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## *chapter 3.* GENERAL DETAILING

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### 3.1 ENVIRONMENTAL SETTING

Prior to reviewing the details of appropriate wood construction, the authors believe it is important to discuss building location. Throughout the West, particularly along the Pacific Coast and in Hawaii, a series of micro-environments exists. These micro-environments can be as small as a single building site or as large as several miles. In fact, multiple micro-environments exist within a building site, i.e., north vs. south exposures, shaded and sunny exposures, or even the difference between exposures at the roofline and at the base of a wall. It is essential that the designer recognize micro-environments when they occur and evaluate their impacts on buildings and building elements.

To assist the designer, the following section describes weathering components that can have a major effect on wood performance:

**3.1.1** The most common condition is the effect of weathering on exposed wood building components. The common agents of weathering are light, water, and heat.

#### LIGHT

When discussing light, we are usually concerned with the ultraviolet spectrum, but evidence exists that other wavelengths also affect wood. Sunlight causes surface erosion

and discoloration of the finish and, elevation of the surface temperature.

#### WATER

Water is without question the single most important adverse environmental influence. Its presence or its rapid variation causes damaging shrinkage, swelling, and checking. These problems lead to warp-cupping, bowing, and twisting. The presence of water over protracted time periods results in decay and encourages most types of insect infestations.

#### HEAT

The time-temperature effect on wood strength is not normally considered significant below 150°F. However, prolonged exposures at as low as 125°F may cause problems in some circumstances. Normal daily fluctuations can cause checking because of moisture content gradients.

**3.1.2** Salt spray or salt-laden air may cause a defiberization of exposed wood, resulting in surface degradation and, in severe cases, a loss of structural integrity. The resulting salt in the wood also elevates the equilibrium moisture content of the wood, which may lead directly to fungal attack.

**3.1.3** Chemicals and air pollution can also cause wood degradation, usually affecting the appearance, erosion rates, and, in severe cases, strength.

**3.1.4** Insect attack occurs in all sections of the United States. These attacks can range in severity from a nuisance to the total destruction of wood.

**3.1.5** Wood-destroying fungi are present throughout the environment and may attack wood if it becomes wet. Damage may be severe if wet conditions continue for a long time or are optimal for fungal growth.

If the designer is to provide optimal or adequate wood service life, all of these weathering conditions must receive reasonable attention.

## **3.2 GENERAL FRAMING REQUIREMENTS**

The ultimate performance of good exterior wall design and construction starts with proper framing. Framing that is out of plumb, in poor alignment, or poorly fastened, for example, generally establishes conditions that often preclude proper wall-covering applications. The following are a few key items of concern:

### **3.2.1 Green Lumber**

When green lumber is used for framing, the potential for movement due to shrinkage is significant, which can cause enormous problems in the building. This condition requires careful detailing to avoid trouble.

### **3.2.2 Flush face**

Providing a flush face over the entire wall with particular attention to the plates, rim joists, and concrete footing enhances the probability of a good siding installation. Misalignment of members almost always results in bows, gaps, or weak fastening in most siding conditions and with most siding materials. Individual recessed members can be a problem if fastenings, is attempted to that member.

### **3.2.3 Spacing**

Proper spacing of studs allows proper nailing of siding. Blocking for nailing must be provided for board siding applied vertically. All joints in plywood and other panel sidings must be supported by framing members to give adequate edge nailing support. When nailing guns are used, it is difficult to know if the nails are even hitting the framing, so it is critical that both the horizontal and vertical framing alignment with panel joints be precise.

### **3.2.4 Framing**

With finish siding, the designer and the contractor must understand that the framing is the structural base for the siding, not the reverse. Siding should not be used to handle structural loads (excluding shear) unless it is specifically designed to do so. Accordingly, the framing must be well tied together and not temporarily held until the siding is installed.

### 3.3 MEMBRANE

Most exterior surface materials used in wood buildings do not provide levels of resistance to water infiltration that are adequate to withstand moderate to severe weather conditions. Installation of a continuous membrane behind these surfaces is therefore necessary. A proper membrane will prevent free moisture penetration while it allows a reasonable level of vapor transmission of limited amounts of moisture that may have entered the wall cavity from the interior or exterior. The membrane should not be a vapor barrier, because vapor barriers may cause condensation of moisture vapor inside the wall. The membrane should be strong enough to resist normal construction exposure and abuse without tearing. It should have a high level of permanence where moisture conditions are adverse. Finally, the membrane detailing and installation must allow a free path down and out to the exterior for water that may have penetrated the siding materials.

These functions have been traditionally served by using asphalt-saturated rag felts (both #15 and #30 felts). The authors contend that most newer, cheaper building papers are not suited for their intended uses. The old standbys, #15 or #30 organic felts are, in our opinion, superior products for membrane use. A few new products are available that appear to have properties equivalent to or exceeding those of organic felt. The designer should carefully investigate these products before using them.

The appropriate grade of membrane should not only depend on the moisture exposure noted above but should also vary with the type of substrate to which the membrane is

fastened. Where the membrane is fastened directly to studs, rafters, or stripping, a stronger membrane or more careful workmanship is needed than where it is solidly backed. Plaster work and brick veneer generally require a stronger membrane or better workmanship than does wood siding, because the installation process tends to be more prone to membrane abuse. Prolonged exposure of the membrane during construction also requires a more durable material.

It is not possible to chart all the variables in wall systems and exposure conditions here. The following example may assist the designer in making the correct choice: even in a wet climate, a 5/8 inch-thick textured plywood skin wall system with proper head, sill, window, and joint details represents a lower moisture exposure for the membrane than a portland cement plaster system. Thus, although the membrane for the plaster wall should be a severe exposure type with high tear strength, the plywood skin wall will perform well with a moderate exposure type membrane. With good workmanship, the plywood skin wall will probably perform adequately with a mild exposure membrane.

#### 3.3.1 Openings

Special attention should be given to the installation of felt membranes around window and door openings. Currently, preassembled windows with metal nailing fins are commonly used in place of the traditional wood windows. These "nail-on"-type units are used for most metal windows, clad wood windows, and sliding metal doors. Properly done, this system provides a higher level of

infiltration resistance than the traditional wood installation. The "nail-on" windows and doors are significantly improved by an additional layer of felt at the jamb. See **Figure 3-1A-D** for a step-by-step illustration of membrane installation around a window.

### 3.3.2 Penetrations

Cantilevered deck joists and beams or other miscellaneous penetrations are often ignored by the designer, which creates major problems. Sometimes the designer feels there are too few penetrations to be concerned about. Other times they are partially protected and the designer may feel there is no exposure. Unfortunately, these conditions have a high incidence of water penetration into the framing, which frequently leads to decay of the cantilevered beam at the point where shear and bending are greatest. The decay often extends into the building interior. To properly handle this condition, sheet-metal flashing must be correctly shingled with the wall membrane (see **Figures 3-3A-D** and **3-4**). We are unaware of any other successful systems that do not rely on awnings or sheet metal. A much safer approach is to avoid through-wall framing and, instead, to support the deck with ledgers and columns.

