Chapter 5: Air Leakage and Moisture Control

[502.1.6] **Vapor Retarders.** A vapor retarder is a material placed to minimize vapor movement through the diffusion process. Types of vapor retarders include:

- Kraft paper or foil facings on insulation.
- 4-mil or thicker polyethylene.
- Vapor retarder rated paint.

To meet Code, vapor retarders need to be rated at 1 perm dry cup or less. This is a rating of how permeable to vapor movement a given material is (see Table 5-1 for perm ratings).

Components of the house requiring a vapor retarder are:

- Floors between heated and unheated spaces.
- Walls – on the inside (warm side in winter).
- Ceilings averaging less than 12 inches of ventilated area above the insulation.

[502.1.6.2.] **Floors.** Floors that separate a heated from an unheated space are required to have an installed vapor retarder. Sometimes the floor decking itself meets the perm rating and qualifies as a vapor retarder. Three-quarters inch (3/4") tongue-and-groove exterior plywood and exterior grade OSB both meet the vapor retarder requirements. Floors with obvious gaps and holes call for a vapor retarder such as polyethylene or 15 lb. felt paper.

[502.1.6.6] **Walls.** All walls separating heated from unheated spaces must have a vapor retarder. Vapor retarders need to be installed on the inside of the wall, or the warm side in the winter.

[502.1.6.3] **Ceilings.** All roof/ceiling assemblies must have an installed vapor retarder when the ventilation space averages less than 12 inches. This is an average amount of ventilation space from the top of the insulation to the underside of the roof sheathing.

Table 5-1

Permeance Values for Common Building Materials*

Materials	Permeance
Polyethylene (4 mil)	0.08
Latex Primer/Sealer	6.28
Vapor Retarder Paint	0.45
Polyvinyl Acetate Latex (PVA)	5.5
Kraft Paper (Asphalt Impregnated)	0.03
15 lb. Asphalt Felt Paper	1.0
Gypsum Wall Board (3/8″)	50
Plywood (1/4″ with exterior glue)	0.7

*2005 ASHRAE Handbook of Fundamentals

Materials must be applied in accordance with manufacturer's instructions to achieve specified permeance ratings.

Air leakage control is an important but commonly misunderstood component of the energy efficient house. Tightening the structure with caulking and sealants has several positive impacts. A tight house will:

- Have lower heating bills due to less heat loss.
- Have fewer drafts and be more comfortable.
- Reduce the chance of mold and rot because moisture can't enter and become trapped in cavities.
- Have a better performing ventilation system.

