# 7

# Framing

## Energy Code Requirements

- **R-values of insulation**—The R-values determined from your compliance analysis can affect the dimensions of framing lumber you use. For example, an R-19 wall would often be built with 2x6 wall studs. However, there is almost always an alternative. For example, an R-19 wall can also be built with 2x4 studs, R-13 insulation and 1.5" of polystyrene foam board (R-6).
- **Air sealing details**—Most air sealing details can be carried out at any point up until the insulation and drywall are installed. However, many are much easier to implement during framing. Some of these critical details include band joist/sill areas, housewrap details (if housewrap is used as an air barrier), dropped soffit areas, draftstop blocking between wall and roof or wall and floor assemblies, etc. Detail drawings showing appropriate air sealing of these areas are shown in Figures 7.1, 7.2, 7.8, and 7.11-7.18.
- **Raised truss construction** or equivalent roof framing. This type of construction gives you some credit in the code compliance analysis, and also performs better. Examples of raised truss equivalents are shown in Figures 12.5-12.8.

## ENERGY STAR

To meet the ENERGY STAR rating, you may need slightly more insulation R-value in the walls or ceiling than you would just to meet the code, and you may have to pay more attention to the air sealing details as well. However, there are some techniques you can use to help pay for these upgrades without compromising the structure of the building. Here are some suggestions:

- Use details that need less wood and leave more room for insulation, at exterior wall corners, partition wall intersections, headers, and the like. See Figures 7.4-7.7. EEBA has a section on framing with detail drawings showing additional options.

- Housewraps have been marketed for years as air barriers, but their primary purpose and benefit is as a drainage layer behind the exterior cladding. No siding and flashing system is completely waterproof, so a dependable drainage plane under sidings is needed in the New York climate. Appropriate counter-flashing details are critical, and a vented rain screen can provide the best performance for keeping water out of the building. Housewrap, properly installed and sealed with tape, can contribute slightly to the air tightness of a building, but does nothing to slow down air leakage in most large leaks, which are located in basements and attics.

  In addition, plastic housewraps may be incompatible with unprimed cedar and redwood, and with cement stucco materials; and perforated plastic housewraps have been shown to leak water much more rapidly than unperforated plastics or felt paper. Felt paper or building paper may be a good alternative as a drainage plane. EEBA has in-depth discussions about rain drainage planes and air flow retarder systems.
- Try to discuss HVAC layouts with mechanical subcontractors before framing. If you can adjust framing to allow space for ducts and pipes, layouts can be more efficient and less costly, and less damage will be done to the frame during installation. For example, if a long center wall in a two-story house is framed with 2x6 studs, duct risers can be easily installed for floor registers in the upper story. Be sure to align floor framing with wall studs. At the very least, be sure that adequate mechanical chases exist. This type of approach can save on duct installation costs. The EEBA *Builder's Guide* section on design has more ideas related to HVAC integration.
- Consider sealing air leaks in the exterior of the walls as well as the interior. Two air barriers are better than one air barrier. Exterior air barriers help keep cold out and help prevent wind-washing of the cavity insulation, and they are easy to install (see the EEBA section on air barriers).



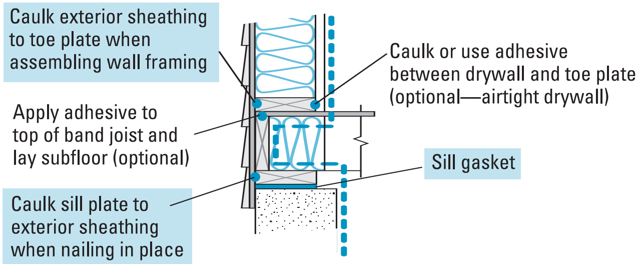
## Going Further

Use advanced framing techniques that allow you to use less wood in the frame of the building, leaving more room for insulation and more room in the budget (see Figures 7.9-7.10). You can choose to use some of these techniques and not others; but you do have to think about how to apply these details. For example, don't use single top plates unless you "stack" roof, wall and floor framing. Don't use a single stud at the rough opening unless you hold the header up with hangers rated for the load. When they are applied properly, these techniques meet codes and work well. For more detail on advanced framing (sometimes called "Optimum Value Engineering") see *Cost Effective Home Building: A Design and Construction Handbook* by NAHB (contact information in Appendix B).