### 3.3.3 General Flashing or Overlap Conditions

Installation of the felt at intersections, end conditions, and penetrations is critical to the performance of the exterior skin. All membranes should maintain a minimum of 2-inch horizontal lap and 6-inch vertical lap in all internal joints. In locations where the

membrane is subjected to severe wind pressure or around openings, the lap distance should be increased. An additional split sheet of half-width felt should be applied at all corners of a building, as these areas are subject to greater physical abuse during construction (see **Figure 3-2A-B**).

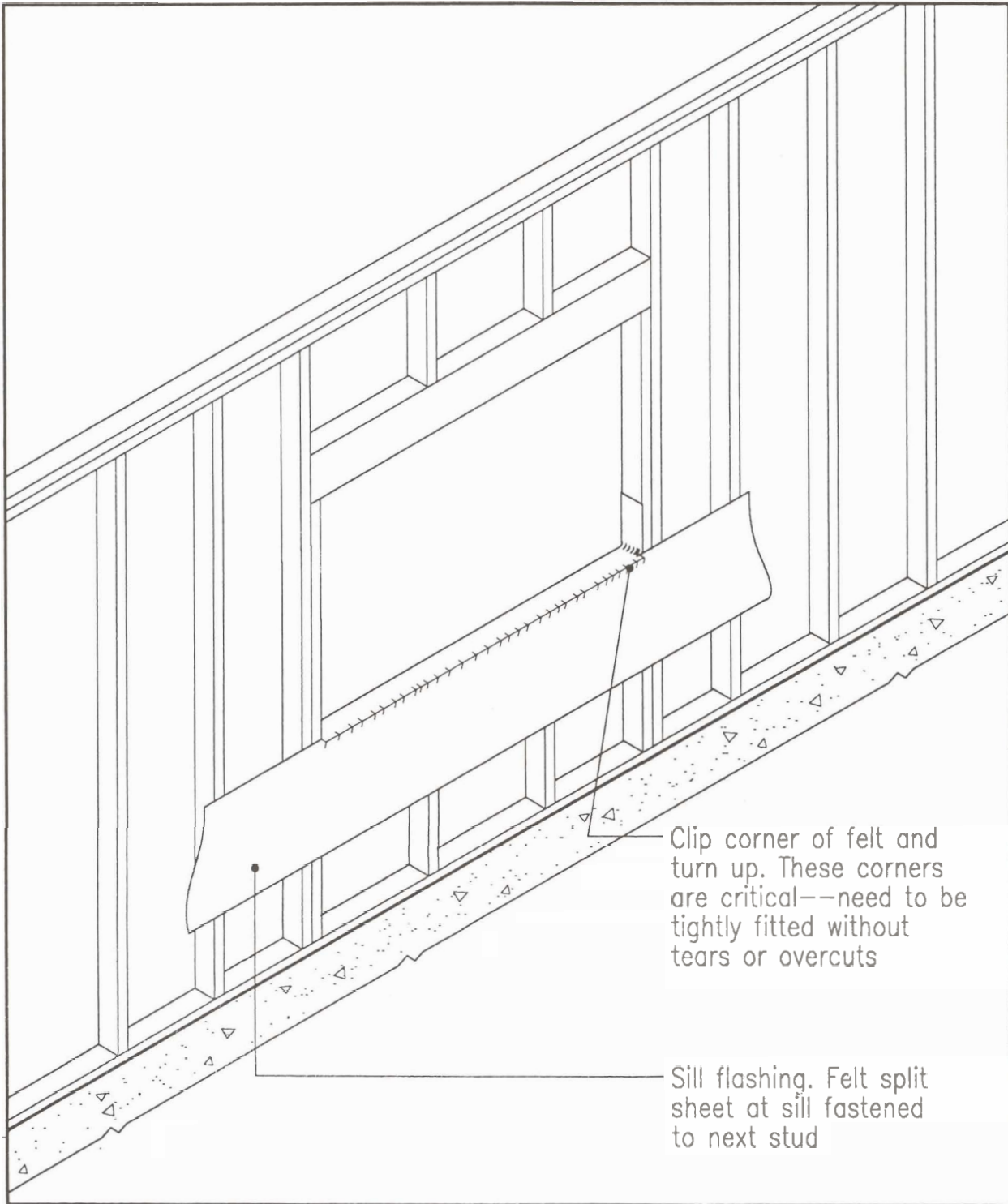
Overlapping of exterior materials in the building envelope is a time-proven method of preventing water infiltration. When properly detailed and constructed with an appropriate external membrane, high levels of infiltration resistance, suitable for the normal building, can be achieved. The overlap requirement is directly related to the velocity of wind-driven rain.

The following are suggested minimum standards for normal wind-driven rain conditions.

**Table 3-1**  
"A" Dimension - Vertical Lap Dimension  
for Water-Shedding Action

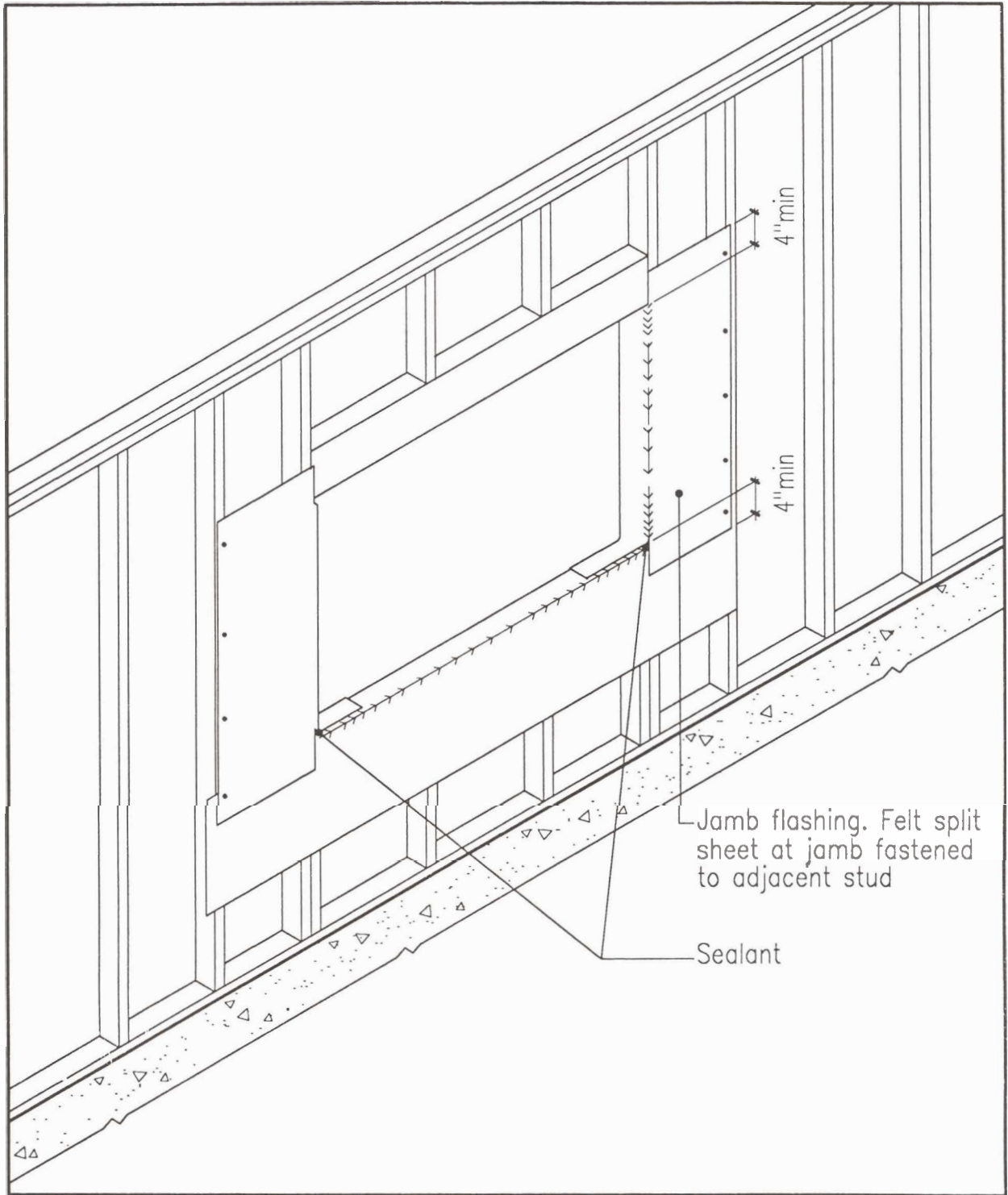
Expected Maximum Wind Velocity of Wind-Driven Rain	Minimal Overlap "A" Dimension
Under 50 MPH	1 1/2"
51 to 65 MPH	2 1/2"
66 to 80 MPH	3 1/2"
81 to 99 MPH	4 1/2"
over 100 MPH	use special design criteria