Critical Areas for Air Leakage Control

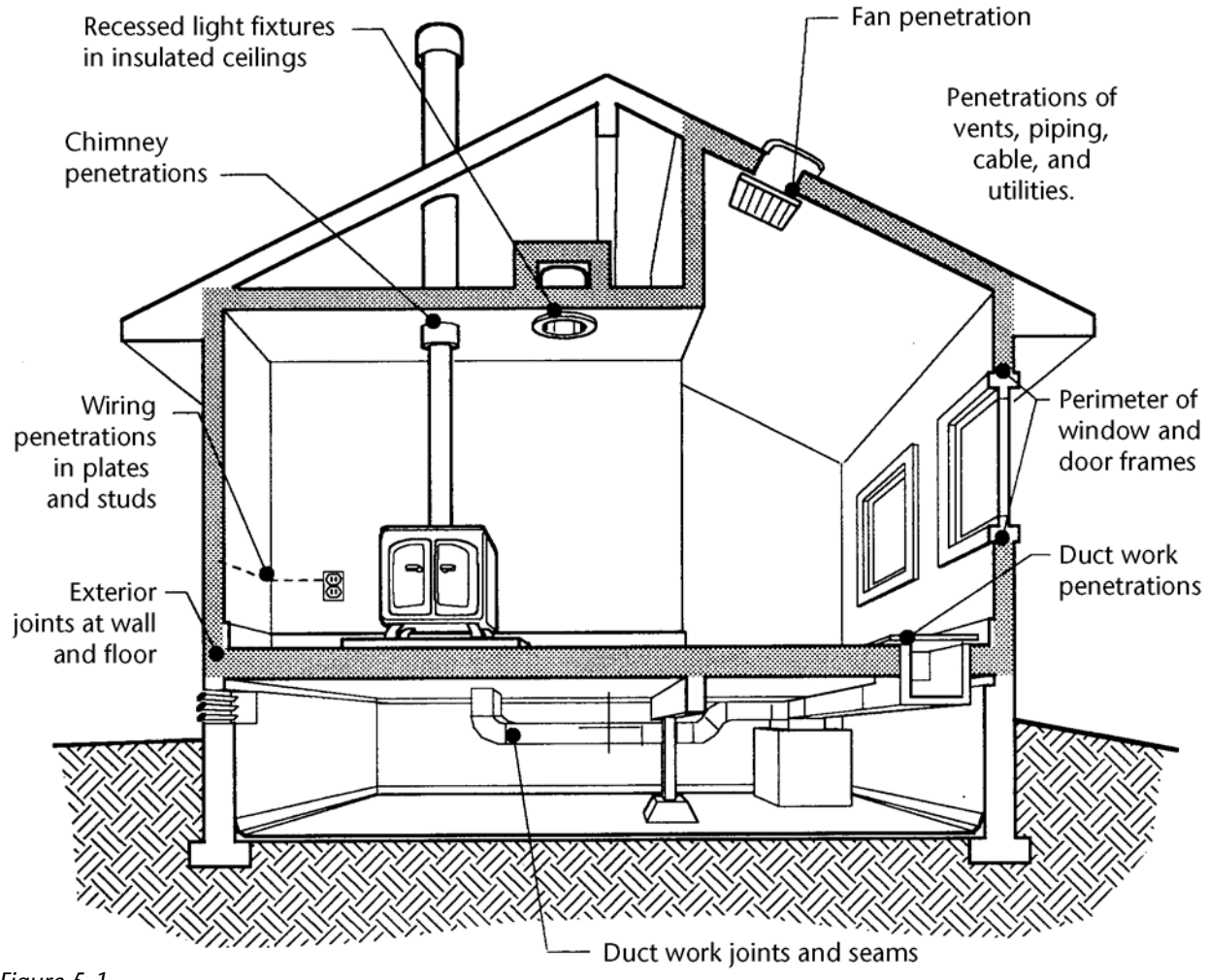

Figure 5-1

[502.4.1] WSEC states specific locations in buildings requiring sealing. Air leakage must be controlled where outdoor ambient conditions are separated from interior spaces that are heated or mechanically cooled (see Figure 5-2).

The type of sealing material used varies with the size of the gap. For example:

- Caulk and low expansion foam should be used for small holes and cracks (less than 1/8" [one-eighth]).
- A combination of caulking and backer rod (foam rope) should be used for wider gaps (greater than 1/8" [one-eighth]).
- Polyethylene, rubber, or neoprene material should be used for large openings (greater than 1").

Window Sealing

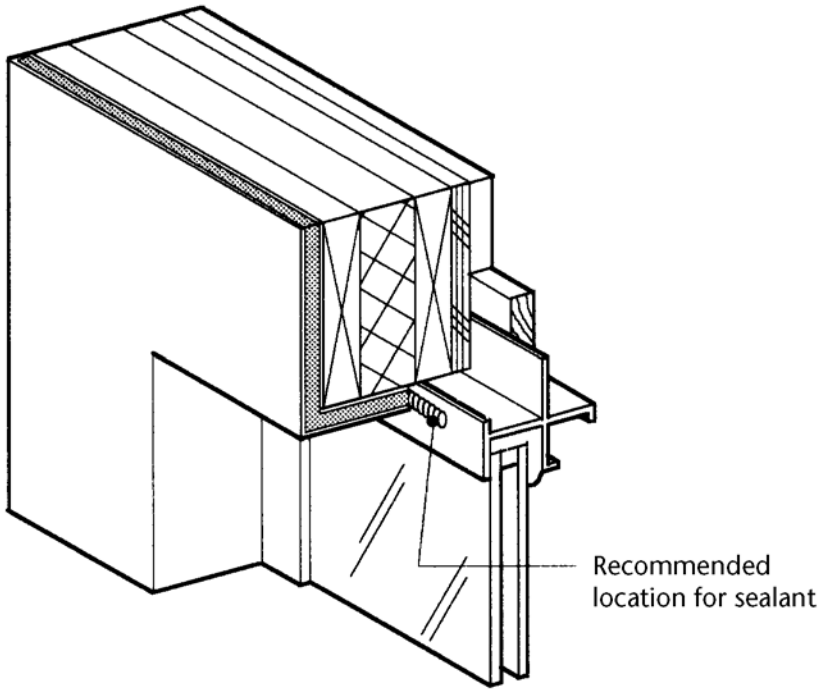

Figure 5-2

Fiberglass, loose cellulose, and rockwool insulation are not suitable air sealing materials; they do not stop air movement.