Think about the ways in which framing affects the installation of an effective rain control system (roofing, siding, trim, flashing, etc.), and an effective water vapor control system (vapor retarders, roof ventilation, etc.). For example, roof framing has a direct impact on the effectiveness of various roof ventilation strategies. See EEBA for more on rain control, framing details for moisture control, insulation, sheathings and vapor diffusion retarders.

FIGURE 7.1

## Sealing band joists during framing



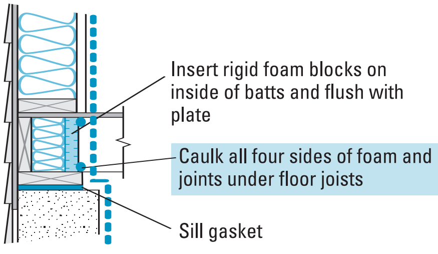

Remember to caulk or tape vertical seams between sheathing panels.



**TIP:** For better results, also use construction adhesive when setting the band joist on the sill.

FIGURE 7.2

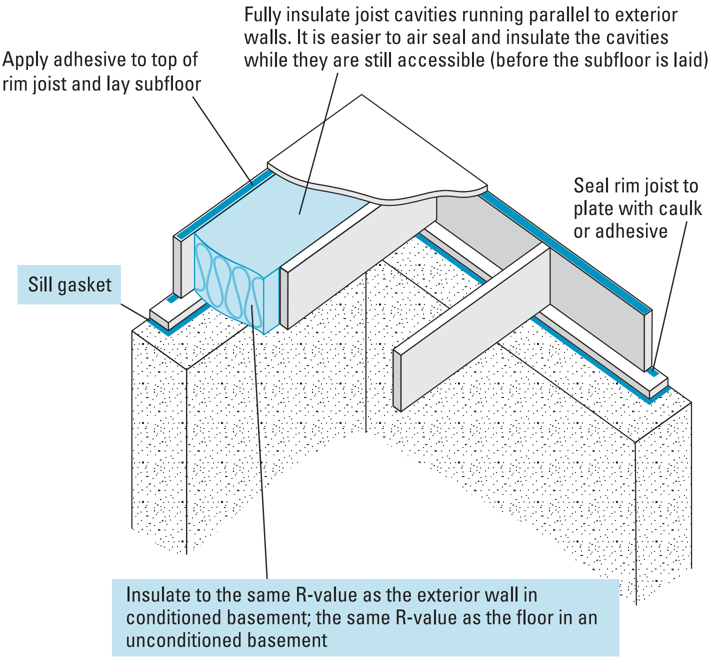
## Sealing band joists after framing (alternate method)




Sealing the band joist is easiest to do during framing, but if it is missed at that time, this technique works well also.

FIGURE 7.3

## Sealing and insulating band joists during framing

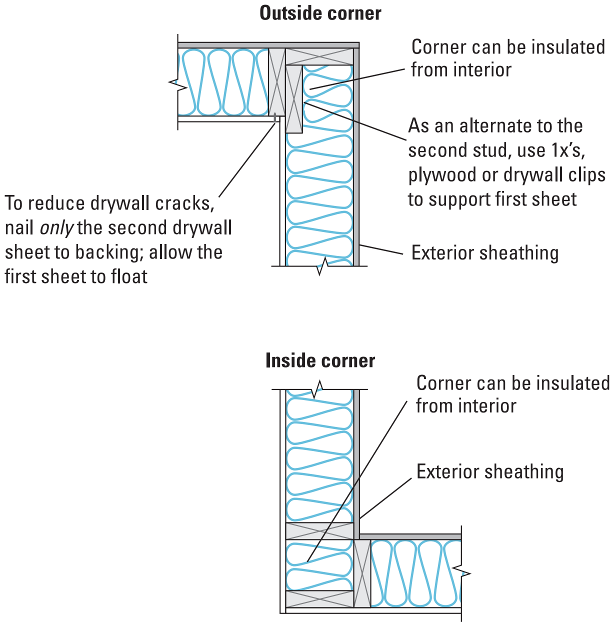



**TIP:** If you use a blown-in or sprayed insulation such as icynene, blown-in cellulose or fiberglass, or a similar system, this area can usually be insulated with the rest of the house.

Insulating the band joist after the floor sheathing is installed can be very difficult, depending on the joist layout. Care must be taken to keep insulation dry when installed during framing.