Overlap dimensions are especially critical at joints in the building surface material and at openings where there is a discontinuity in the membrane. The use of proper overlap dimensions will also reduce the membrane's exposure to water and prolong the life of the membrane.



## FELT MEMBRANE LAYOUT AROUND WINDOW

Figure 3-1A

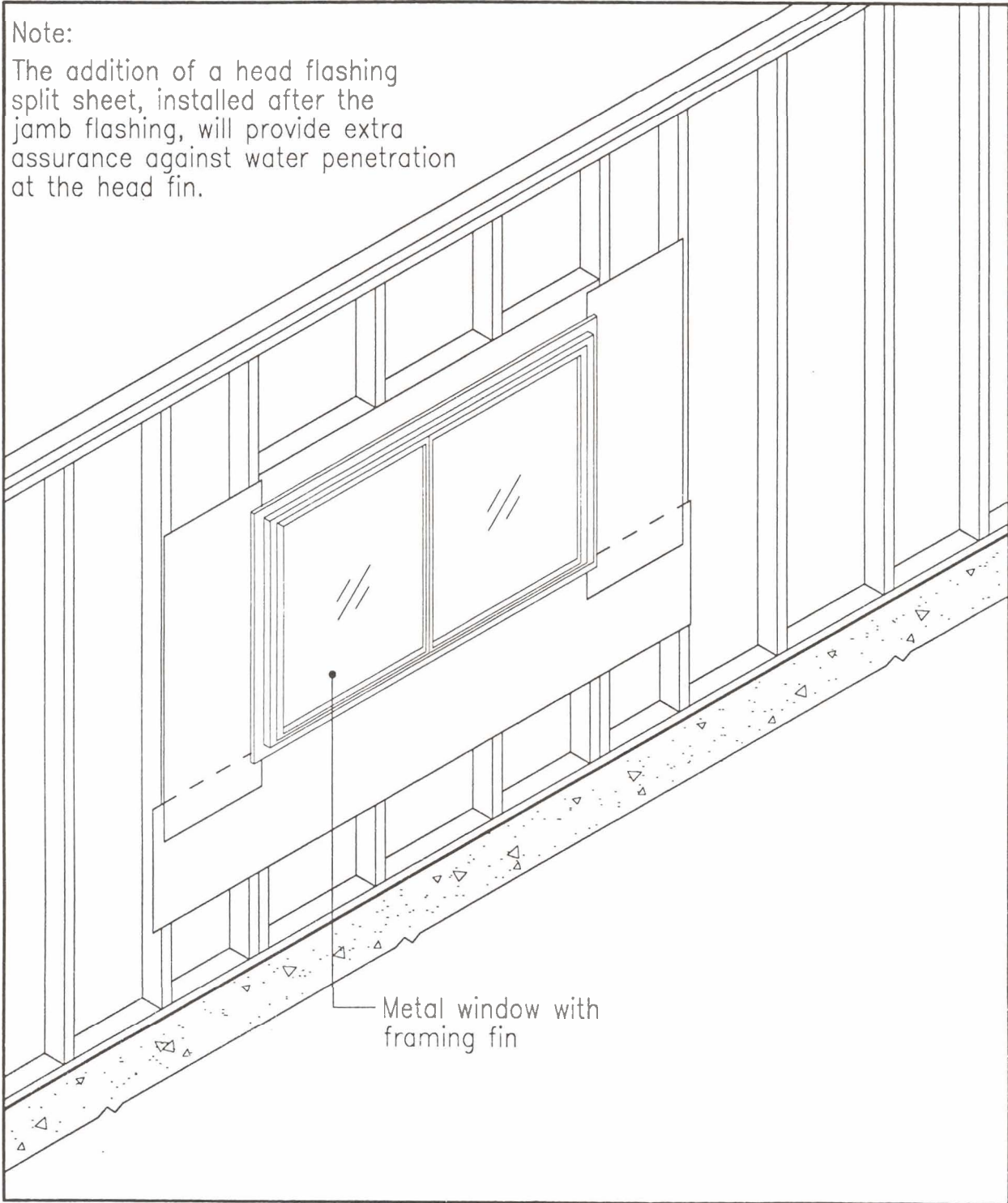


# FELT MEMBRANE LAYOUT AROUND WINDOW

Figure 3-1B

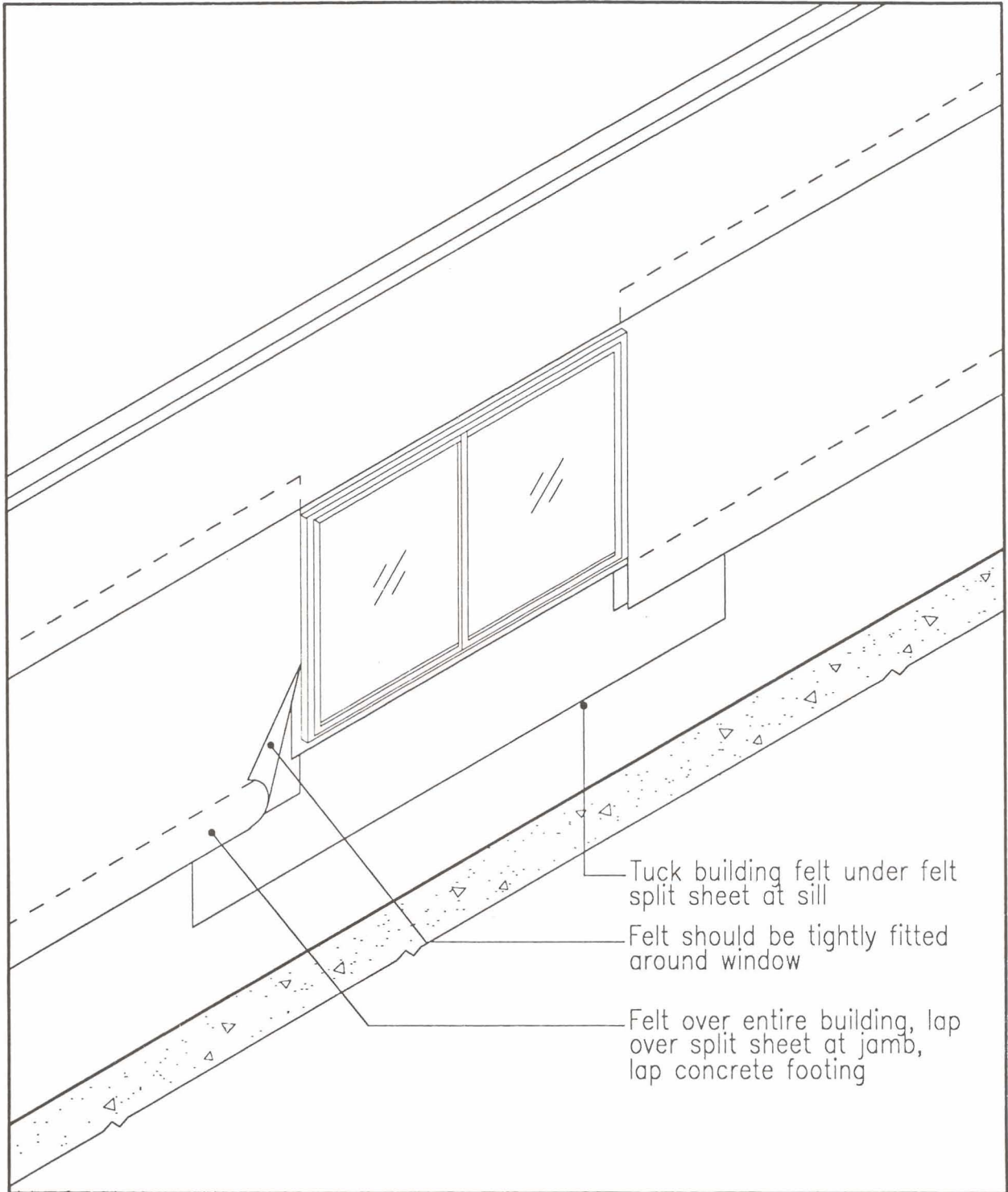
Note:

The addition of a head flashing split sheet, installed after the jamb flashing, will provide extra assurance against water penetration at the head fin.



