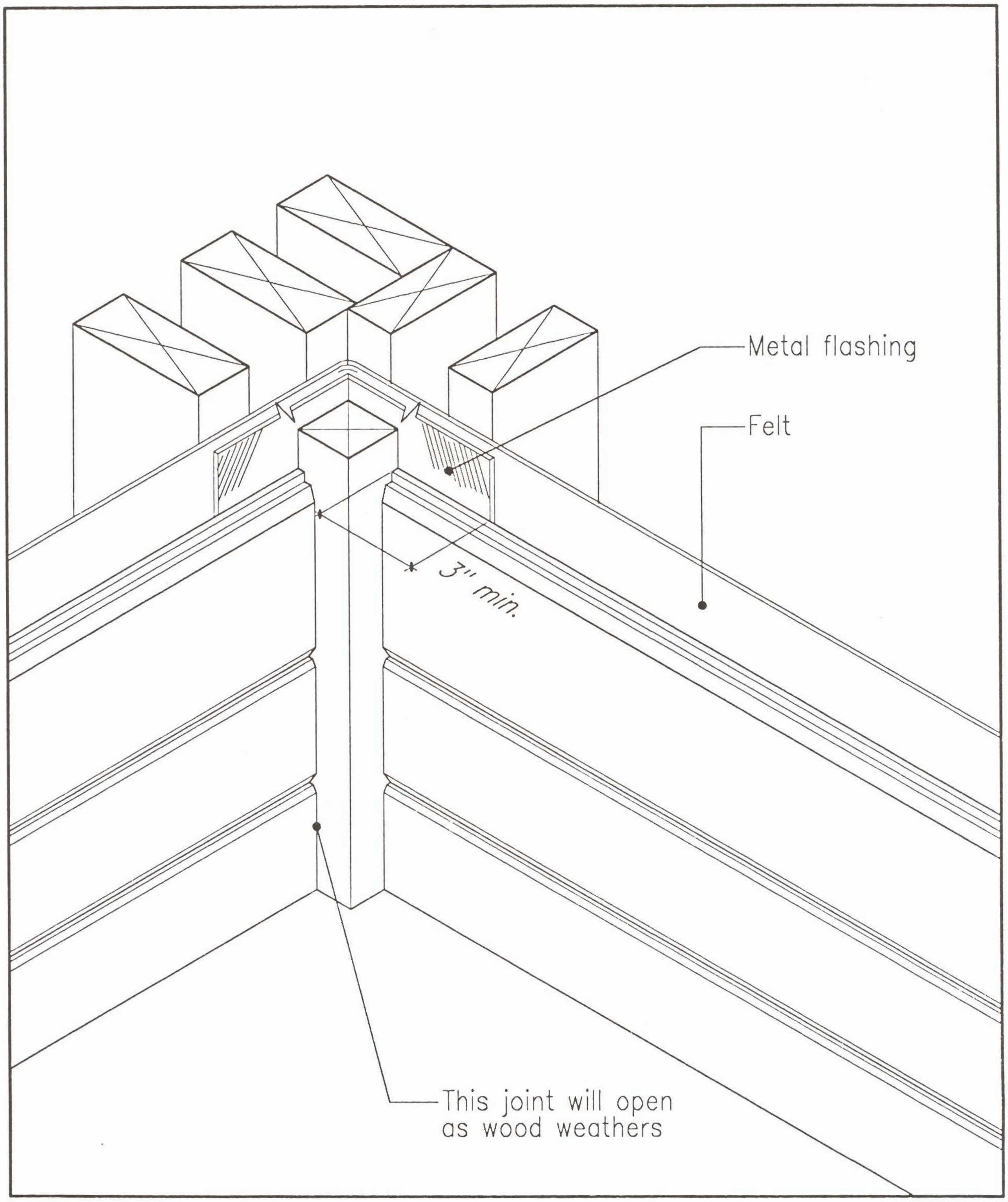
LUMBER VERTICAL JOINT
EXTERNAL CORNER DETAIL

Figure 6–10



LUMBER VERTICAL JOINT
EXTERNAL CORNER DETAIL

Figure 6–11



LUMBER VERTICAL JOINT
INTERNAL CORNER DETAIL

Figure 6–12