[502.4.3] **Windows and Doors.** All windows and doors in exterior walls must be sealed between the frame and the rough opening framing material (see Figure 5-2).

Wiring and Plumbing Penetrations. Holes drilled in top and bottom plates (between heated and unheated spaces) need to be sealed. Plumbing penetrations often leave large holes requiring sealing (see Figure 5-3).

Plumbing Bypass

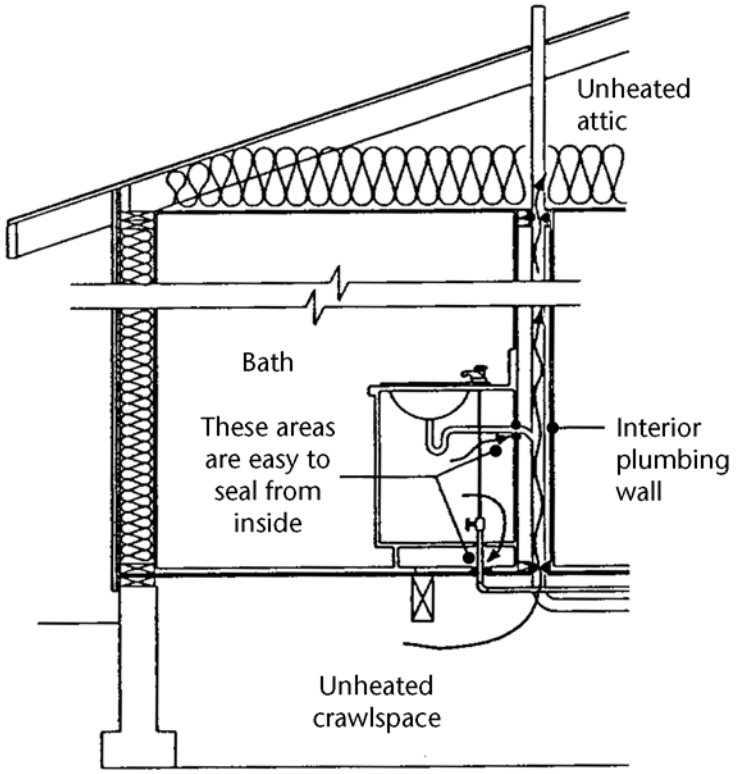

Figure 5-3

[502.4.3] Drain traps penetrating floors over unconditioned spaces are often overlooked, but must be sealed (see Figure 5-4).

Holes drilled where interior and exterior walls intersect also need to be sealed.

Electrical boxes are considered holes in the envelope and call for sealing. A typical sealing technique is to caulk where the wire enters the box. Make sure that a latex or non-petroleum based caulk is used. A silicone type caulk may corrode the insulation on the wiring and expose the wire.

