Chapter 9

Air Tightening Specialist

Air leakage can account for 30 to 40 percent of home heat loss. That is why the Super Good Cents program emphasizes air leakage control. Good air leakage control means lower heating bills and better comfort.

You can choose from two approaches to air leakage control: Standard Air Leakage Control (right construction) and Advanced Air Leakage Control (super-tight construction).

In addition to caulking and sealing that are part of Standard Air Leakage Control, Advanced Air Leakage Control creates a "continuous air barrier," usually at interior wall, ceiling, and floor surfaces.

The many steps in each air leakage approach add up to a conservation measure as important as insulation, good windows, insulated doors, efficient heating systems, and solar features.

Air leakage control may be accomplished in many ways. One way is to have subcontractors seal joints and penetrations they create in their work: Framers seal framing joints and seams, electrical contractors seal electrical penetrations, plumbers seal plumbing penetrations, and HVAC contractors seal penetrations for ducts and other air leakage sites in the heating system. Another way is to make one person—the air tightening specialist—responsible for all air sealing. Air tightening specialists are most effective when they focus on two stages in the construction sequence: 1) the rough framing stage before walls are insulated and 2) after the drywall is hung.

STANDARD AIR LEAKAGE CONTROL MEASURES AT ROUGH FRAMING STAGE

1994 LTSGC 2.3.1

Floors

- _____ Plumbing penetrations
- _____ Tub plumbing penetration (see Chapter 6 for details)
- _____ Electrical penetrations
- _____ Heating system penetrations
- _____ All duct joints and seams
- _____ Joints around masonry
- _____ Heated basement:
  - _____ Mudsill sealed to stem wall
  - _____ Rim joist sealed to mudsill and flooring
- _____ Upper floor rim joists

Walls Between Heated and Unheated Spaces

Penetrations through the top and bottom plates of all walls and through siding and sheathing

_____ Electrical penetrations
_____ Plumbing penetrations
_____ Telephone penetrations
_____ TV cable penetrations
_____ Penetrations around through-the-wall vents
_____ Wall to floor joint
_____ Penetrations at partition intersections with exterior walls
_____ Horizontal top plate joint
_____ Window and door rough openings
_____ Exterior door thresholds

Ceilings Between Heated and Unheated Spaces

Penetrations

_____ Attic hatch (if inside heated space)
_____ Skylight seams and joints
_____ IC recessed lights

STANDARD AIR LEAKAGE CONTROL MEASURES AFTER DRYWALL

Walls Between Heated and Unheated Spaces

_____ Switch boxes sealed to drywall
_____ Outlet boxes sealed to drywall
_____ Plumbing penetrations sealed
_____ Through-the-wall air vent penetrations sealed
_____ Beam pockets sealed

Ceilings Between Heated and Unheated Spaces

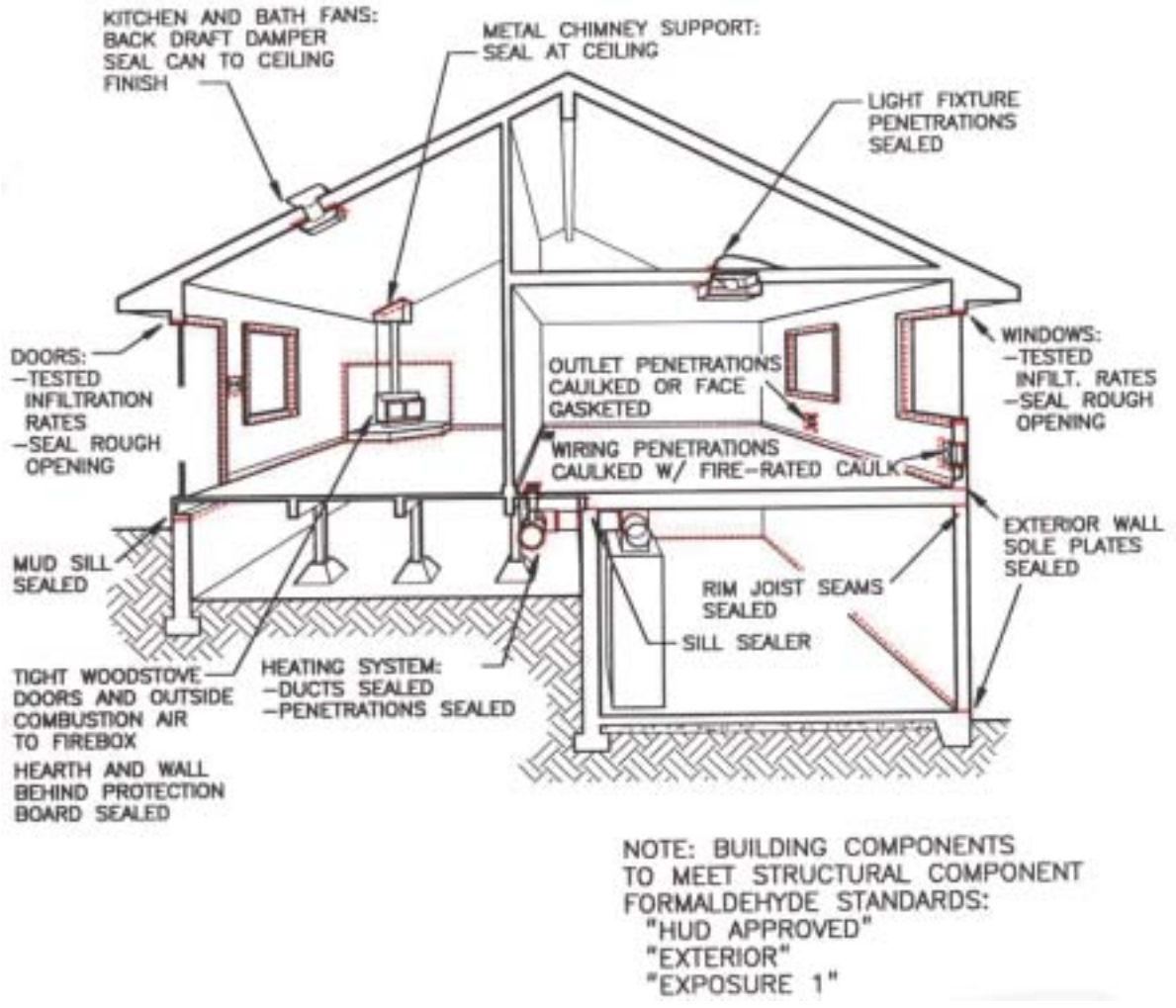
_____ Light box penetrations sealed to drywall
_____ Recessed light cans sealed to drywall
_____ Fan cans sealed to drywall

TIP: The tub penetration is difficult to seal once the plumbing and tub are in place. It is best handled by the plumber during tub installation. See Chapter 6 for tub sealing details. If gaskets are not used, install a separate cover around the pipes by boxing them in with framing and sheathing to completely seal the opening.

TIP: Framers can seal the rim joist to the mudsill after the rim is in place and floor layout marks have been completed, just before floor joists are installed. See Chapter 4 for floor framing and insulation details. Once wall framing begins, rims can quickly be covered by sheathing. The air tightening specialist must seal the rim before it is covered. Typical sealing materials are caulking and expanding foam.

Figure 9A shows air sealing sites.

Figure 9A
STANDARD AIR LEAKAGE CONTROL: PLACES TO SEAL



ADVANCED AIR LEAKAGE CONTROL MEASURES

1994 LTSGC 2.3.2; Appendix A 3.3

If you qualify for the Super Good Cents program using Advanced Air Leakage Control, specifications require a blower door test to verify house tightness. The test measures building air leakage and identifies air leakage locations.

Advanced Air Leakage Control With Heat Recovery Ventilation

In some cases, even if advanced air leakage is not used to qualify the home, it may be an "associated measure" for optional heat recovery ventilation. When Advanced Air Leakage Control functions as an associated measure, prescriptive air sealing measures are installed and inspected, but no blower door test is required. Heat recovery ventilation systems are described in Chapters 5 and 7.

Blower Door Testing Standard

1994 LTSGC Appendix C

Blower door tests for Super Good Cents qualification should be conducted by trained blower door technicians. Where no local testing contractors are available, your Super Good Cents representative may be able to help you track down someone who can do the testing.

Appendix C of the 1994 Super Good Cents specifications gives the required protocol for a valid test to certify Advanced Air Leakage Control.

Blower Door Test Procedure

Most blower door manufacturers supply computer software with their doors for determining air leakage rates. In most cases, the computer printout and a cover letter are sufficient to demonstrate to the Super Good Cents representative that you used the correct testing protocol.

