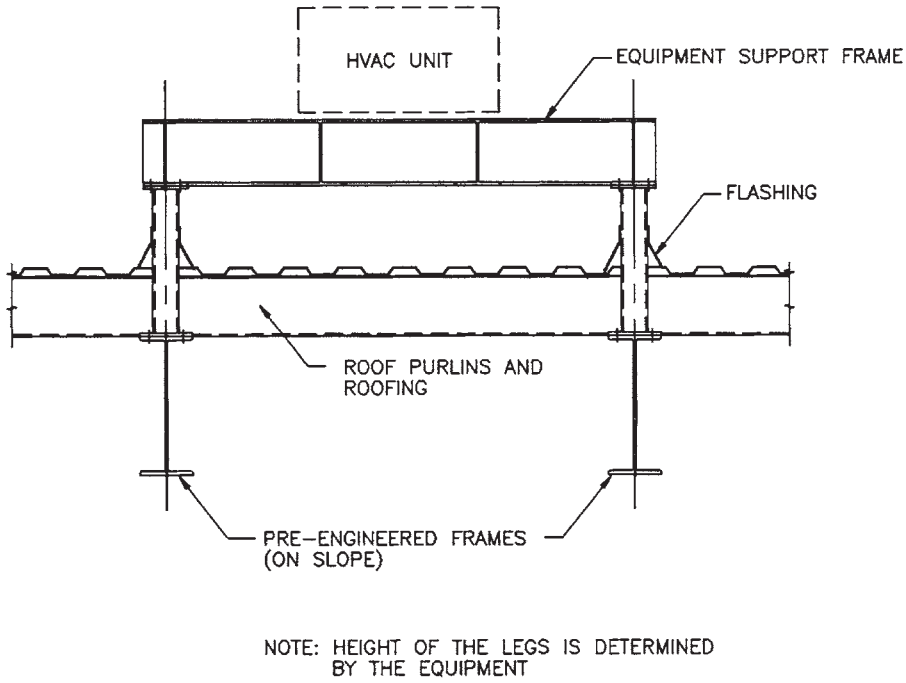

FIGURE 10.13 Elevated frame on legs.