Gasket at Tub Penetration

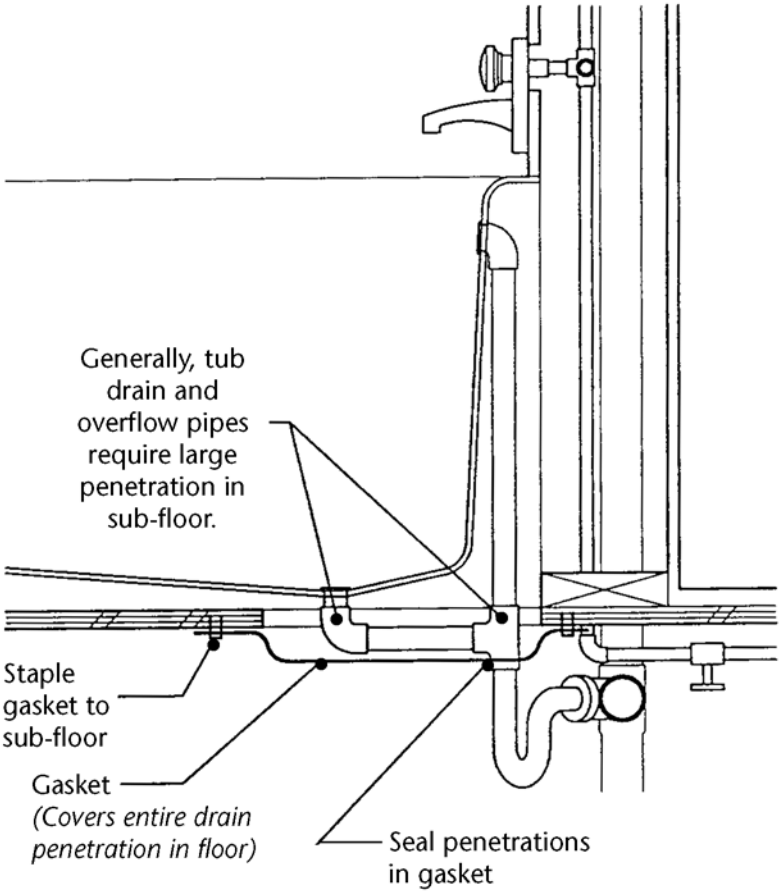

Figure 5-4

Outlet and switchplate gaskets are always recommended, but should always be installed if there are gaps between the box and wallboard.

Recessed Lighting Fixtures. Leaky recessed lighting fixtures, when installed in the building envelope, can be a major source of heat loss and moisture movement. WSEC does not limit the number of recessed lights that can be installed, but does give specific installation specifications.

[502.4.4] To meet Code, a recessed fixture must be IC-rated (insulation cover) and installed in a way that limits air leakage (see Figure 5-5):

- Type IC rated, tested using ASTM E283 method. Certified and labeled to meet the WSEC air leakage requirements.

> **Note:** Many recessed lighting fixtures only meet the air sealing requirement when a specific trim kit is used. Check with your supplier for details.

Recessed Lighting Fixtures

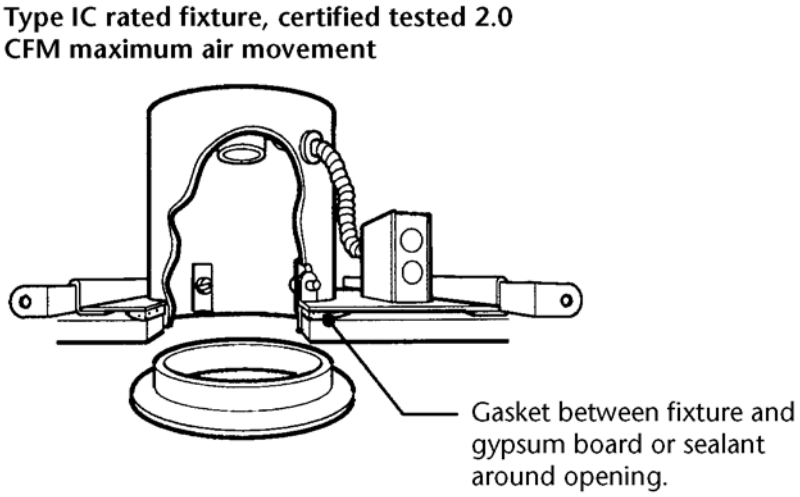

Figure 5-5

[502.4.3a] **Other Building Penetrations.** Additional areas of potential air leakage that require sealing are:

- **Sole Plates.** Sealing sole plates to subfloors is commonly done after the house is framed and dried in. The caulking is applied at the point where the sole plate meets the subflooring. This method works well because the caulk can be applied to a clean, dry surface for a better bond and the building inspector can easily see that it has been done.

  Alternative methods are to seal the sole plate on the bottom when it is erected or by using a plate gasket product (see Chapter 3, Figures 3-2 and 3-3).

- **Rim Joists.** Rim joists between floors can be sealed either on the interior side with caulking or on the exterior side. Exterior sealing approach requires sealing the house wrap at the rim joist to create an air barrier.

- **Mud Sills.** These are treated the same as sole plates. Mud sills are usually placed on a sill sealer that stops both air leakage and moisture wicking.

- **Flues.** Chimney penetrations are typically sealed where the support or collar meets the ceiling. Observe all fire rating restrictions.