**FIGURE 7.4**

**Insulated three-stud corners**

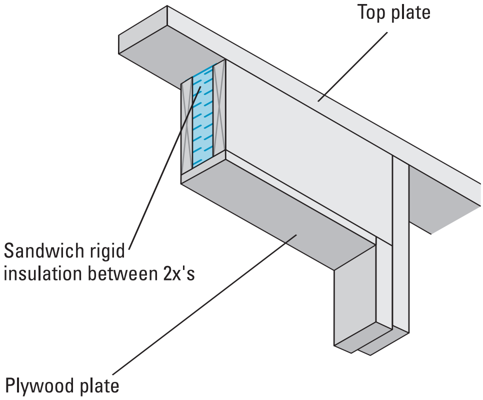





Conventionally framed corners are difficult to insulate and use more wood than insulated three-stud corners. For more savings and reduced drywall cracking, use clips for drywall backing at outside corners instead of the third stud.

**FIGURE 7.5**

**Insulated header in a 2x6 wall**

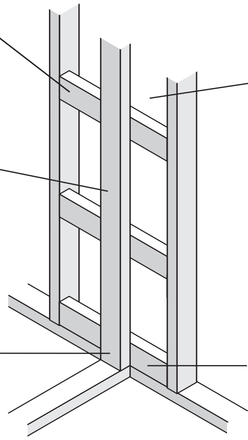



**TIP:** Use a few standard header sizes that will work in several locations. There is no need to size all headers equally.

As an alternative, insulated headers pre-manufactured from engineered wood I-beams and rigid foam may be used. Follow manufacturer's instructions regarding acceptable loading, span and support.

**FIGURE 7.6**

## Ladder blocking for interior partition walls

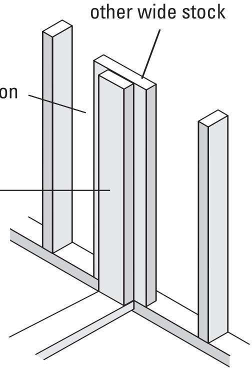





Conventional box channels for partition walls are difficult to insulate. Ladder blocking (or vertical backing, Figure 7.7) use less wood, are easier to insulate, and are easier for electricians as well. See Figure 11.3 for air sealing details.

**FIGURE 7.7**

## Drywall backing for interior partition walls




Vertical nailing stock can also be replaced by drywall clips to support drywall.

FIGURE 7.8

## Cavity sealing example: chase on exterior wall

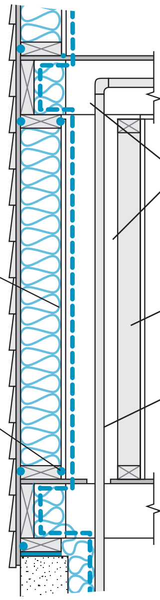
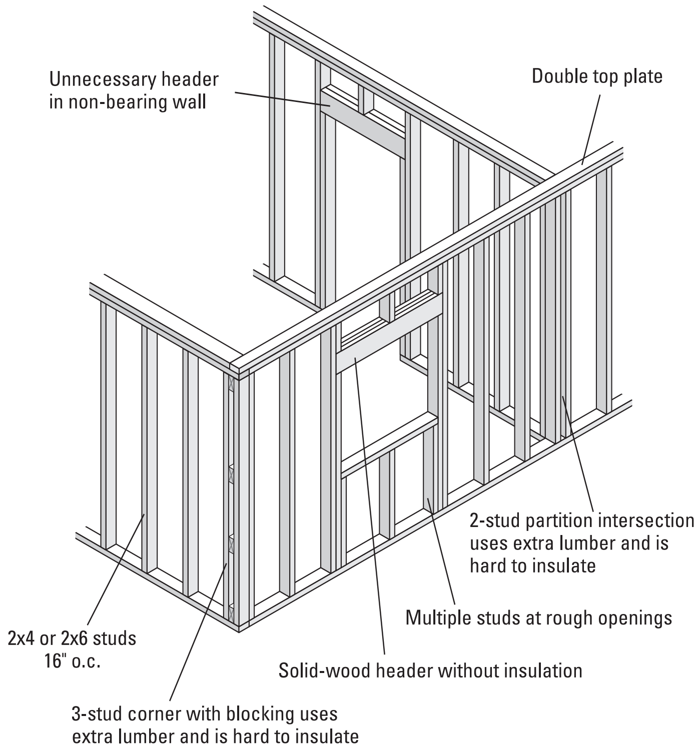