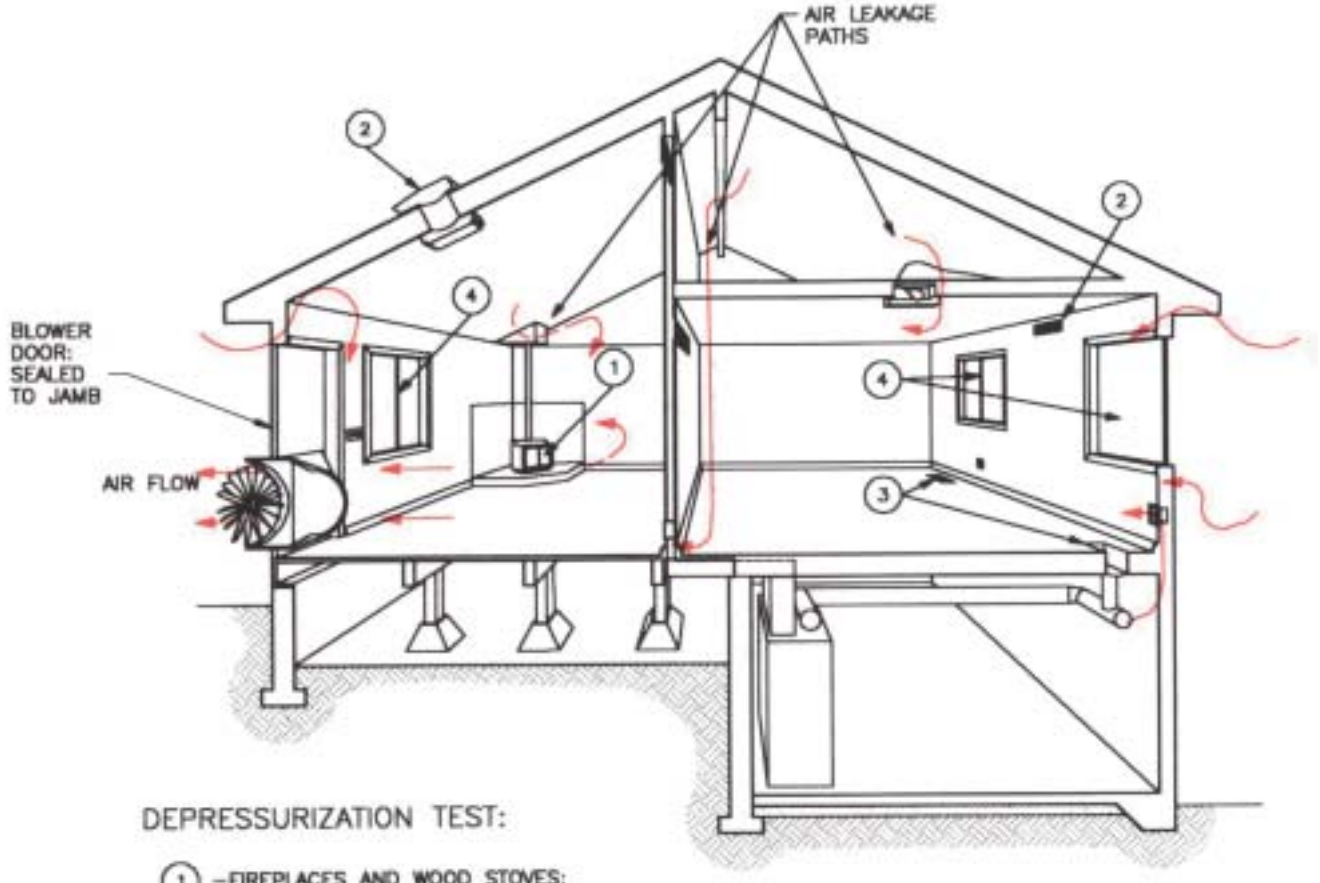
Remember: House certification depends on blower door test results. Testing must be done carefully.

Figure 9B shows how a blower door test works.

Super Good Cents Advanced Air Leakage Control Performance: 1.8 ACH at 50 Pascals

When you qualify a home with Advanced Air Leakage Control measures, the blower door test must indicate 1.8 air changes per hour (ACH) or less at 50 Pascals air pressure difference. If the home fails the test, additional house tightening usually

Figure 9B
BLOWER DOOR TEST



brings the home into compliance with the performance standard. The blower door, used in conjunction with smoke pencils or other leak detectors, helps find leaks that may have been missed during construction.

What Is a Continuous Air Barrier?

Many materials are effective barriers to air leakage. Continuous air barriers simply join air barrier materials together to create a barrier unbroken over the entire building envelope. Figure 9C shows how an air barrier can be made continuous throughout the building envelope.

Commonly used air barrier materials include drywall, sheathing, plastic sheets, glass, framing materials, and doors.

The trick is to use sealants and gaskets to join these materials into a continuous air barrier.

Is an Air Barrier a Vapor Retarder?

An air barrier prevents air movement through cracks and crannies of the building envelope. A vapor retarder blocks diffusion of moisture directly through a building material.

Some air barriers also function as vapor retarders. It depends on their "perm rating," a measure of resistance to moisture transfer. Polyethylene has a low perm rating. That makes it a good vapor retarder.

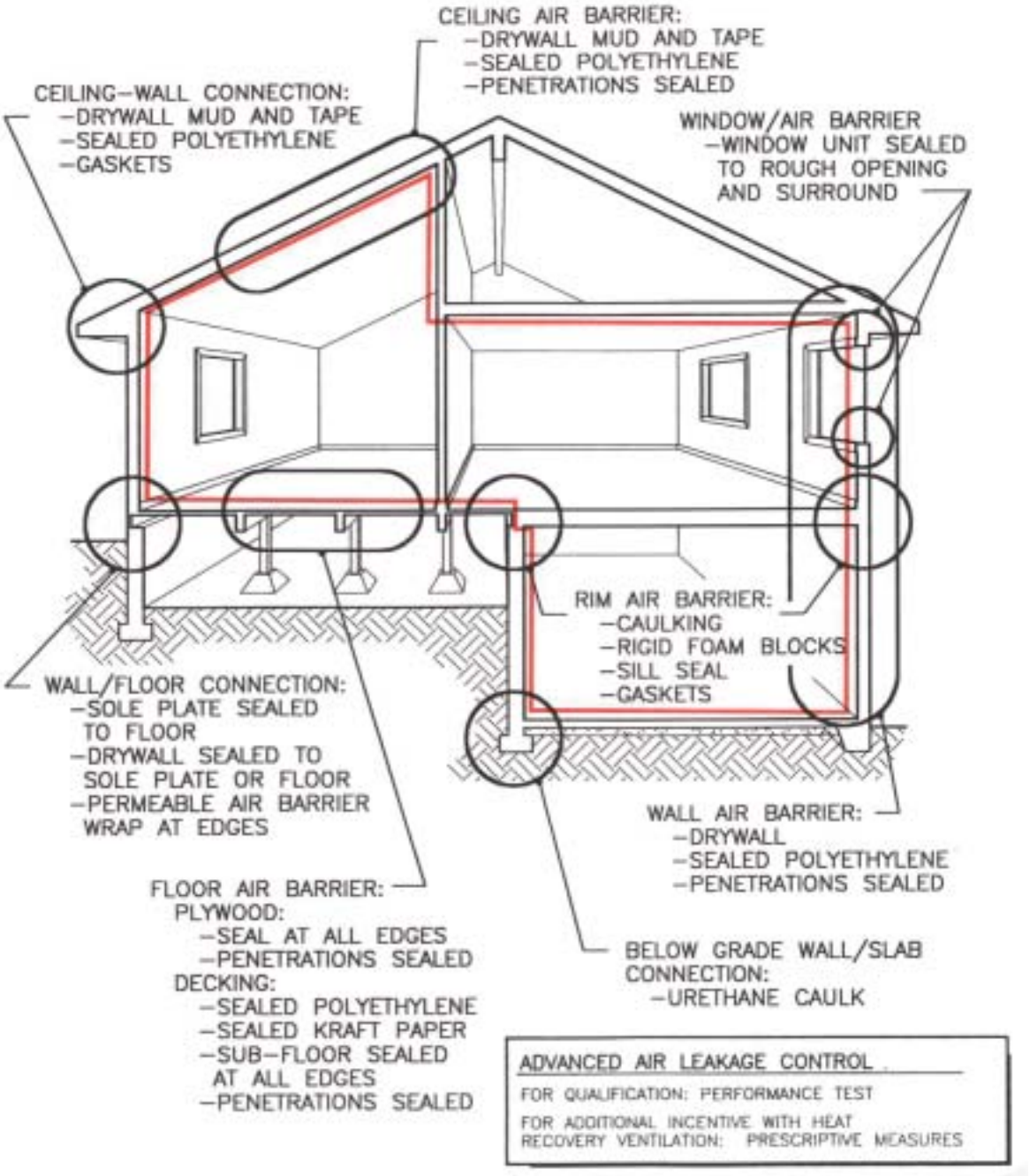
To make a good air and vapor barrier with polyethylene sheets, make a continuous seal with them, and join them continuously with other continuous building components. You also must install and fasten the sheets strongly enough to resist normal construction abuse, wind, and air pressures induced by a blower door test, if applicable.

Rigid foam boards typically have a low perm rating. To achieve the continuous air barrier required by Advanced Air Leakage Control, place rigid foam boards on the interior side of the wall, sealed together and connected to other building components.

The "Advanced Drywall Approach" uses gaskets or otherwise seals drywall to building components to form a continuous air barrier. Since drywall has a high Perm rating, you must use another material for your vapor retarder. Builders typically use tested vapor retarder paint, faced insulation, or polyethylene.

Rule of thumb: If a material has a perm rating of 1 or lower, it makes a good vapor retarder.

Figure 9C
CONTINUITY IN AN AIR BARRIER



Approaches to Advanced Air Leakage Control

Any method that tightens the building envelope to 1.8 ACH50 is OK. Most approaches to Advanced Air Sealing start with Standard Air Leakage Control measures, then go the next step to make the air barrier continuous.

Continuity in an air barrier can be achieved in a number of ways:

- Advanced Drywall Approach - A drywall gasketing system
- "Simple*cs" - A simple caulk and seal system described below
- Polyethylene air/vapor barrier system
- Interior rigid foam sealing system

You can mix and match these systems. Just keep the idea of continuity in mind.

ADVANCED DRYWALL APPROACH

The idea behind the Advanced Drywall Approach is to use materials you are already using in the house (such as drywall, sheathing and concrete) as your continuous air barrier. Use sealants and gaskets to join materials together to form the barrier.

The main air barrier material in walls and ceilings is drywall. The typical air barrier material in floors is plywood or other continuous sheathing materials.

Figures 9D and 9E show versions of a drywall gasketing system used to block air infiltration paths from partition walls into exterior wall cavities and from wall cavities into attic spaces or vaults. After you tie the drywall system to the frame, tie the framing to a continuous floor and ceiling air barrier.

The air tightening specialist can apply gaskets as part of rough framing caulking and sealing. Troublesome areas include soffits, stairwells, and tub enclosures. Visualize air leakage paths that these constructions create to help you effectively apply gaskets.

You may use continuous beads of drywall adhesive instead of gaskets, as long as the drywall installer applies them just before each sheet is hung. Figures 9M through 9S show other ways to provide continuity in Advanced Drywall Approach applications.

SIMPLE CAULK AND SEAL SYSTEM - "SIMPLE*CS"

Simple*cs is a simple caulk and seal system that is a variation of the Advanced Drywall Approach. Simple*cs recognizes that sheet materials of the building envelope make up 90 percent of the air barrier and focuses on connecting components. It simplifies the process by placing all air sealing points inside the building. That way, one person can do most air sealing in a warm, dry environment and nearly all at one time.