## FELT MEMBRANE LAYOUT AROUND WINDOW

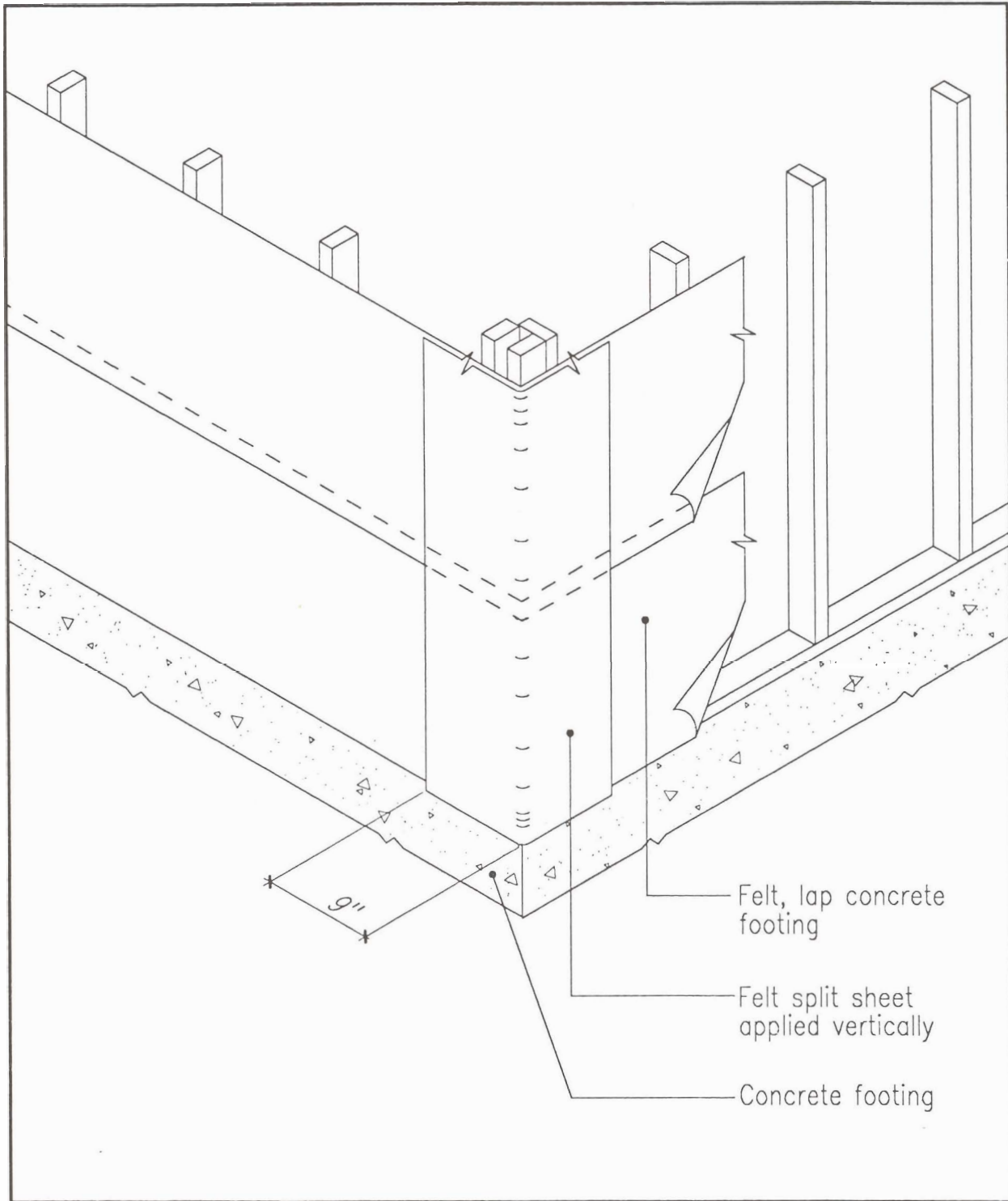
Figure 3-1C



## FELT MEMBRANE LAYOUT AROUND WINDOW

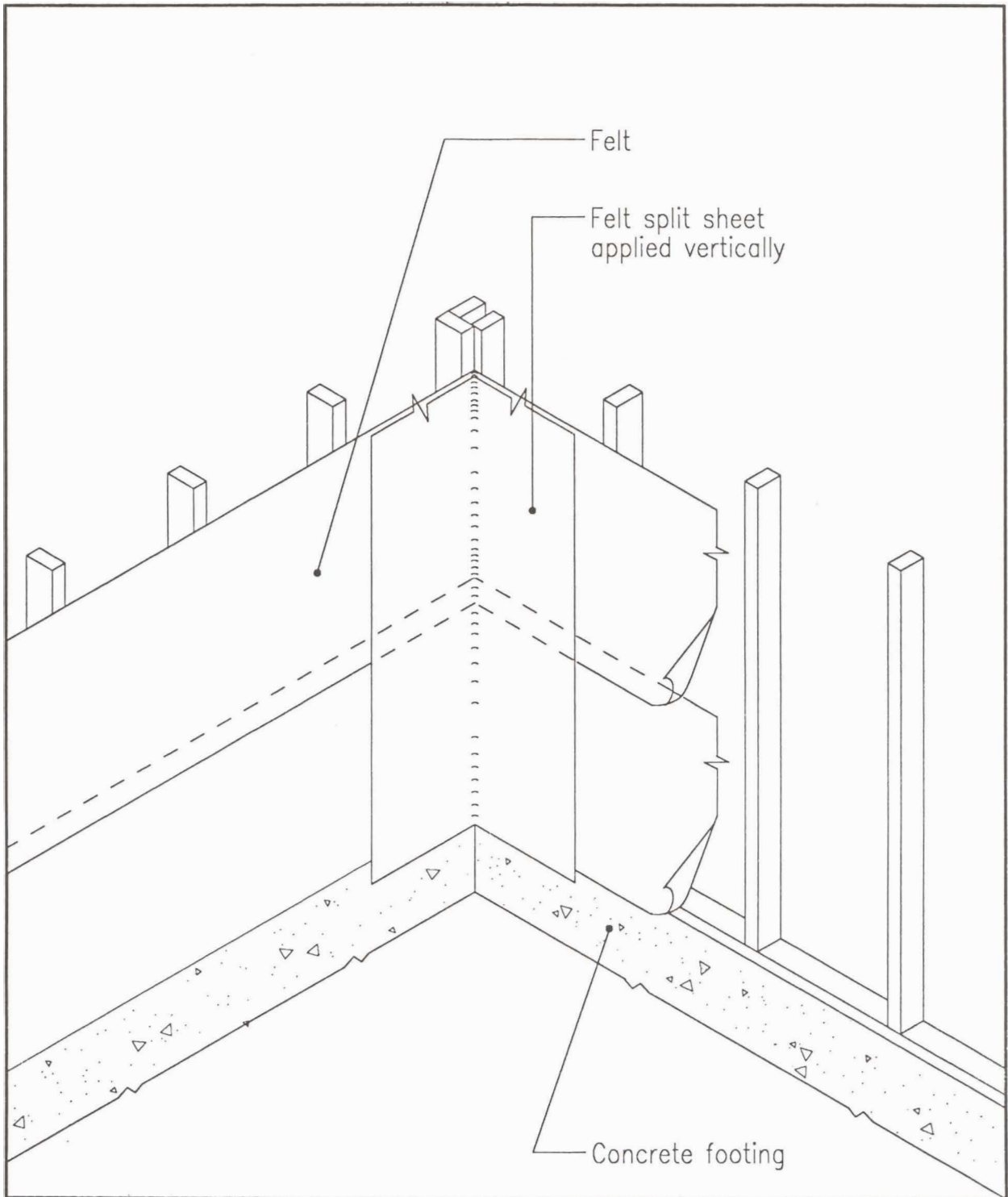
Figure 3-1D





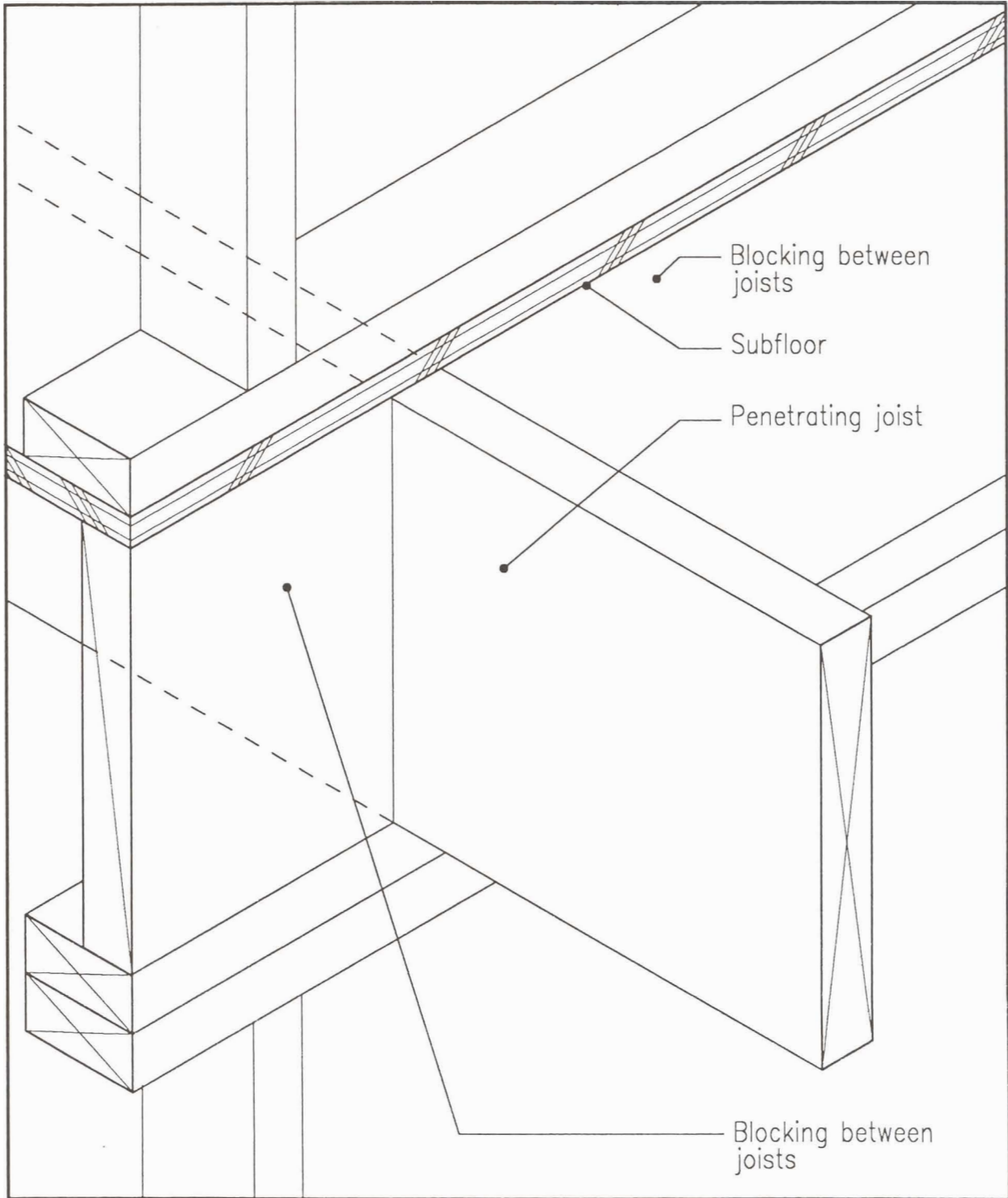
# FELT MEMBRANE LAYOUT AT EXTERNAL CORNERS