FIGURE 7.9

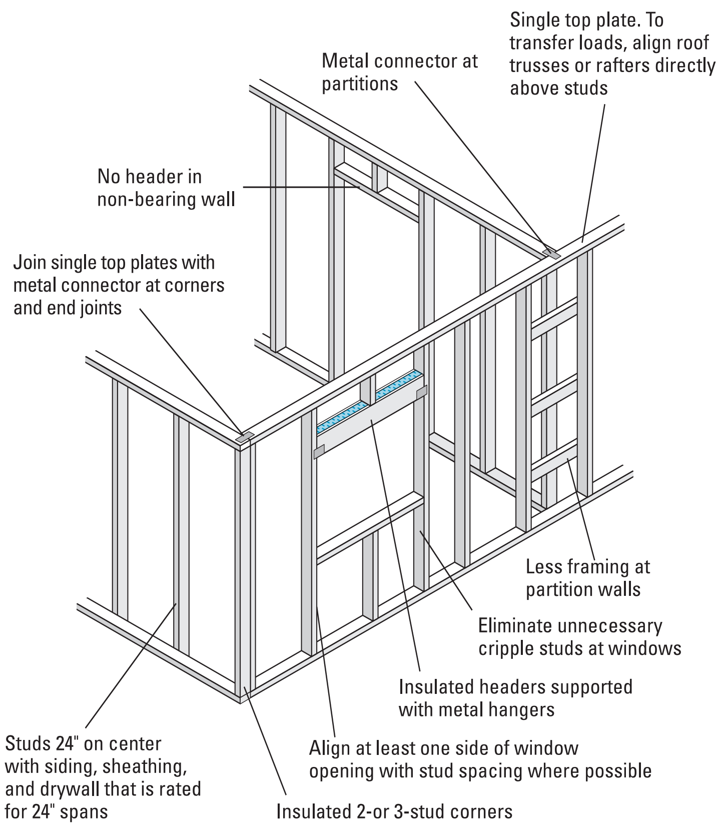
## Conventional framing




Standard framing techniques use unnecessary wood and leave less room for insulation. Advanced framing techniques are tested and proven by the National Association of Home Builders, and meet structural codes. For more detail on advanced framing (sometimes called “Optimum Value Engineering”) see *Cost Effective Home Building: A Design and Construction Handbook* by NAHB (contact information in Appendix B).

**FIGURE 7.10**

## Advanced framing

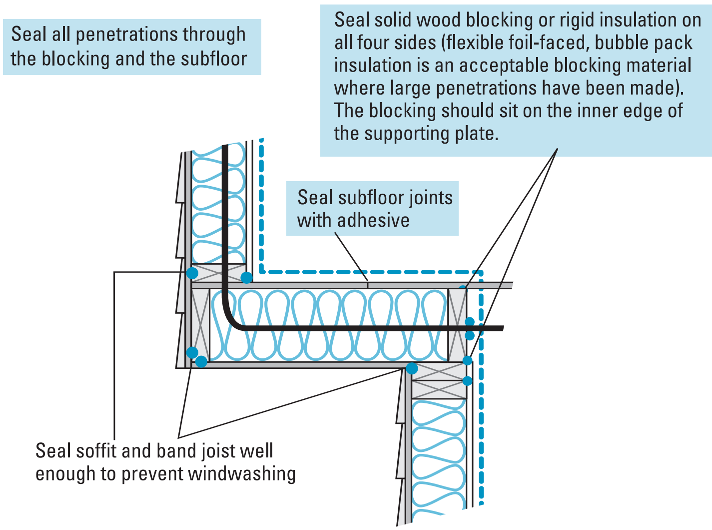



Advanced framing uses up to 25% less wood, increases overall insulation R-values by 5 to 10%, and costs less to build. Most of these techniques can be used even when framing at 16" on center.

⚠ **CAUTION:** Code requires stack framing (structural support members are all aligned vertically) and metal splice plates to be used with single top plates.