Figure 9D

DRYWALL SEALING AT INTERSECTIONS OF INTERIOR/EXTERIOR WALLS AND WALLS/CEILINGS

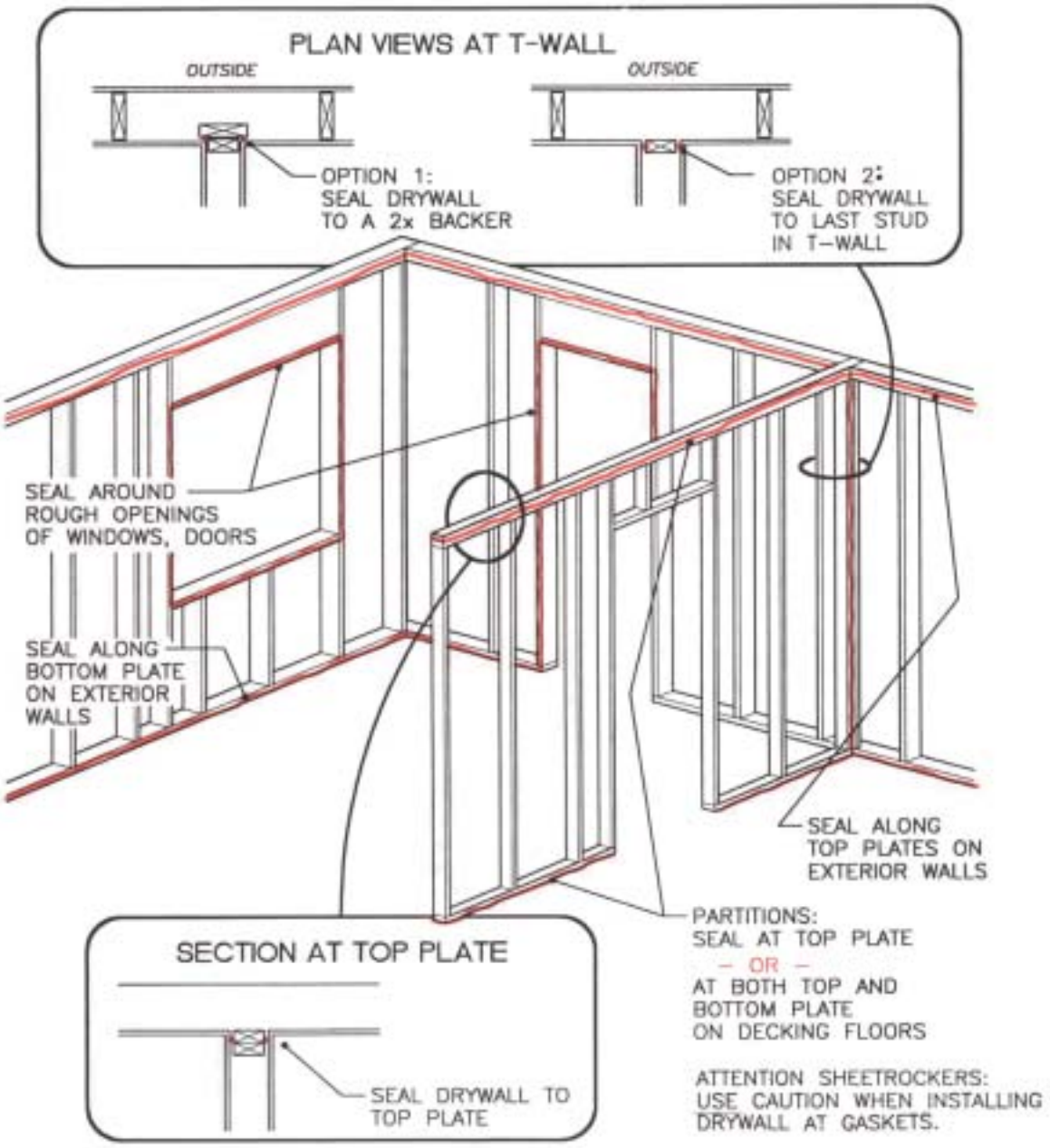
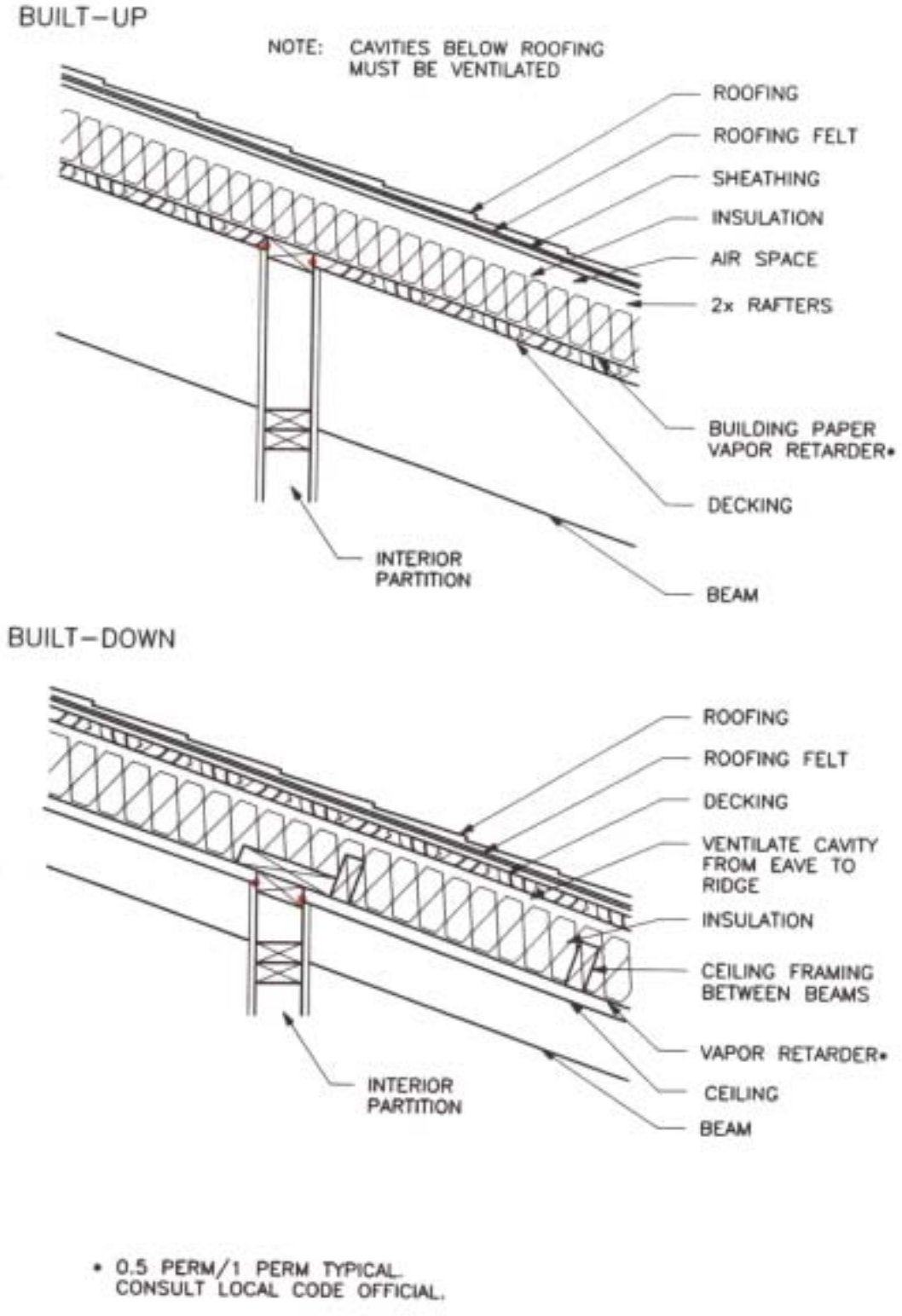


Figure 9E
DRYWALL SEALING AT WALL/VAULT INTERSECTION



Start by examining the house plan. Identify and highlight air leakage paths. Sort items that need sealing into three groups: major structural openings and intersections, major service penetrations, and other penetrations. Determine sealing methods, sealing materials, and timing. Identify who will be responsible for what. Planning improves effectiveness of air sealing and reduces interruption to the normal flow of work.

Ask your Super Good Cents utility or state technical assistance provider for more information on Simple*cs.

POLYETHYLENE AIR AND VAPOR BARRIER

Polyethylene (often referred to as “poly”) has been used for many years in homes in Canada and the U.S. The perm rating of 6-mil-thick poly is 0.06. It is suitable for use as a vapor retarder as well as an air barrier.

When you use poly as an air barrier, seal or tape the sheets together and seal them to other building components to achieve air barrier continuity. If poly serves only as a vapor retarder, you do not need this extra sealing.

Install polyethylene sheets after drywall backing is in place but before you install drywall. Seal the poly with acoustical sealant and staple the poly through the sealant to hold the seal in position. Or use special (extra sticky) tape formulated to stick to polyethylene.

Ceiling Poly

To achieve a continuous ceiling air barrier, staple ceiling poly to ceiling framing and seal the poly to interior and exterior wall top plates. Apply sealant along the plate. Double back the poly and staple it to the sealant. Leave plenty of slack at corners so drywall can go in without ripping the air/vapor barrier. See Figure 9F.

Other options, also shown in Figure 9F, use “connector strips” to achieve a continuous ceiling air barrier. These options require cooperation of the framers.

Wall Poly

Apply sealant over the ceiling poly at the top plate, to the frame around window and door rough openings, and to the bottom plate. Lay sheets over the sealant and securely staple poly at framing members. See Figures 9G and 9H. Figure 9I shows details at rims, corners, and ceilings.

