4 ENERGY

In Canada, approximately 30% of all of the country's energy use is consumed in buildings. The largest component of this energy consumption in both single-family and multi-family residential buildings is space-heating. In British Columbia, residential space-heating typically accounts for between 30% and 60% of a building's total energy consumption.

Reducing space-heating energy use is a primary function of the building enclosure. While heat flow through the building enclosure cannot be prevented, it can be controlled to reduce the total energy consumption and improve comfort. This is achieved by constructing a thermally insulated and airtight building enclosure.

This chapter discusses the mechanisms of heat transfer associated with specific building enclosure assemblies, minimum thermal performance requirements for building components in British Columbia, as well as opportunities for better performance.

4.1 Heat Transfer and Building Enclosure Assemblies

Wood-Frame Walls

The primary means of controlling heat flow through wood-frame walls is the placement of insulation within the stud cavity (interior insulated). To improve thermal performance insulation may also be placed solely to the exterior of the sheathing (exterior insulated), or in both the stud cavity and to the exterior of the sheathing (split insulation). See Figure 4-1.

This chapter discusses wall assemblies in the context of thermal performance; however moisture control is also important. The vapour flow control strategy must consider insulation type, location, ratio of insulation inboard and outboard of the exterior sheathing, and vapour permeability of the various layers.

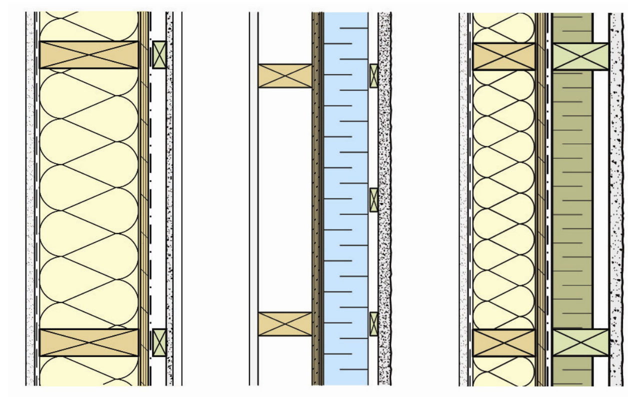

Figure 4-1 Insulation placement within wood-frame walls

Table A3.4 within ASHRAE 90.1-2007 and 2004 provides assembly U-factors for wood-frame walls depending on the type of framing system, either standard or advanced (See Figure 3.9). The wall assembly includes interior and exterior air-films, drywall and sheathing, and stucco cladding.

Note that these tables reflect different insulation R values than presented in the *BCBC*. For example, the ASHRAE tables refer to R-19 and R-21 effective R-values, whereas *BCBC* refers to RSI 3.5 (R-20) for 140 mm (5 1/2″) framing depths.

An excerpt from ASHRAE Table A3.4 is provided in Table 4-1 and Table 4-2. The following framing factors are assumed:

Standard wall framing assumes:

- Wood studs at 406 mm (16″) o.c. filled with 368 mm (14 1/2″) wide insulation in both 89 mm (3 1/2″) and 140 mm (5 1/2″) cavities. Double headers leave no cavity, and
- 75% insulation and 25% framing factor consisting of 21% studs, plates, and sills and 4% headers.

Advanced wall framing assumes:

- Wood studs at 610 mm (24″) o.c. filled with 572 mm (22 1/2″) wide insulation for both 89 mm (3 1/2″) and 140 mm (5 1/2″) cavities. Double header cavities are left open or insulated.