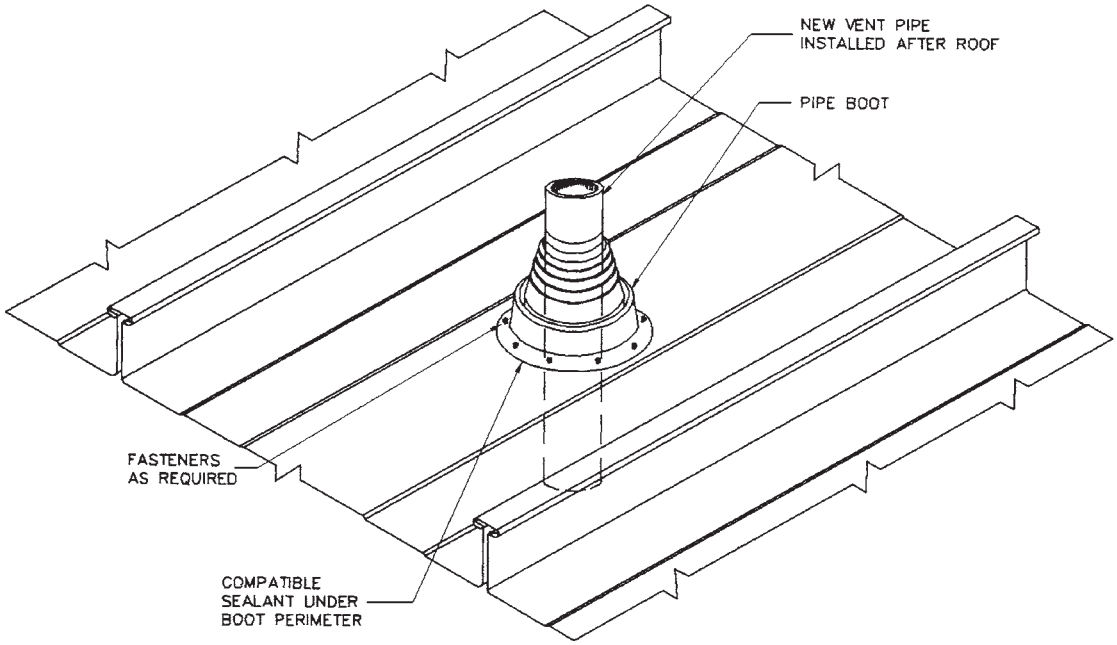

FIGURE 10.14 Sealing pipe penetration with a flexible boot located within flat area of the panel. Sealant is applied between the panel and metal flange of the boot before fastening. (*Centria.*)

In any event, the location and weight of HVAC equipment needs to be closely coordinated with the building manufacturer to ensure proper structural support. It is easy to see how a lack of such coordination can easily result in "extras" if any additional framing has to be provided after the roof is in place.

10.6 CONFUSING ROOF SNOW AND LIVE LOADS

As readers might remember from Chap. 3, there are two externally applied uniformly distributed roof loads: snow load and roof live load. The nature of these loads and the differences between them have been explained already; our present discussion deals with problems of specifying them.

During the last two decades, application criteria for these loads have changed dramatically, confusing the manufacturer and the specifier alike; even the building officials are sometimes unclear on this subject. The owner has to be assured that all the manufacturers interested in the project apply the same design loads and would supply buildings of similar strength. Otherwise, a party claiming to conform to the project design criteria but employing legerdemain to arrive at the design loads that are lower than those used by others will gain a major competitive advantage. As Miller and Evers[7] put it:

> Competition may prompt some companies to look for any way to gain a pricing advantage. For the hard-pressed competitor, this may mean using questionable methods of interpreting code and design loads to achieve the lowest price. It is normally less a question of outright cheating than of clever interpretation of a sometimes allowable reduction, or failure to consider a recent code update.

Experienced structural engineers know that the magnitude of design loads is among the most important factors affecting construction cost. As Ruddy[8] has found for single-story steel-framed buildings, the cost of structure increases at a rate of 2 cents per square foot for each additional pound per square foot of superimposed load. For example, if the roof framing, columns, and foundations cost $5 per square foot when the design load is 20 lb/ft^2, the same building may cost $5.20 per square foot when designed for a 30 lb/ft^2 roof load.

A common problem is the designer's failure to differentiate between roof live and snow loads. The specifiers should compare the design values for both, as listed in the local building code, and clearly understand which one controls the design for the project's location. For northern regions, it is usually snow, for the south—roof live load.

The code could specify the snow-load value as either "ground snow" or "roof snow." Often, the ground or "basic" snow load can be converted into the roof snow load by a multiplication coefficient of 0.7 (and other factors). To eliminate a potential for confusion, the contract documents should list a value of the design roof snow load (if snow controls the design) and clearly call it snow. A careful check of the design certification letters (see Chap. 9) should be made to verify that no bidder has mistakenly assumed the design load to be a ground snow load that could be further reduced by another 30 percent. Such a reduction alone could cut the amount of steel by as much as 5 percent.[7]

Roof live loads present another complication: live load reduction allowed by the codes for large areas—usually in excess of 200 ft^2—supported by a roof structural member. In many codes, low-slope roof live load is taken as 20 lb/ft^2 for tributary areas of up to 200 ft^2, 16 lb/ft^2 for tributary areas between 201 and 600 ft^2, and 12 lb/ft^2 for tributary areas over 600 ft^2. Therefore, if the contract documents refer to "roof live load" of 20 lb/ft^2, this load will be reduced by all the bidders in the same fashion. However, if the documents specify a "roof live load" of 30 lb/ft^2, although what was really meant is a roof *snow* load of 30 lb/ft^2, an expensive problem is invited. Some manufacturers will have understood that snow load was meant and will design all their roof members for 30 lb/ft^2, while others might reduce it proportionally to the above-listed numbers for roof live load. A load reduction from 30 to 18 lb/ft^2 may save as much as 8 percent from the cost of primary frames.[7] The manufacturer taking this reduction will clearly be positioned to win—unfairly to the competition—because of ambiguous contract documents.