Figure 9F
POLY AIR BARRIER AT TOP PLATE

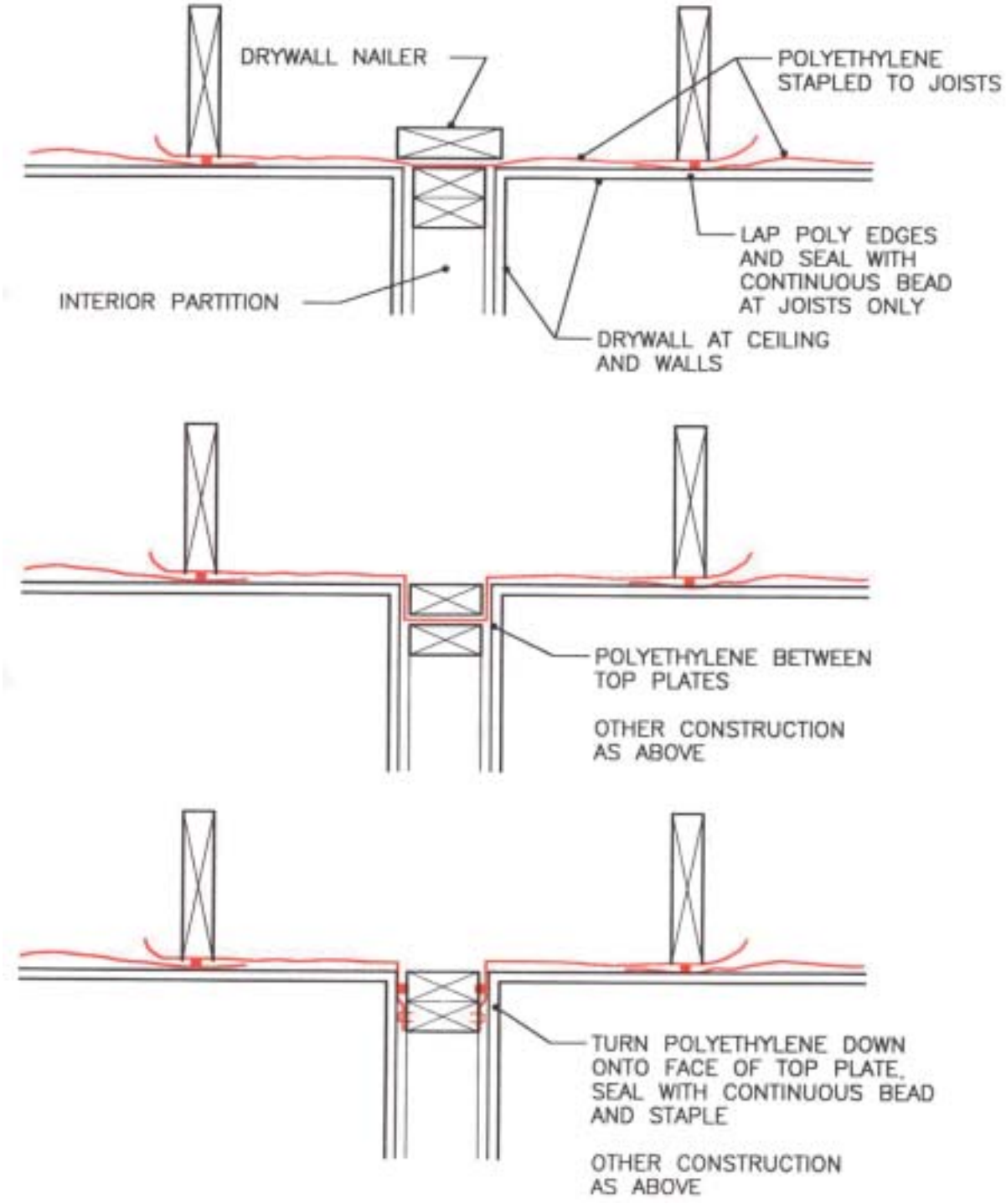


Figure 9G
SEALING POLY SHEETS

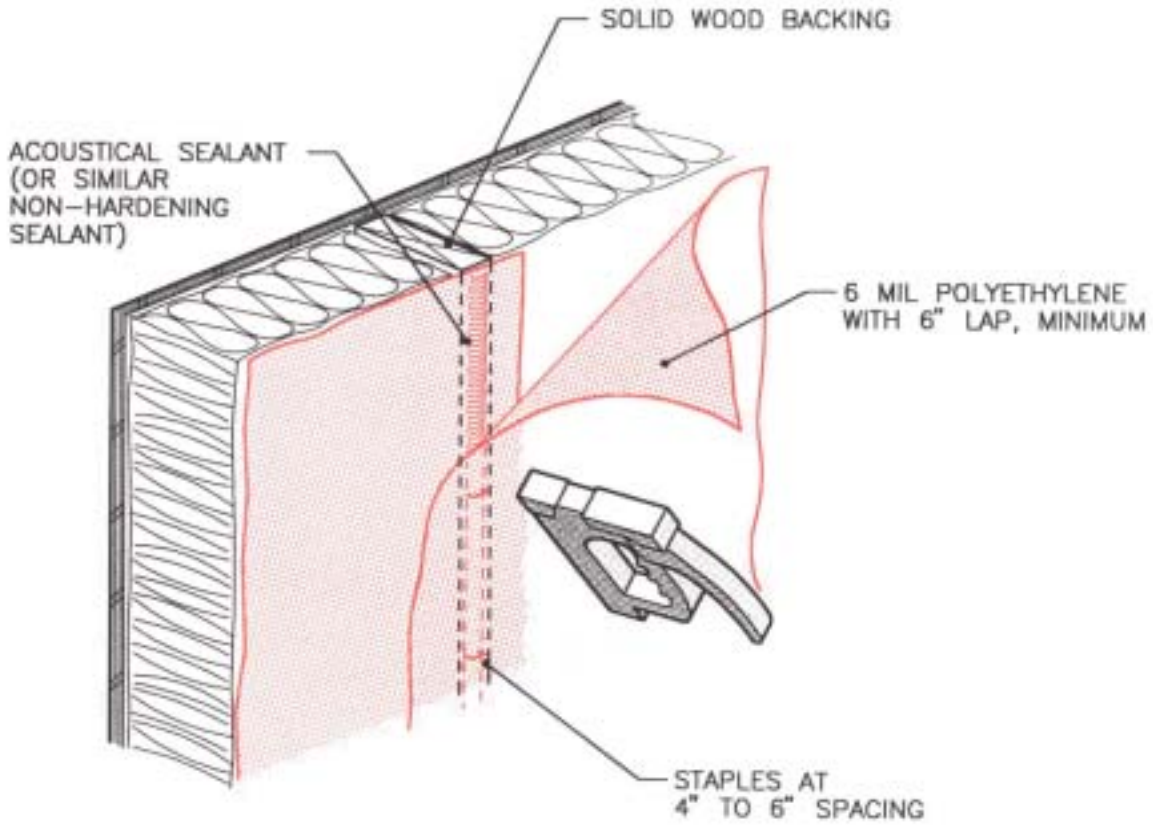


Figure 9H
POLY AIR BARRIER AT CORNER AND INTERIOR/ EXTERIOR WALL INSTERSECTION

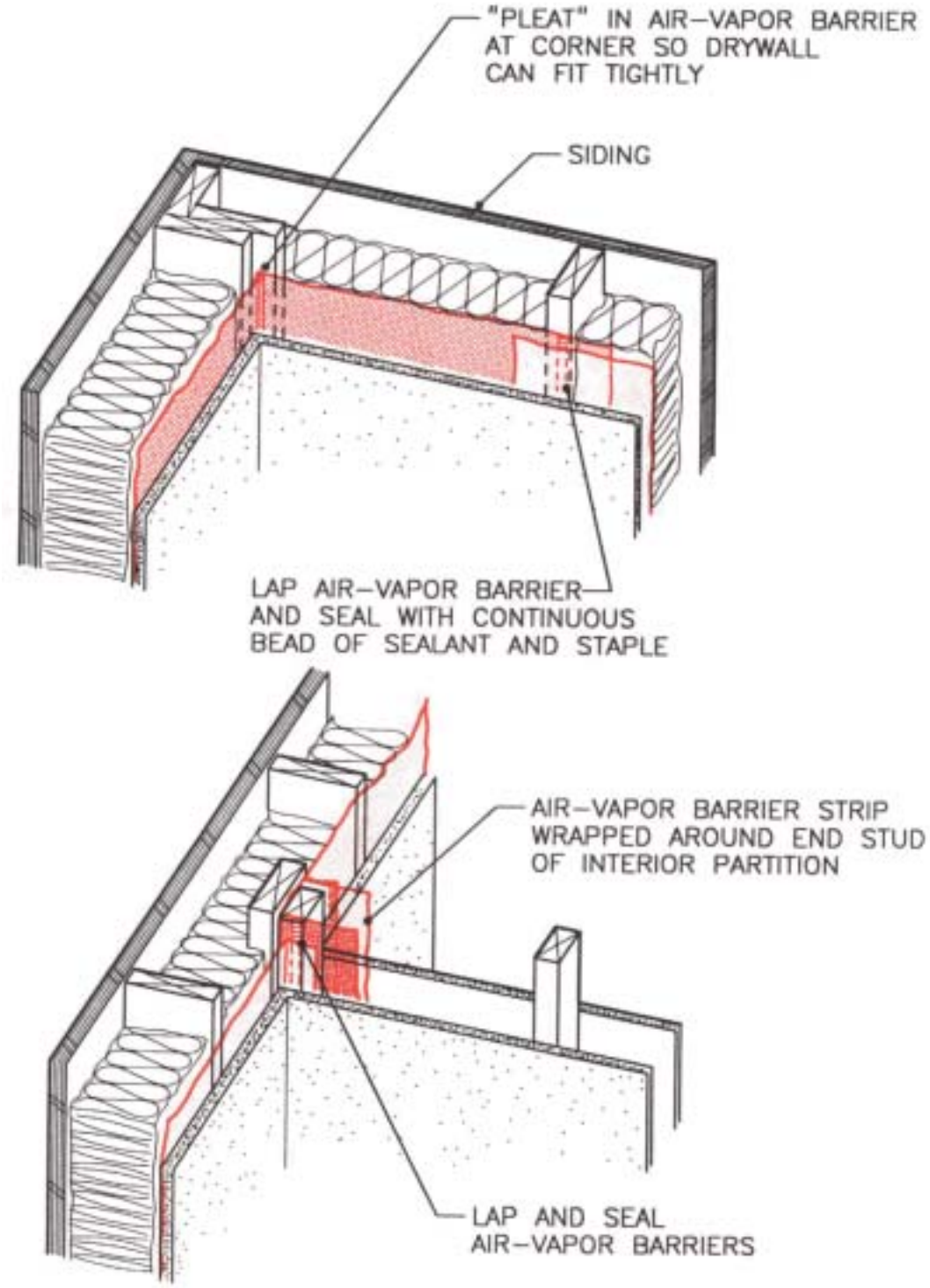
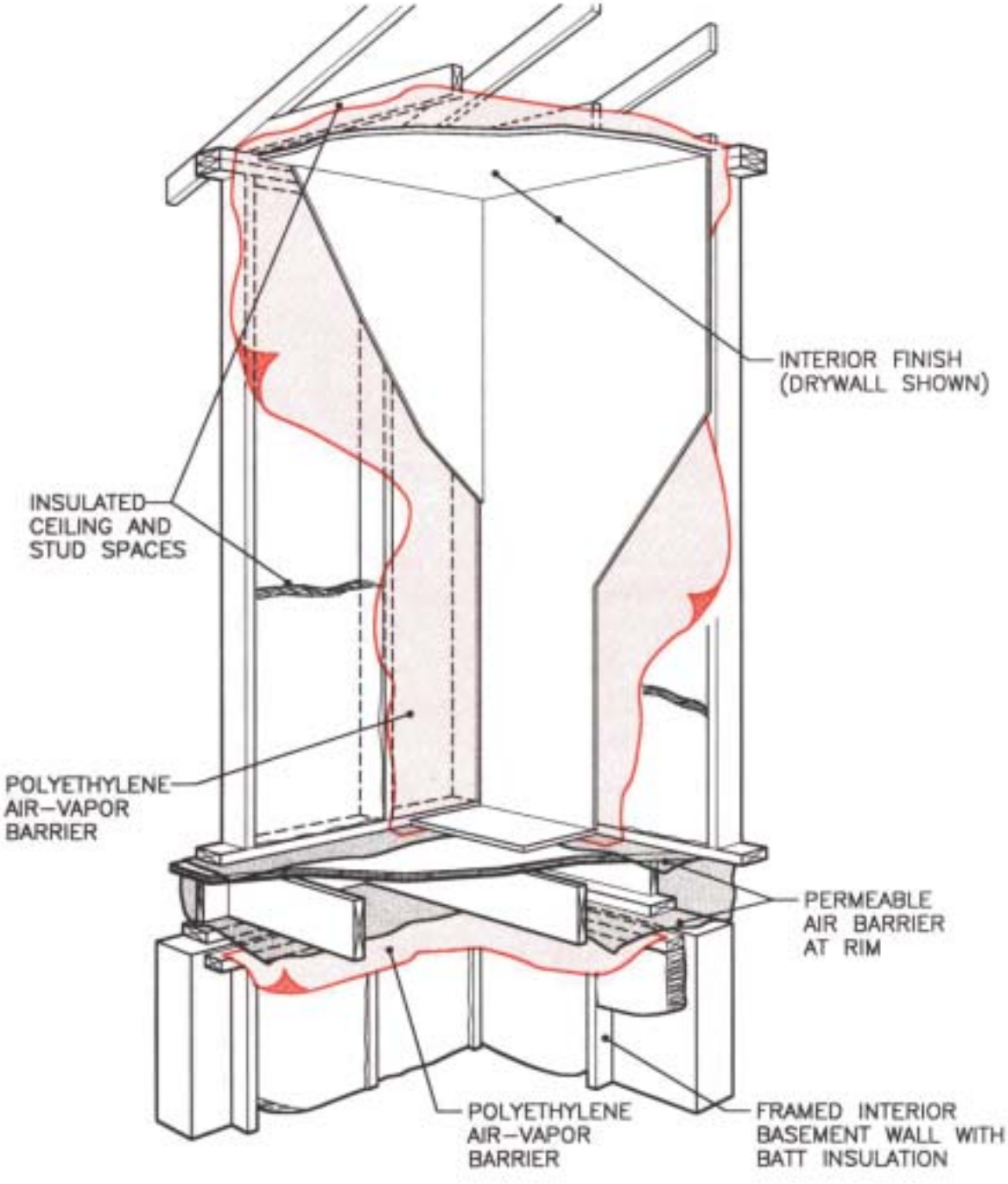