Figure: 3-2A



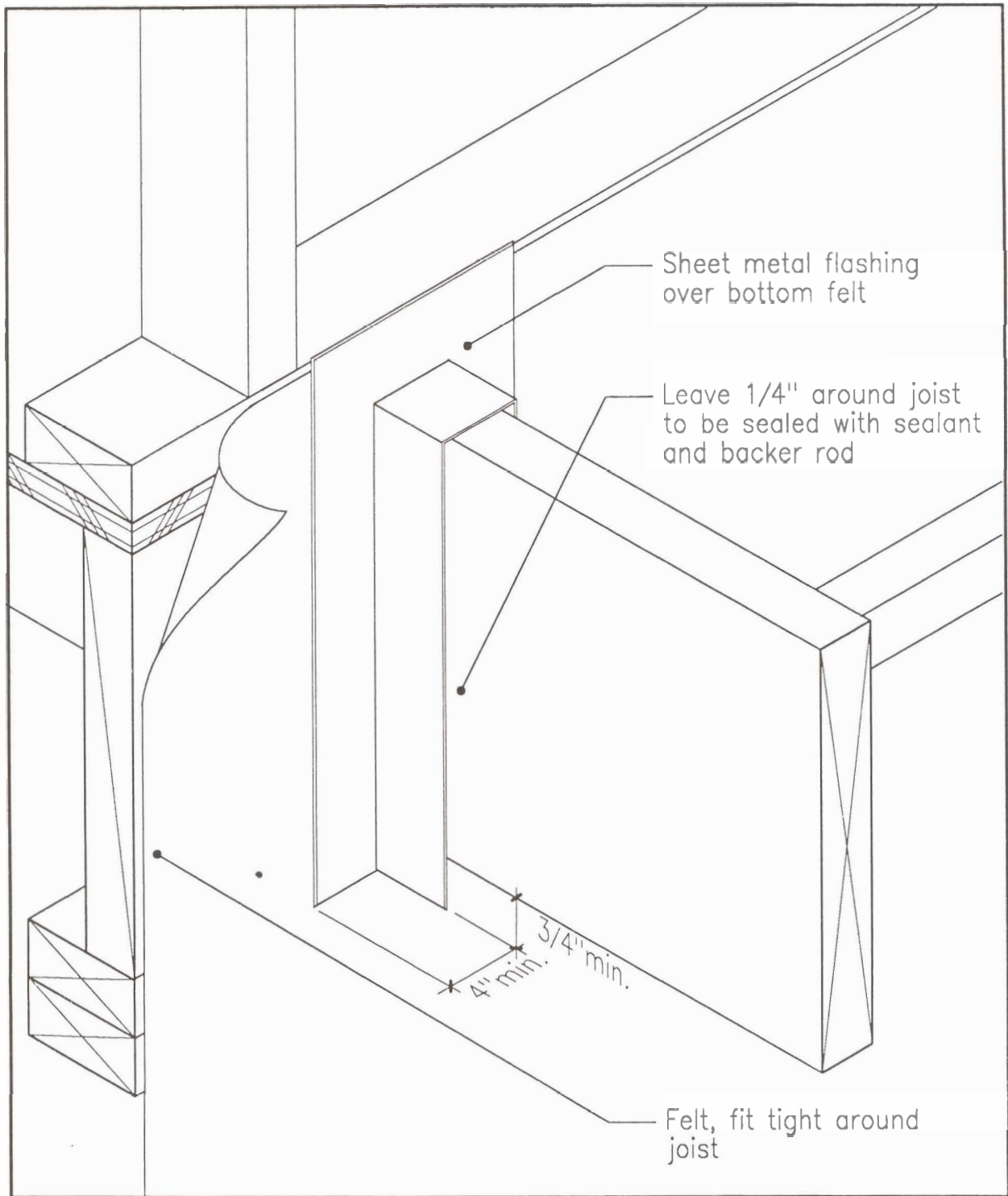
## FELT MEMBRANE LAYOUT AT INTERNAL CORNERS