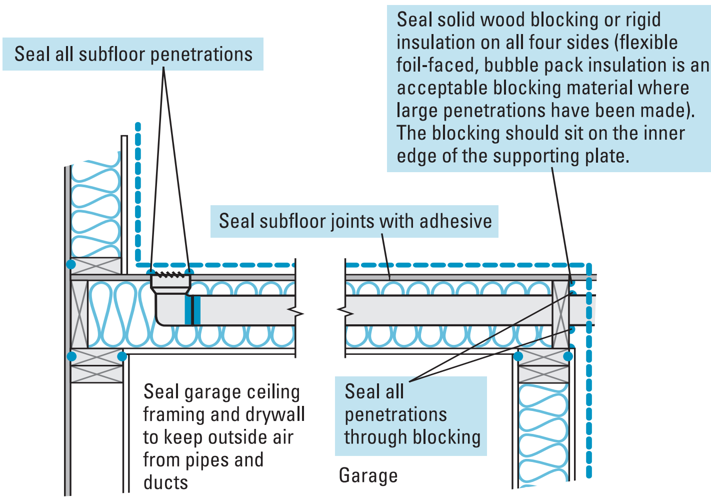
**FIGURE 7.11**

**Exterior cantilever floor with interior air sealing**




**CAUTION:** Blocking is often pushed out by subcontractors. Encourage subs to make slightly oversized holes in blocking which are easier to seal later, rather than removing the entire piece.

FIGURE 7.12
## Tuck-under garage




Tuck-under garages and attached garages are especially important to seal and isolate from the rest of the house, not only because of heat loss but also for health and safety reasons. Air leakage paths from a garage into the house can bring car exhaust, fumes from stored gasoline or other dangerous chemicals, or fire from the garage into the house. The floor over a garage is also a common area for freezing pipes and poor heat distribution. Provide both an interior and exterior air barrier to thoroughly isolate the floor system and reduce these potential problems.

FIGURE 7.13

## Dropped soffit on interior wall

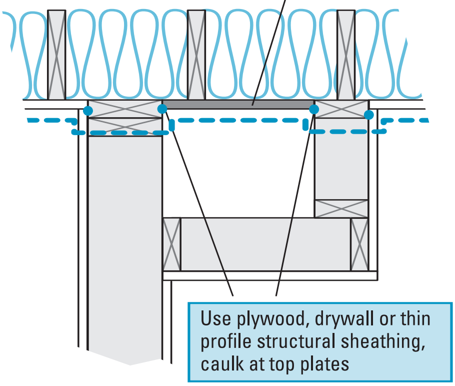
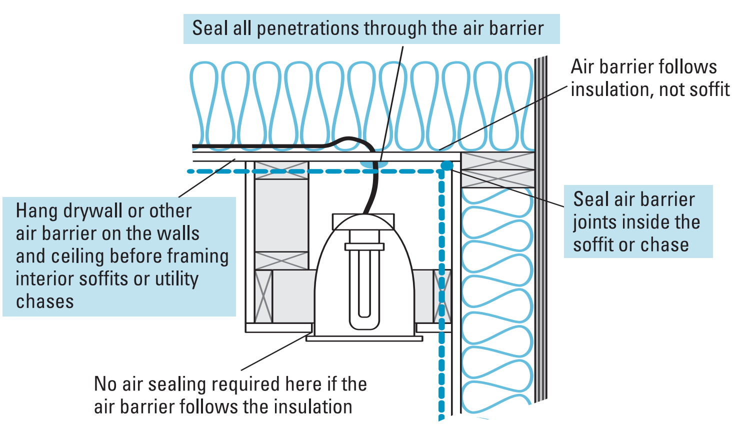





FIGURE 7.14

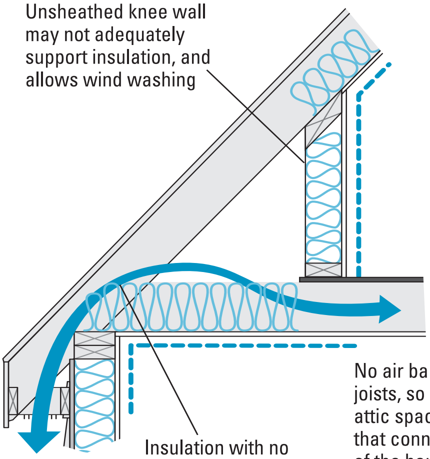
## Interior soffit on exterior wall




Dropped soffits are commonly built with direct air paths from inside interior walls into attics. When recessed lights are installed, heat from the lights drives air leakage even faster. Installing air barriers before framing the soffit requires coordination of framing crews and materials.

FIGURE 7.15

## Typical $1^1/_2$-story knee wall




Typical knee wall details that are found in cape style homes, bonus rooms over garages, and the like are one of the largest and most common air leakage problems. This figure shows the air movement that allows outdoor air into all the joist bays, between floors. This problem can be eliminated by careful blocking of the floor framing under the knee wall, or by insulating the rafters and providing an air barrier, as shown in Figures 7.16-7.17.