Figure 9I
POLY AIR BARRIER CONNECTIONS AT RIMS, CORNERS, AND CEILINGS



Carefully make cutouts at switch and outlet boxes and carefully stretch the poly around the box. Make the cutout slightly smaller than the box dimensions for a tighter connection. Some people tape the poly to the sides of the boxes for a complete seal.

Make cutouts at window and door rough openings, and lap trimmed poly into the rough opening. Later, the window wrap material will be sealed to the poly lap and to the window frame. See Figure 9J.

The air/vapor barrier is now continuous over ceiling and wall surfaces. Lapping and sealing the poly to a continuous floor air barrier completes the package.

A Warning About Poly Ceiling Air/Vapor Barriers

Once poly is in place, the normal practice is to begin drywall installation. Drywall is hung, taped, and textured. When the drywall contractor finishes, the insulation contractor comes back and insulates the attic.

IF YOU USE POLY IN THE CEILING, YOU MUST INSULATE THE CEILING BEFORE TAPING AND TEXTURING BEGIN. If the ceiling is not insulated, the poly vapor retarder will be cold. In cold weather, moisture released into the building during taping and texturing may reach its dew point at the ceiling. The uninsulated ceiling may actually become wet enough to fall down.

Insulating prior to taping and texturing keeps the poly vapor retarder warm. Released moisture will not reach the dew point in the ceiling, and you will not find the ceiling lying on the floor.

INTERIOR RIGID FOAM AIR BARRIER

To achieve a high wall R-value, you may need to apply rigid foam sheets over the wall framing in addition to the cavity insulation. If foam sheathing is applied to the interior surface of a wall, a few extra steps can create a continuous wall air barrier. The Advanced Air Leakage Control package is complete when the wall air barrier is finally connected to the floor and ceiling air barrier.

Blue, green, pink, and foil-faced foams have a perm rating of about 1. These materials can double as vapor retarders. White bead board typically has a perm rating of 2 or higher. It is not an acceptable vapor retarder. Figure 9K illustrates the rigid foam air barrier.

Special Framing Details

Interior rigid foam systems require special framing details at corners, partitions, and ceilings to provide the extra wide backing needed for a thicker wall finish. Attach nailers around openings and at corners to provide secure nailing for the drywall corner beads. See Figure 9L.