Figure: 3-2B



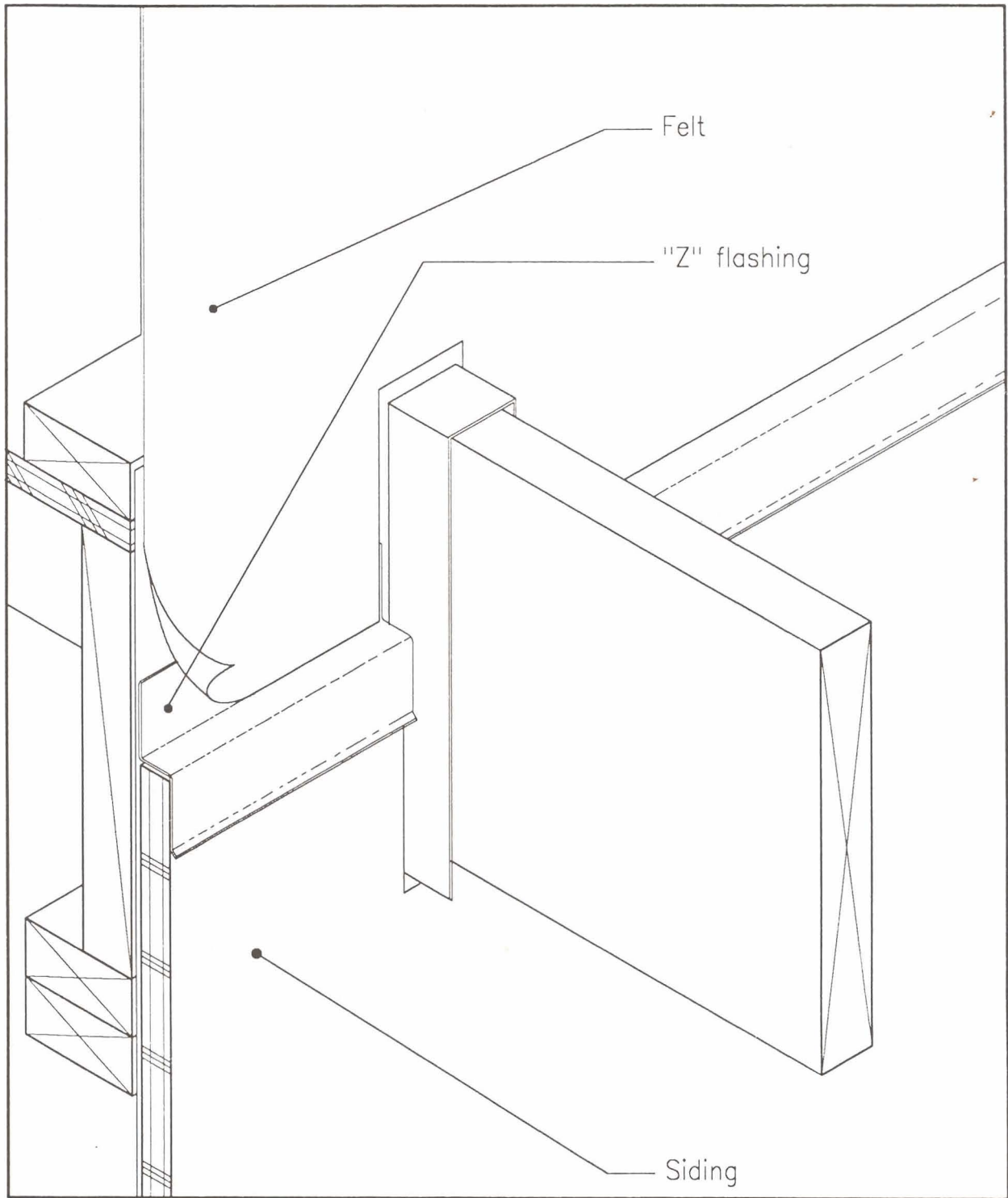
# PENETRATION DETAIL THROUGH PLYWOOD PANEL WALL

Figure 3-3A



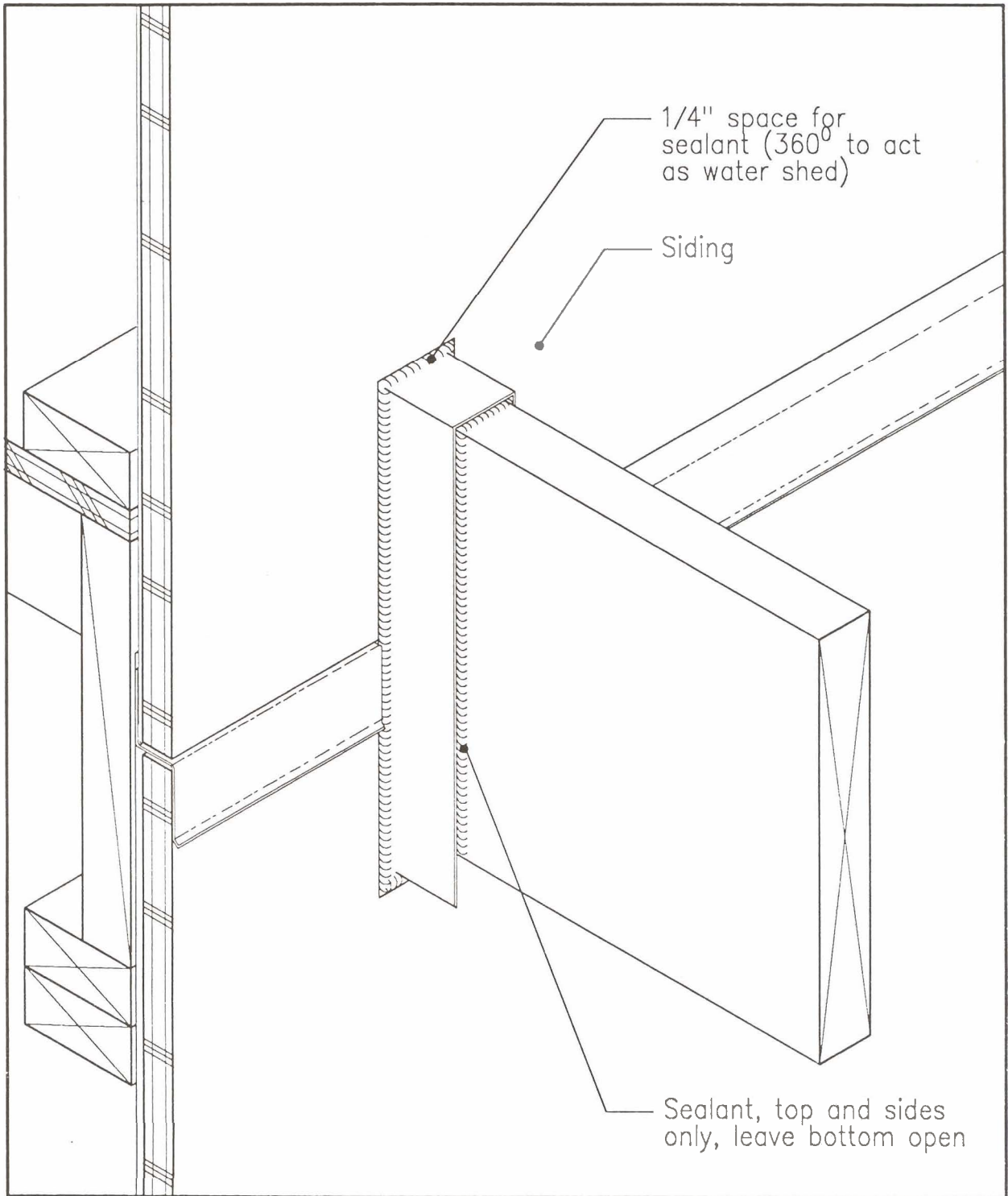
