OBJECTIVE: To obtain an understanding of the specific insulation requirements (prescriptive) for the building thermal envelope of commercial buildings.


KEY POINTS:
- Which compliance options are available for demonstrating compliance with the IECC for commercial buildings? When should one be utilized instead of the other for the building envelope?
- Which parts of the building envelope are covered under Chapter 4 [CE]?
- What two parameters must be determined before the thermal requirements for the building envelope can be selected?
- What are the different wall types addressed in Chapter 4 [CE]?
- Where can roof insulation be installed to meet the envelope requirements? What are the requirements for metal roof systems?
- How does the IECC apply to metal wall systems?
- Which options are available for insulated framed wall systems? Which options are available for insulated concrete or concrete masonry unit wall systems?
- Which options are available when the design includes more than 3 percent of the roof area in skylights?
- How should slab edge insulation be installed to meet the code requirements? Below grade walls?
Code Text: The commercial building project shall comply with 1) the requirements in ANSI/ASHRAE/IESNA 90.1; or 2) the requirements of Sections C402 (Building Envelope Requirements), C403 (Building Mechanical Systems), C404 (Service Water Heating) and C405 (Electrical Power and Lighting Systems). In addition, commercial buildings shall comply with either Section C406.2 (Efficient HVAC Performance), C406.3 (Efficient Lighting System) or C406.4 (On-Site Renewable Energy); or 3) the requirements of Section C407 (Total Building Performance), C402.4 (Air Leakage), C403.2 (Provisions Applicable to All Mechanical Systems), C404 (Service Water Heating), C405.2 (Lighting Controls), C405.3 (Tandem Wiring), C405.4 (Exit Signs), C405.6 (Exterior Lighting) and C405.7 (Electrical Energy Consumption). The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Discussion and Commentary: Compliance for a commercial building shall be demonstrated by using Chapter 4 [CE] to individually evaluate the building envelope, mechanical, service water heating and lighting systems. As an alternative to Chapter 4 [CE] of the IECC, ASHRAE/IESNA Standard 90.1 can be used to demonstrate compliance with the IECC. ASHRAE/IESNA 90.1 is also to be used when the building system is not covered under Chapter 4 [CE].

Sections C402 through C406 are prescriptive in nature. Because of this, there are no trade-offs between the envelope, lighting, service water and mechanical systems. The project may be made to comply by using either IECC Chapter 4 [CE] or ASHRAE 90.1, but not a combination of both. Typically, if ASHRAE Standard 90.1 is selected for the building’s compliance it will be selected because the proposed system falls out of the scope of IECC Chapter 4 [CE]. IECC Section C407 allows trade-offs between levels of efficiency in the building envelope, mechanical and lighting systems.
Typically, insulation requirements for metal-framed walls are more stringent than for wood-framed wall systems because of the increased heat transfer in metal. For example, in Climate Zone 3, metal wall systems must be provided with continuous insulation in addition to the required insulation installed between the framing members. A wood-framed wall in the same Climate Zone is only required to have insulation installed between the framing members.

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Other</td>
<td>Group R</td>
<td>All Other</td>
<td>Group R</td>
<td>All Other</td>
<td>Group R</td>
<td>All Other</td>
<td>Group R</td>
<td>All Other</td>
</tr>
<tr>
<td><strong>Roofs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Metal buildings (not R-5 thermal blocks)</strong></td>
<td>R-19 + R-11.5</td>
<td>R-19 + R-11.5</td>
<td>R-19 + R-11.5</td>
<td>R-19 + R-11.5</td>
<td>R-19 + R-11.5</td>
<td>R-19 + R-11.5</td>
<td>R-19 + R-11.5</td>
<td>R-19 + R-11.5</td>
</tr>
</tbody>
</table>

Typically, insulation requirements for metal-framed walls are more stringent than for wood-framed wall systems because of the increased heat transfer in metal. For example, in Climate Zone 3, metal wall systems must be provided with continuous insulation in addition to the required insulation installed between the framing members. A wood-framed wall in the same Climate Zone is only required to have insulation installed between the framing members.
Code Text: The minimum thermal resistance (R-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less. See exceptions for 1) continuously insulated roof assemblies where the insulation thickness varies by no more than 1 inch and the area-weighted U-factor is equivalent to the same assembly, with the R-value specified in Table C402.2, and 2) unit skylight curbs included as a component of an NFRC 100 rated assembly. Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

Discussion and Commentary: The insulation requirements for a roof/ceiling assembly will vary depending on how the roof is constructed and where the insulation is placed. Three different roof assemblies are addressed in Table C402.2. Based on the roof type, insulation is required to be placed between framing or be continuous. For example, in most Climate Zones a vented attic space will be required to have a minimum R-38 insulation installed between framing. A skylight curb is not required to be insulated where the total glazed assembly, including the curb, has already been rated per NFRC 100 and assigned a U-factor.
Roof Reflectance, also known as Solar Reflectance and as Albedo, is a measure of the ability of a surface material to reflect sunlight. Solar Reflectance Index (SRI) is a single value that incorporates both solar reflectance and infrared emittance to represent a material’s temperature in the sun. This value affects energy savings and the overall heat island contribution of the building.