Figure 9J
POLY AIR BARRIER AT WINDOW ROUGH OPENING

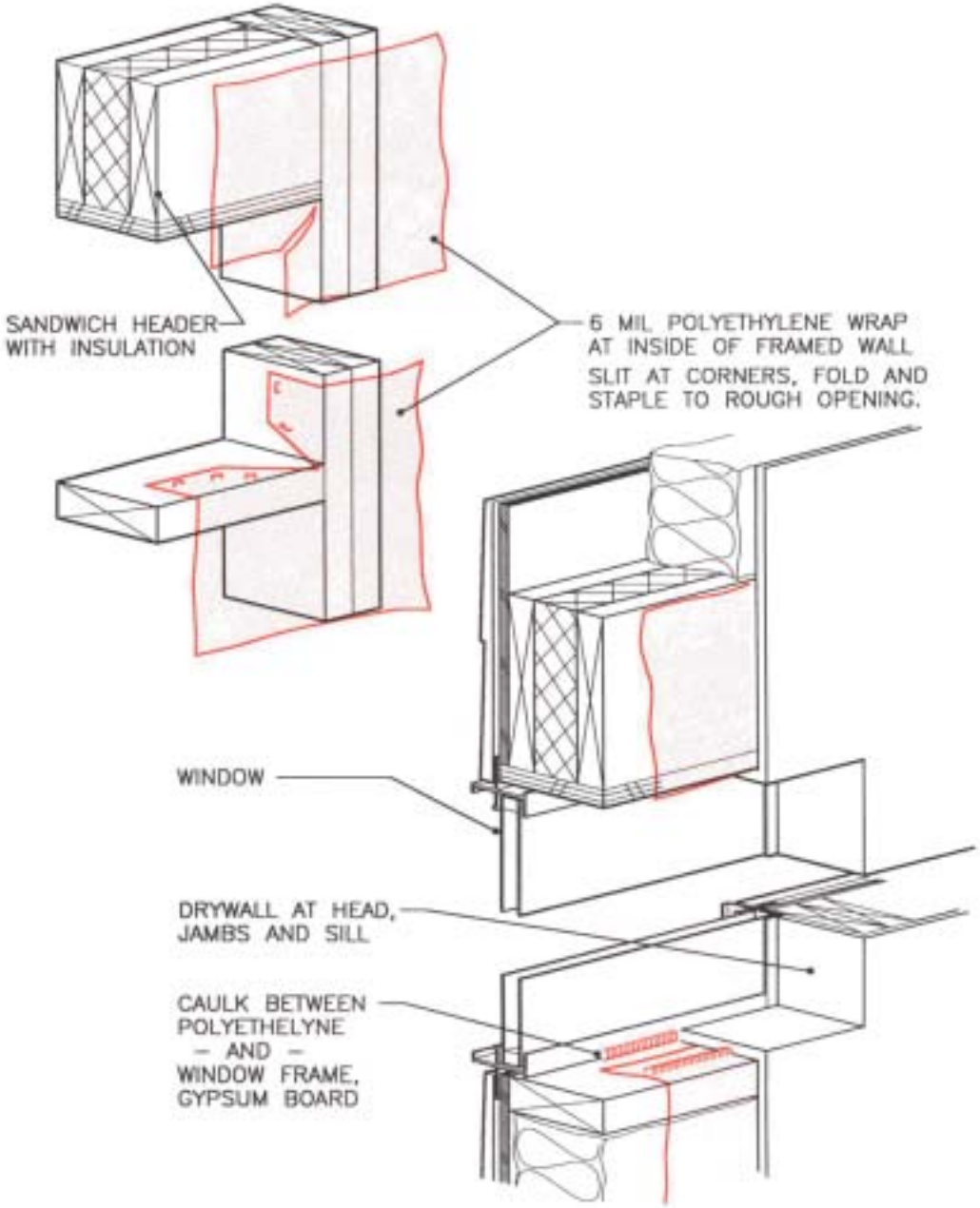


Figure 9K
INTERIOR RIGID FOAM AIR BARRIER

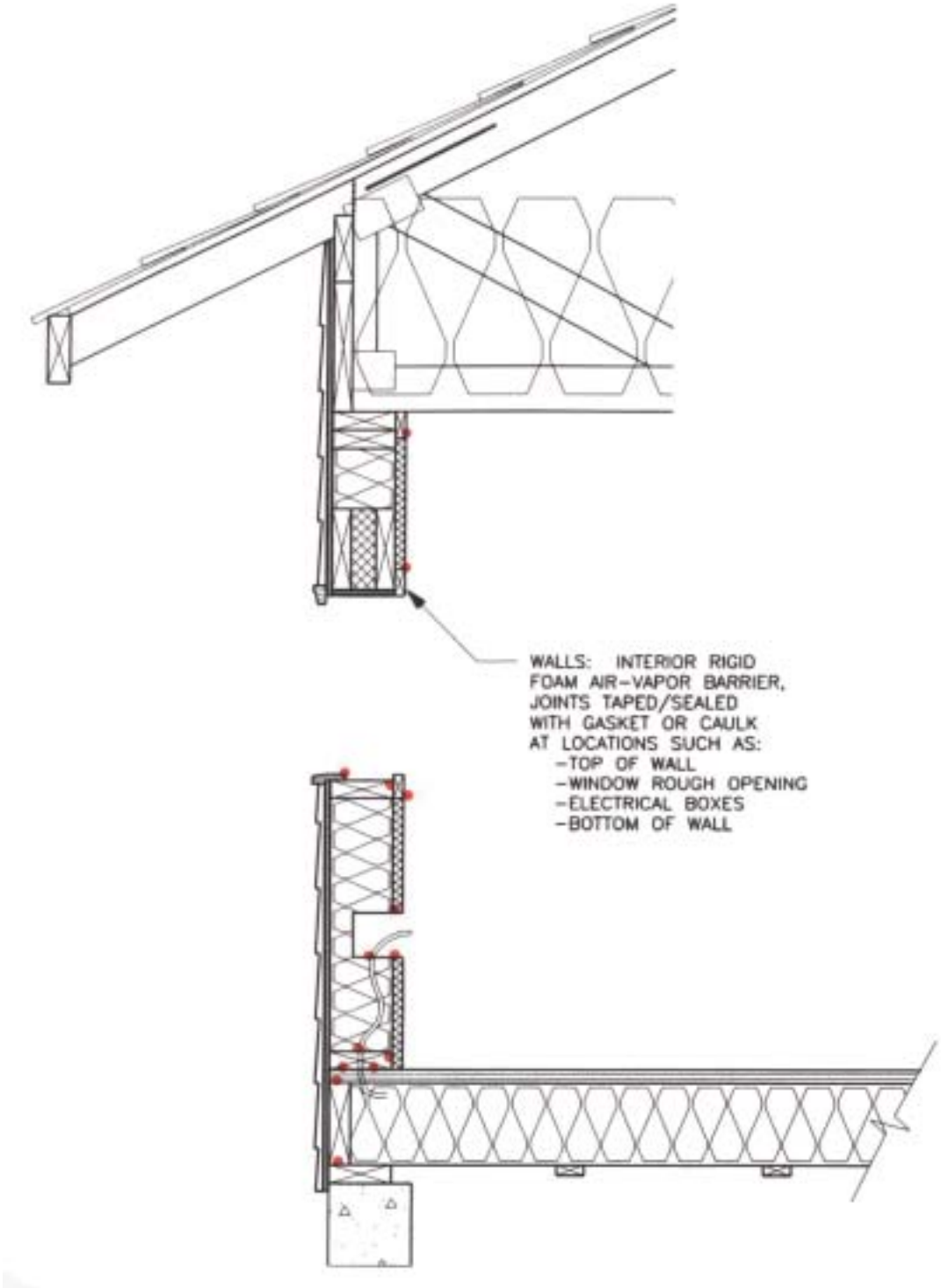
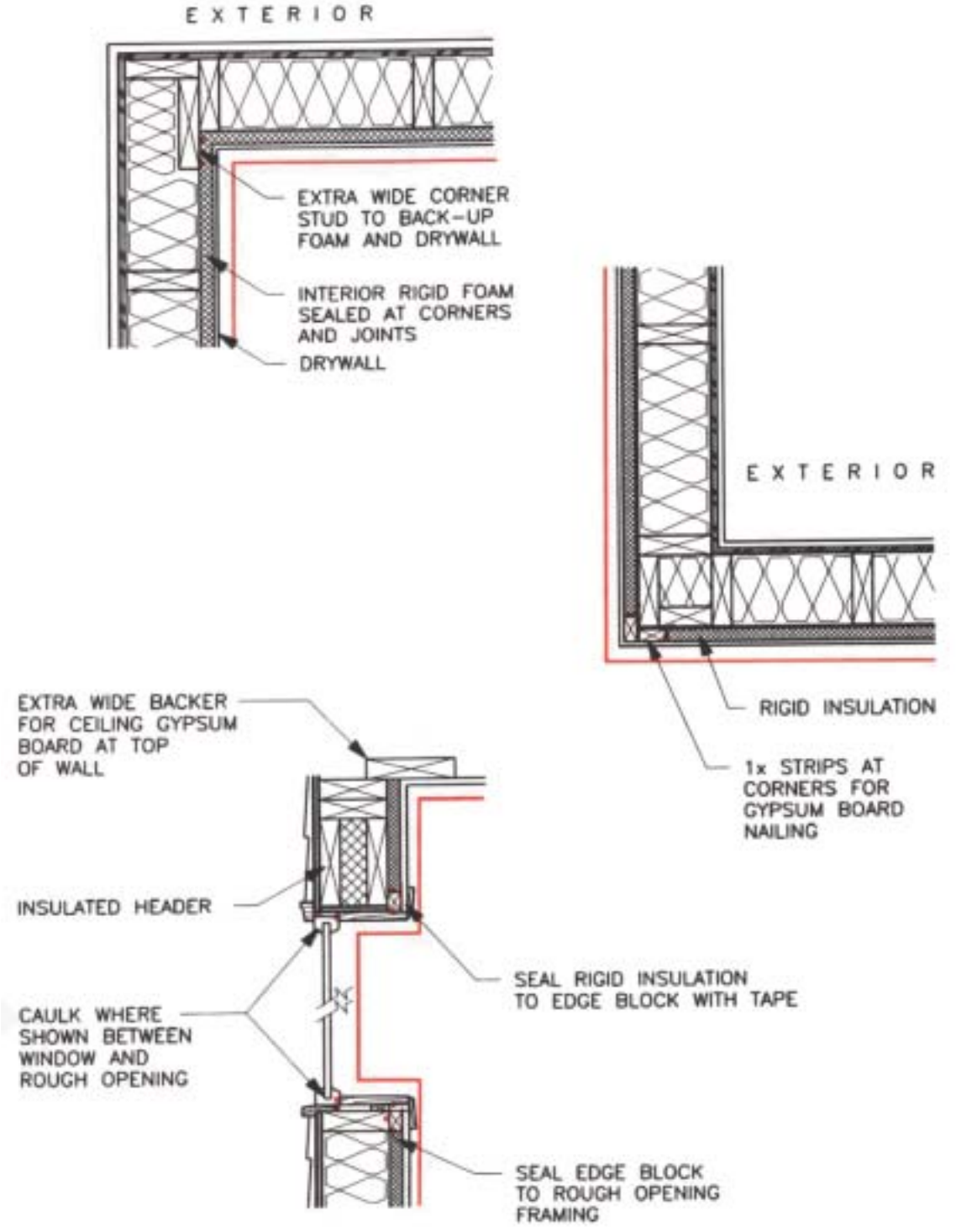


Figure 9L
INTERIOR RIGID FOAM FRAMING DETAILS



Special Electrical Box Adjustment

Let your electrical contractor know that you are using interior rigid foam. That way switch and outlet boxes can be set at the appropriate finish wall depth.

Other Effects of Thicker Interior Wall Cover

The thicker interior wall cover affects width of door jambs and window surrounds. It also may affect overall cabinet dimensions and blocking details for cabinets, curtain rods and closet poles.

Installing Rigid Foam Sheets

Install foam board just like drywall. Mark stud spacing on the floor. Snap stud lines onto the face of the foam. This makes the drywall contractor's job easier.

Seal end joints to the frame with caulk. Tape horizontal and vertical joints in the field. Caulk the bottom edge to the floor. See Figures 9K and 9L.

GET RID OF MOISTURE

The air barrier/vapor retarder systems discussed in this guide are so effective that high levels of humidity occur in the finish stages of construction, during drywall and painting. Natural air change rates are low. Open windows and use fans to move moisture out of the home.

Portable propane and fuel oil heaters release moisture during the combustion process. They are poor choices for drying homes with continuous air barriers. Electric heaters and large-capacity dehumidifiers remove moisture faster.

AIR BARRIER CONTINUITY AT DIFFICULT CONSTRUCTION JOINTS

Figures 9M through 9S show ways to maintain air barrier continuity at some of the more difficult construction joints.