## PENETRATION DETAIL THROUGH PLYWOOD PANEL WALL

Figure 3-3B



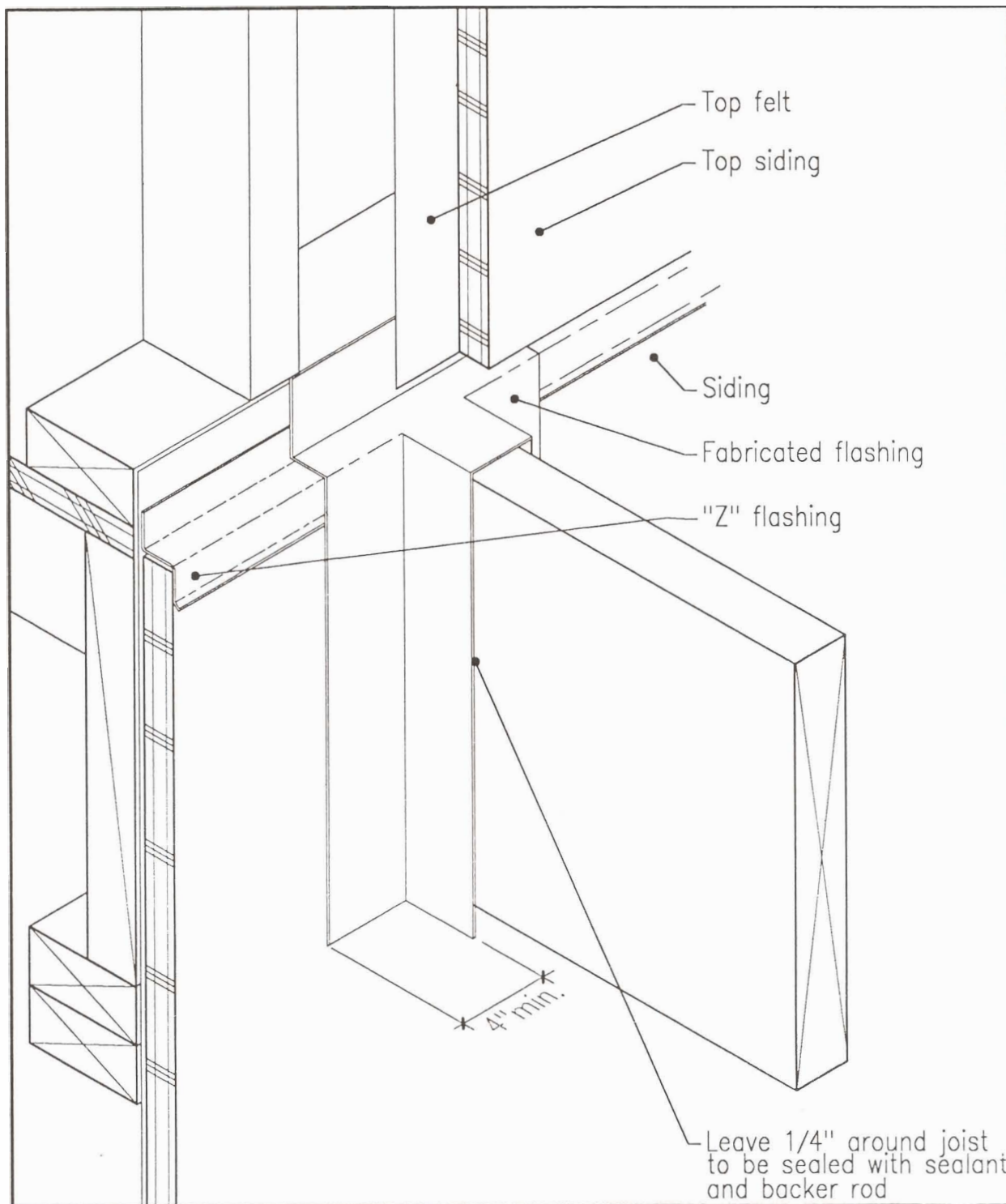
# PENETRATION DETAIL THROUGH PLYWOOD PANEL WALL