FIGURE 7.16

## 1½-story knee wall outside the air barrier

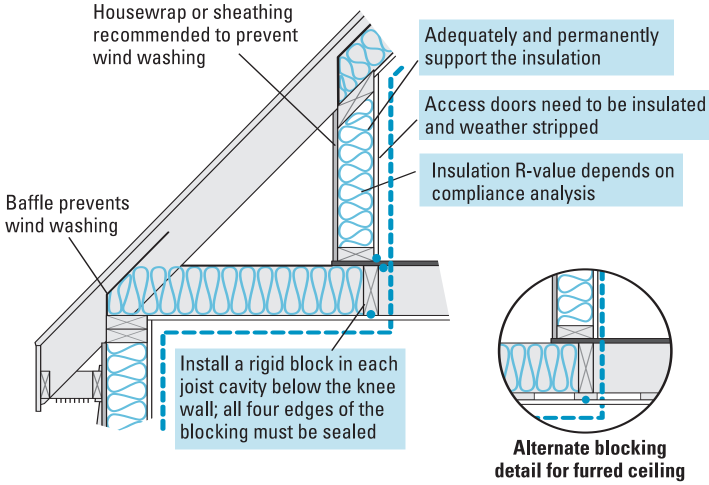





FIGURE 7.17

## 1½-story knee wall inside the air barrier

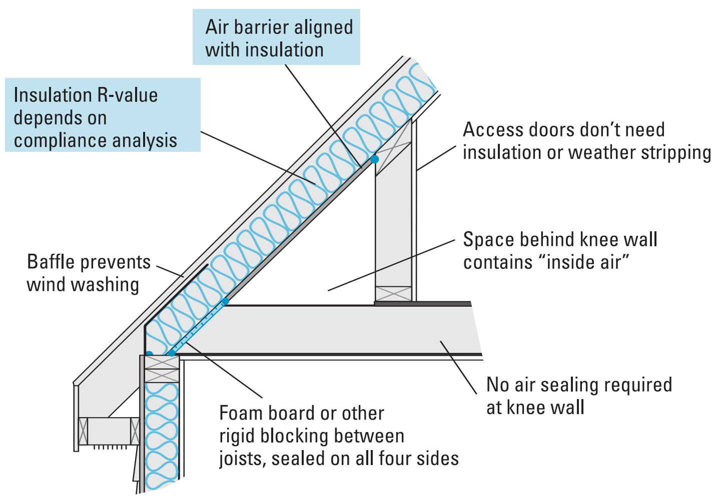
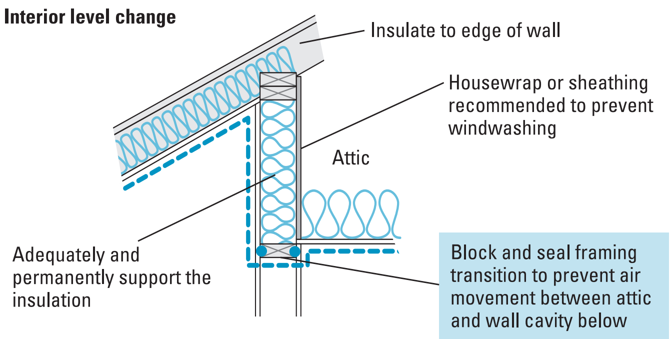
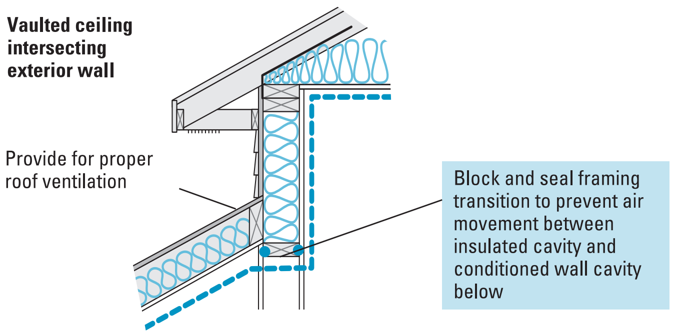


FIGURE 7.18

## Sealing split levels




The lack of draftstop blocking in typical split-level details is another large leak. Be especially careful around stairways framed near these areas in "Tri-level" homes.