Figure 9M
FLOOR SHEATHING AIR BARRIER

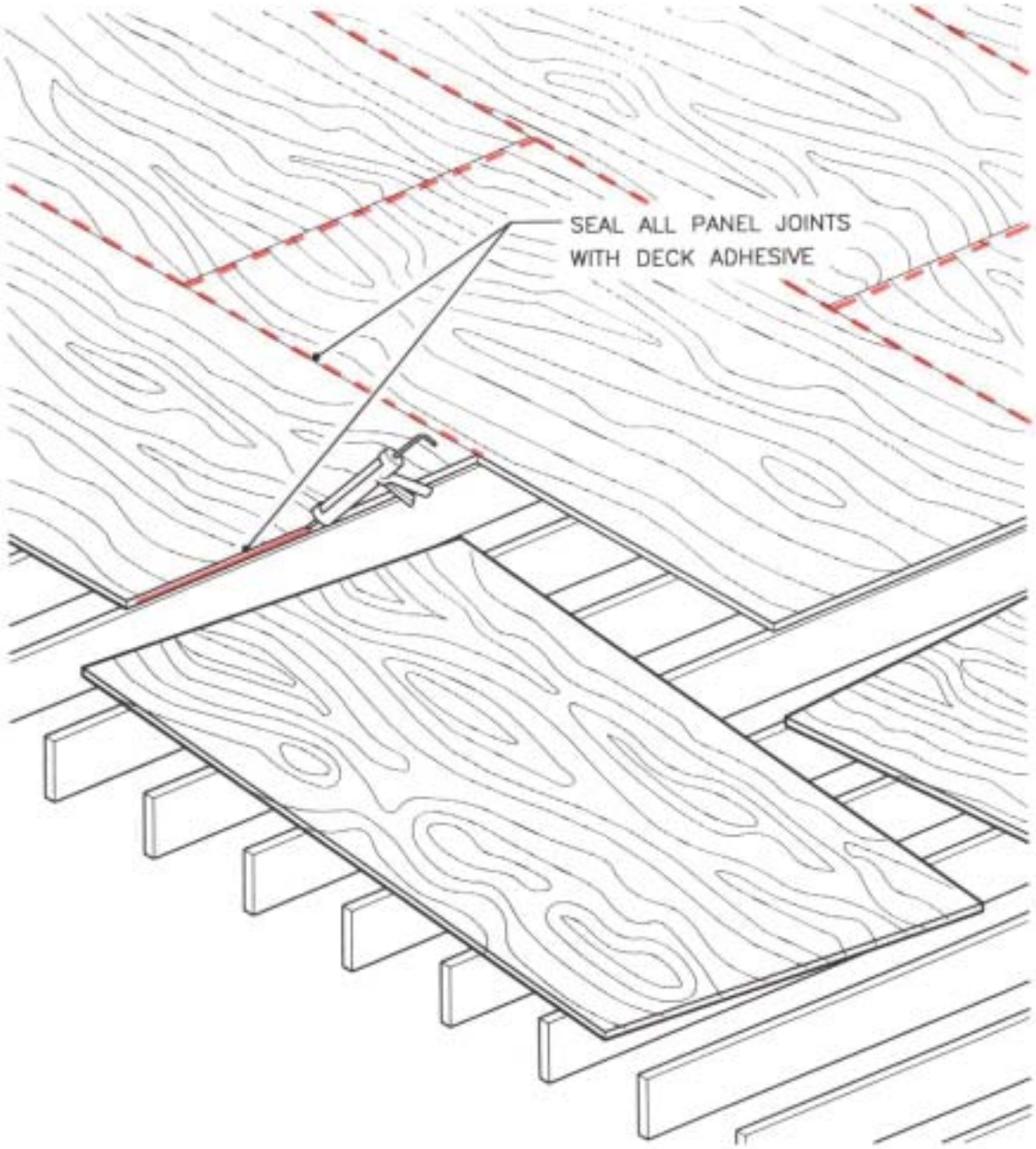


Figure 9N
POST AND BEAM DECKING FLOOR AIR BARRIER

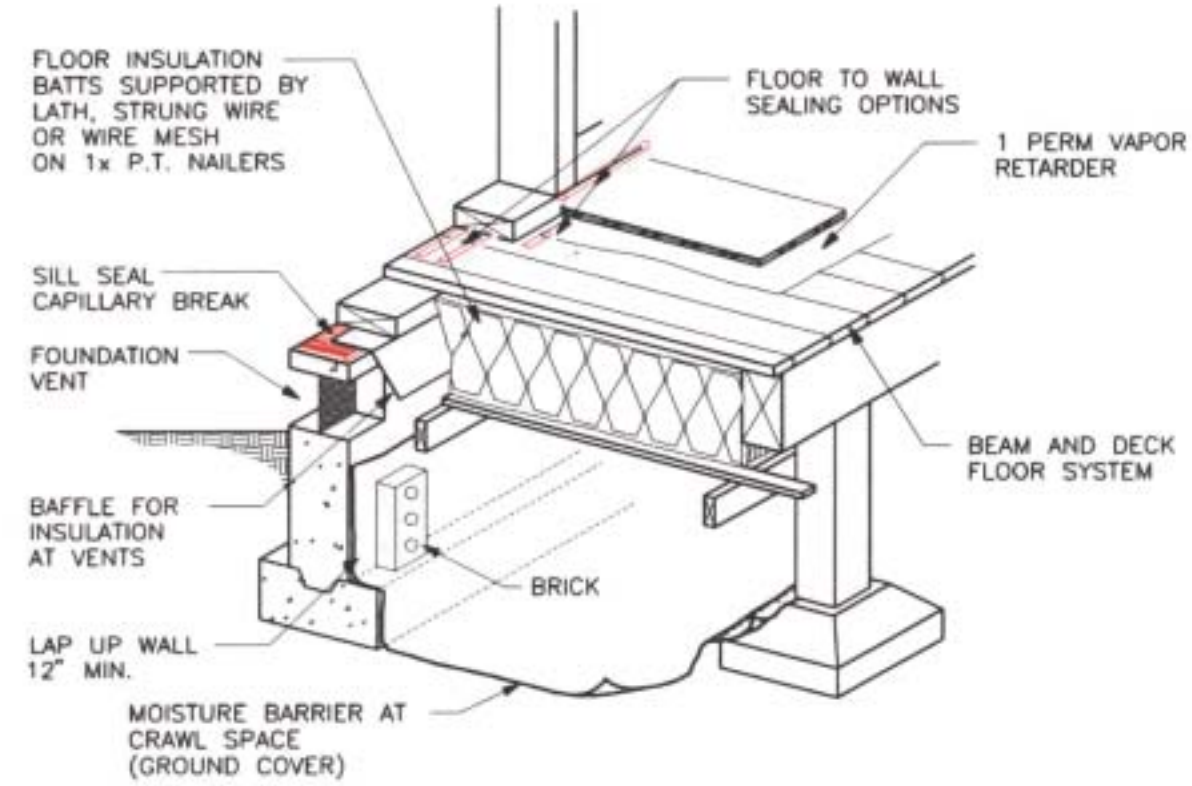


Figure 9O
BASEMENT RIM AIR BARRIER

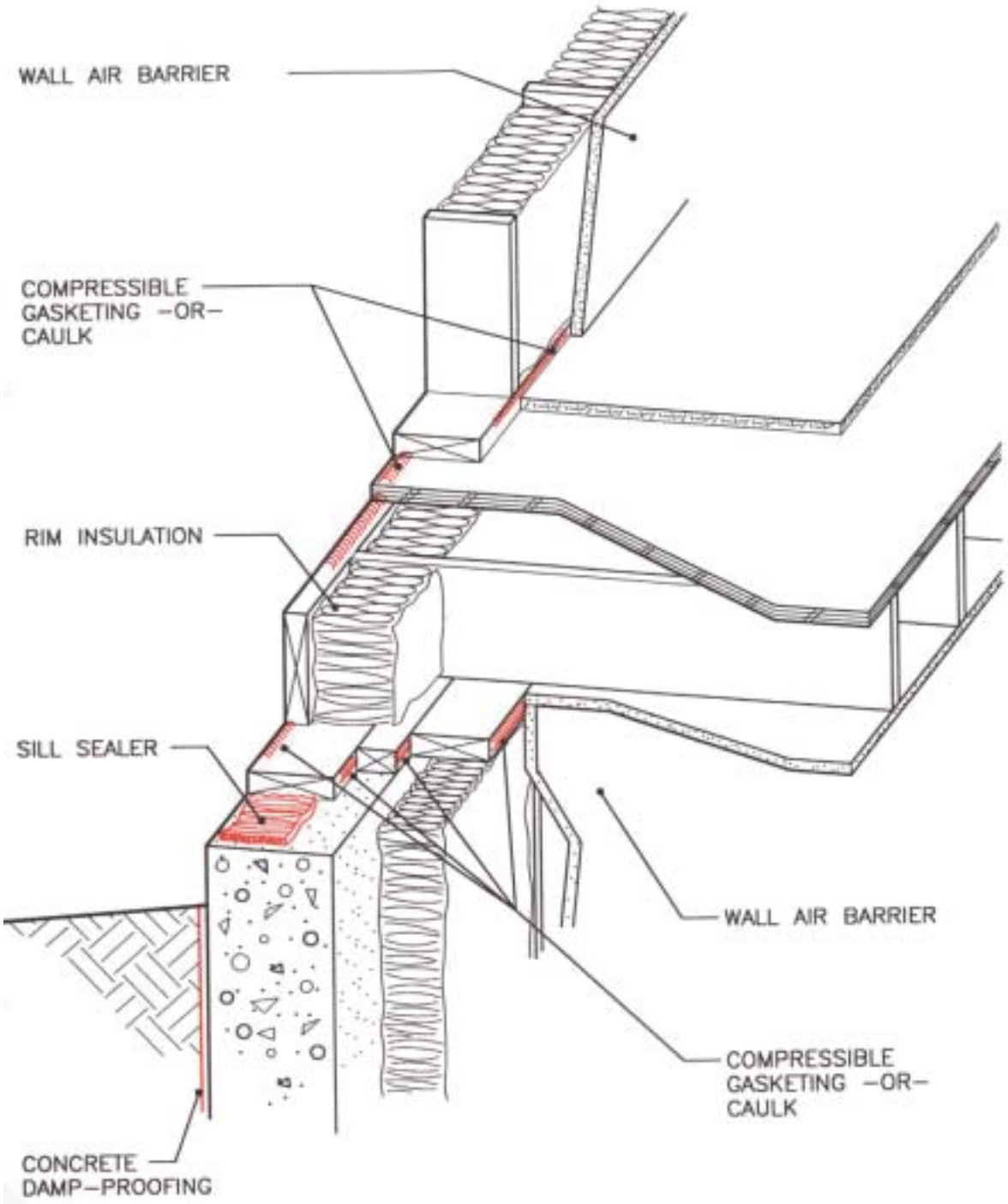


Figure 9P