Figure 3-3C



# PENETRATION DETAIL THROUGH PLYWOOD PANEL WALL

Figure 3-3D



# PENETRATION DETAIL THROUGH PLYWOOD PANEL WALL

Figure 3-4

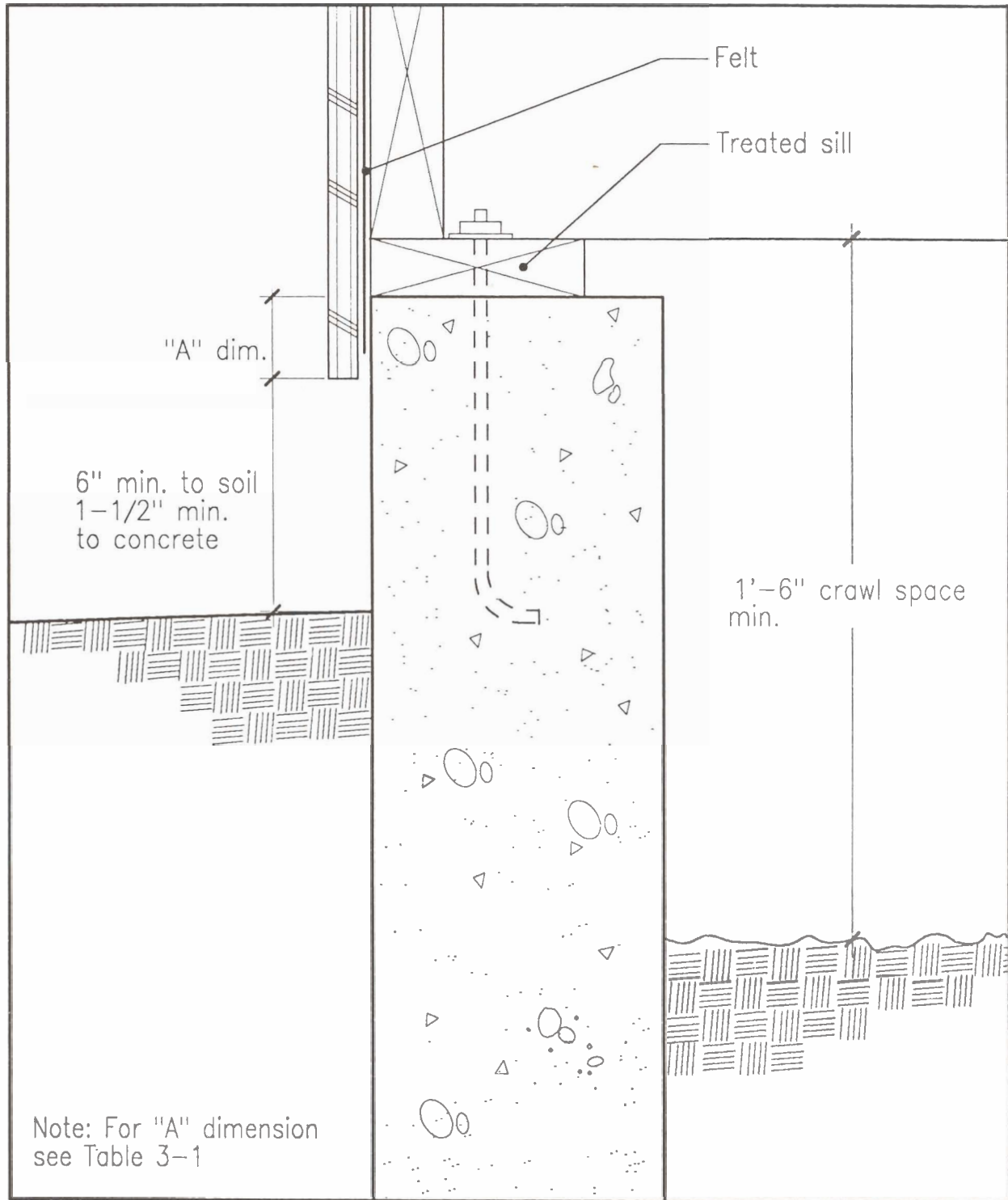
### 3.3.4 Wall Detail At Foundation

The portion of a wall near the ground generally receives greater abuse and is more vulnerable to deterioration than other parts of the wall. Several factors contribute to this condition:

1. Water running down the surface of an exterior wall will collect at the bottom of the wall if not directed away from the building.
2. Water that has gotten behind the siding will run down the face of the membrane and wet the base of the wall if it is not allowed to drain to the exterior.
3. Runoff water from clipped or narrow roof overhangs can splash against the ground and wet this portion of the wall.
4. This area is frequently exposed to irrigation water.
5. Water and moisture from the ground can wet wood products in buildings if ground and wood products are not sufficiently separated.
6. Landscape plantings retard drying.
7. Improper design and construction of decks, planters, storage bins, and so on are often added against this part of the wall.

To adequately protect this area, the siding material and the membrane should be extended at least 1-1/2" below the bottom of the mudsill to allow water to run freely off the wall and to prevent wind-driven moisture penetration. Second, runoff water from the roof or other sources should be prevented from splashing. Rain gutters and downspouts should be installed to catch drainage water from clipped or narrow roof overhangs. Third, the lower edge of the wood and the bottom edge of the siding should be at least six inches above soil and 1-1/2" above any adjacent exposed horizontal concrete surface. In crawl spaces, the separation from soil to floor joists should be at least 18" (see **Figure 3-5**). Where the soil is unusually wet, a vapor retarder installed on the ground will reduce the risk of decay but may increase the growth of mold on the soil surface, potentially causing odor and possible allergy problems. The crawl space must be adequately ventilated.





# FOUNDATION DETAIL

Figure 3-5