RIM JOIST AIR BARRIER

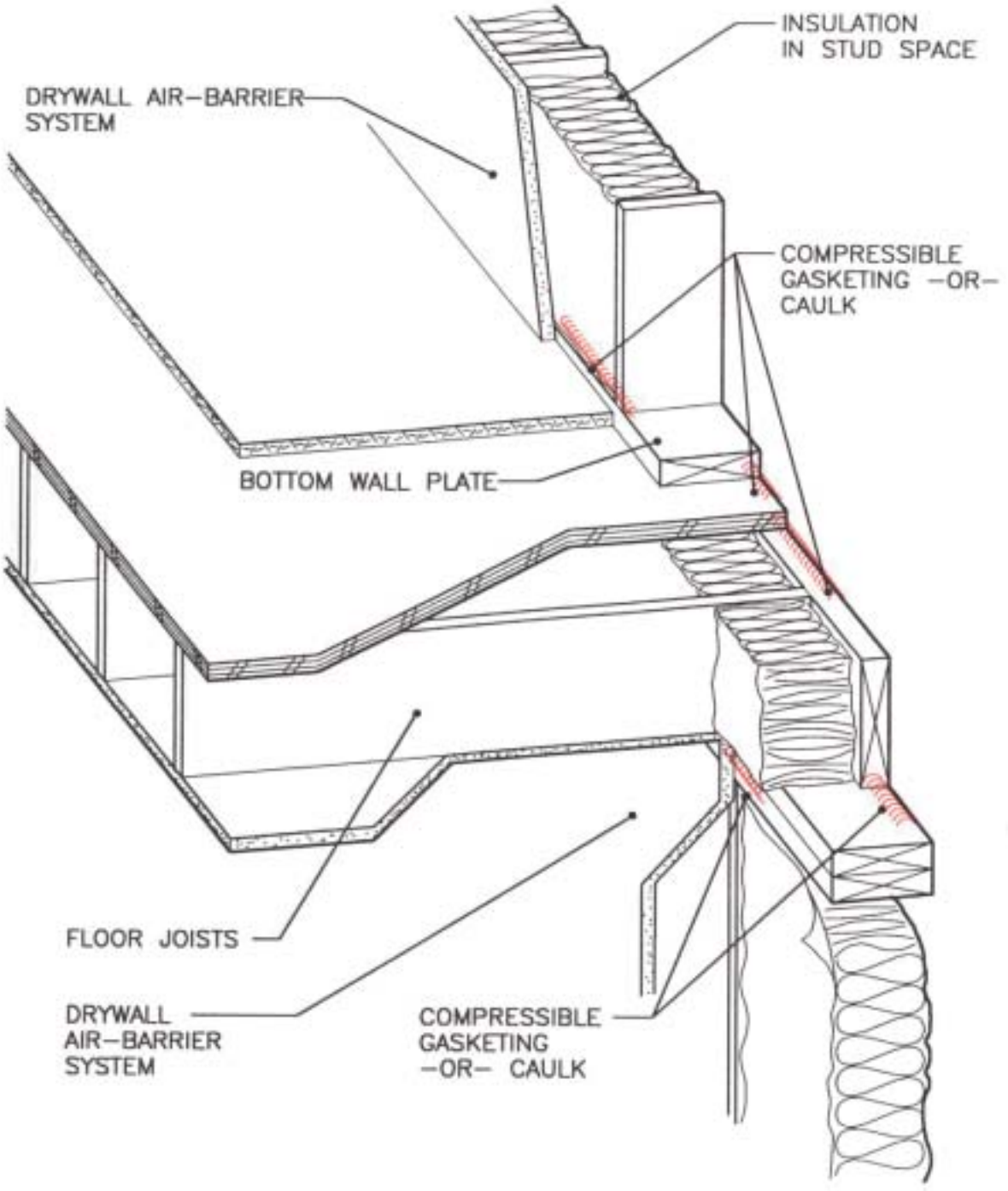


Figure 9Q
OPEN BEAM CEILING AIR BARRIER

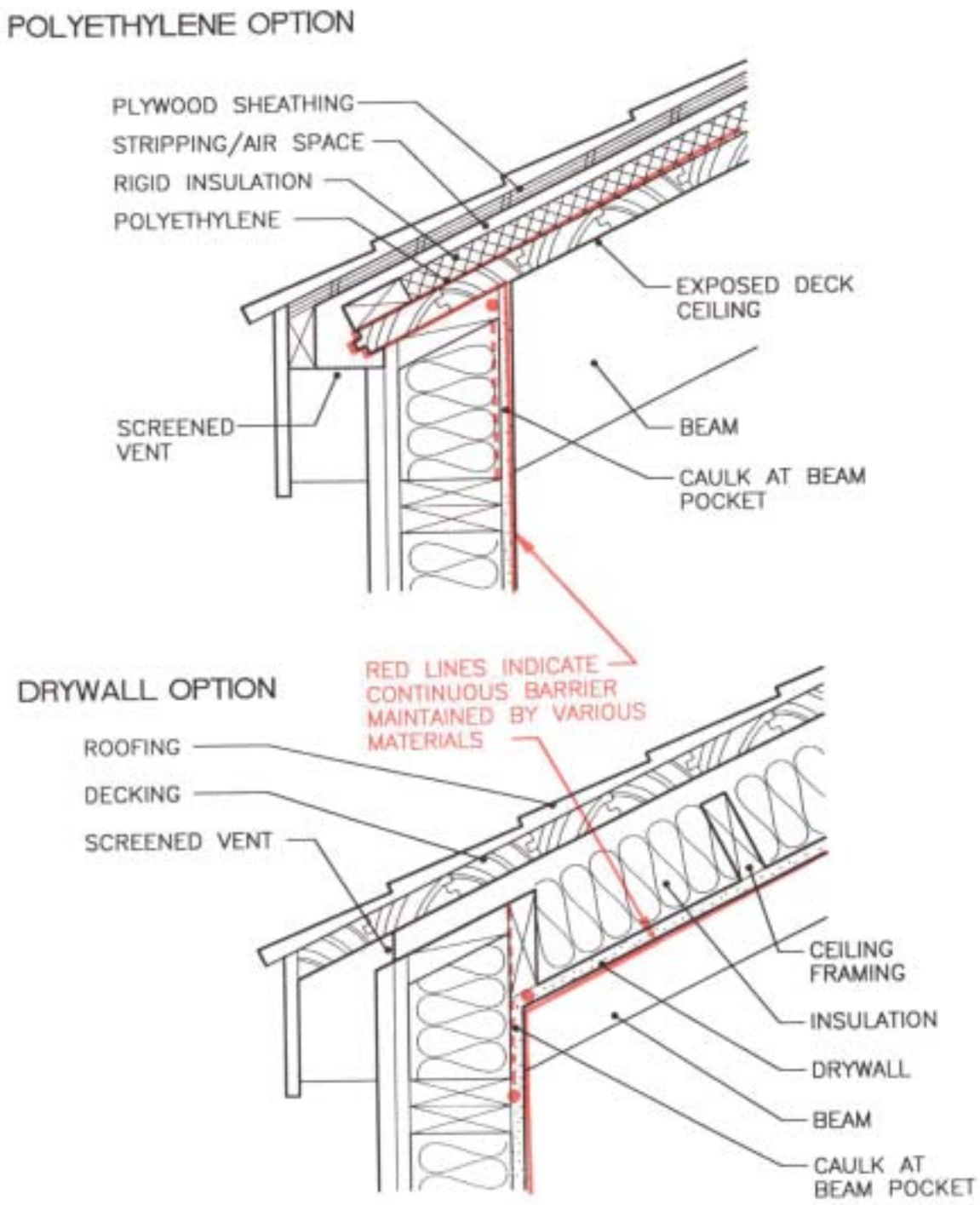


Figure 9R
WINDOW AIR BARRIER CONNECTION

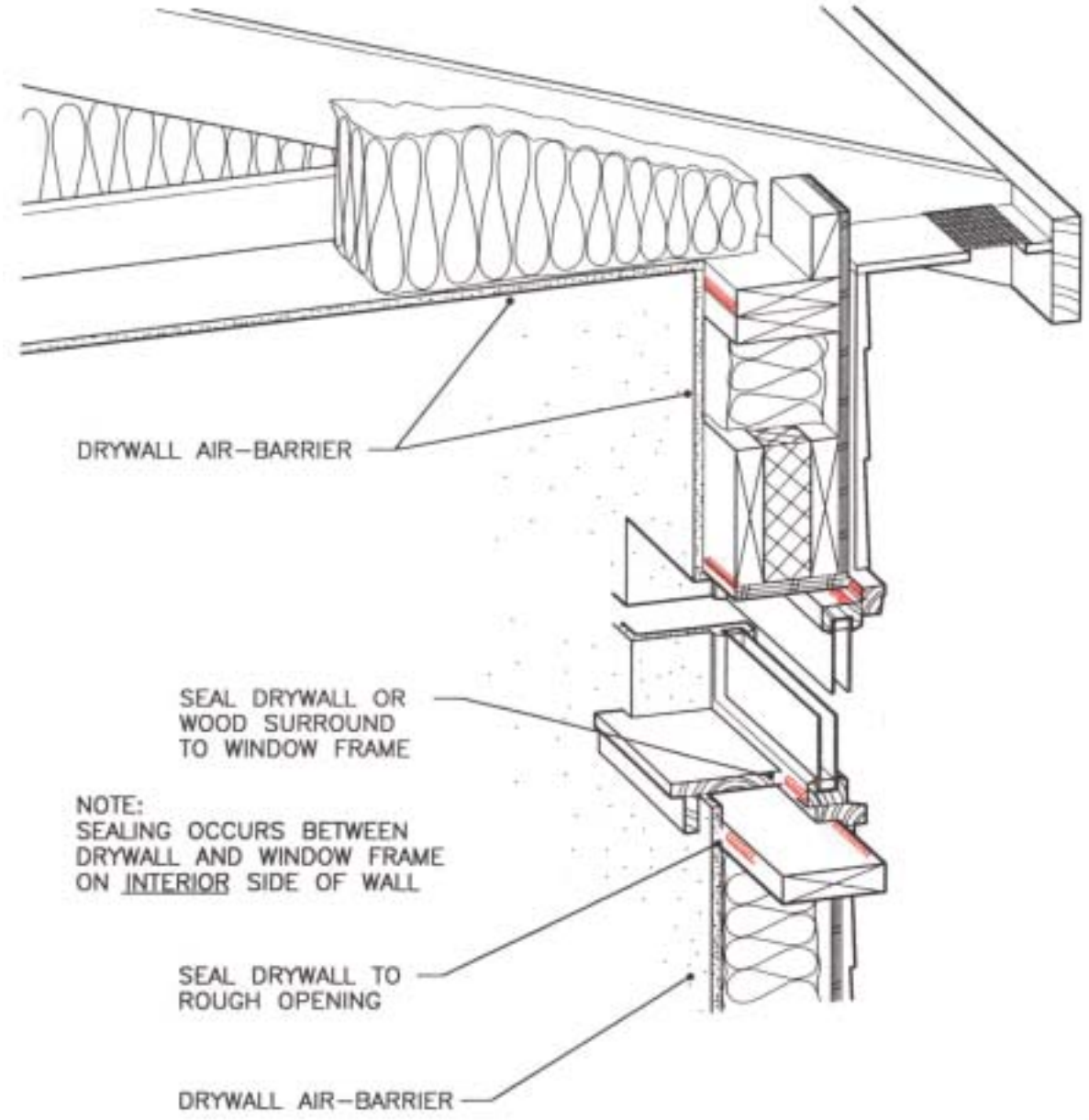


Figure 9S
CEILING/WALL/FLOOR AIR BARRIER CONNECTIONS