



FOAMULAR® Extruded Polystyrene (XPS) Insulation

ASHRAE 90.1 Prescriptive Roof Insulation Requirements

Technical Bulletin

Commercial Low Slope Roof Systems

Energy Codes and Standards

Above deck roof insulation is prescribed by ASHRAE 90.1¹, Energy Standard for Buildings Except Low-Rise Residential Buildings. It establishes minimum energy efficiency requirements for most commercial buildings, including larger residential buildings. Excluded are single-family, multi-family three stories or less, and manufactured homes. The International Energy Conservation Code² (IECC) is a similar standard that is also widely adopted. The International Green Construction Code³ (IgCC) contains building energy performance criteria like the other two standards, but also covers sustainable design concepts. For building envelope design, the IgCC generally prescribes higher energy performance requirements than the other two. ASHRAE 189.1⁴, a design standard for high performance green buildings, is designated in Section 301.1.1 of the IgCC as an alternate to the IgCC.

Adoption and Compliance

Many building code jurisdictions in the United States have adopted an edition of either ASHRAE 90.1, or the similar IECC. The U.S. Department of Energy maintains an energy code adoption website to provide current energy code status by state.

<http://www.energycodes.gov/adoption/states>

Compliance paths in general include either a combination of prescriptive/mandatory thermal performance specifications, a combination of mandatory/

Figure 1
USA Climate Zones (ASHRAE 90.1)

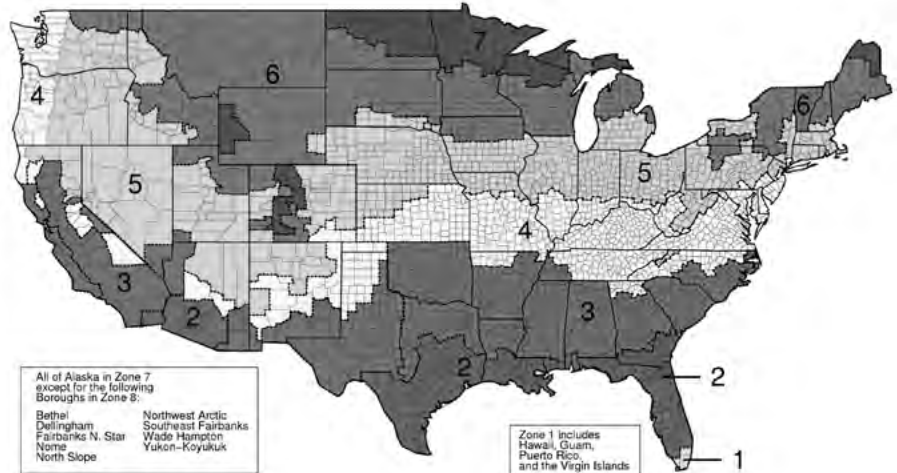
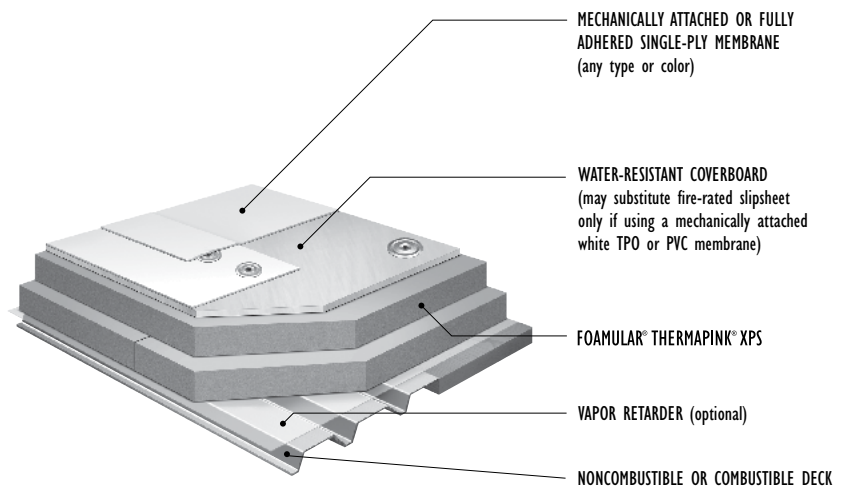


Figure 2
Roof Deck Assembly with Insulation Entirely Above Deck



Other variations of this assembly may include metal roofing, other mechanically attached or fully adhered membranes, other colors such as black, and other cover layers such as a lightweight fabric slip sheet as appropriate for each system. THERMAPINK® insulation is applied direct-to-deck in accordance with Underwriters Laboratories Roof Deck Construction #457, tested in accordance with ANSI/UL Standard 1256.

Prescriptive R (minimum) Requirements for Roofs with Insulation Entirely Above Deck

| Zone | ASHRAE 90.1 - 2004 | | ASHRAE 90.1 - 2007 and 2010 | | ASHRAE 90.1 - 2013 | | IECC - 2012 | | ASHRAE 189.1 - 2011 (alternate to IgCC - 2012)* | |
|------|--------------------|-----|-----------------------------|-----|--------------------|-----|-------------|-----|--|-----|
| | Non-Res | Res | Non-Res | Res | Non-Res | Res | Non-Res | Res | Non-Res | Res |
| 1 | 15 | 15 | 15 | 20 | 20 | 25 | 20 | 20 | 20 | 25 |
| 2 | 15 | 15 | 20 | 20 | 25 | 25 | 20 | 20 | 25 | 25 |
| 3 | 15 | 15 | 20 | 20 | 25 | 25 | 20 | 20 | 25 | 25 |
| 4 | 15 | 15 | 20 | 20 | 30 | 30 | 25 | 25 | 25 | 25 |
| 5 | 15 | 15 | 20 | 20 | 30 | 30 | 25 | 25 | 25 | 25 |
| 6 | 15 | 15 | 20 | 20 | 30 | 30 | 30 | 30 | 30 | 30 |
| 7 | 15 | 15 | 20 | 20 | 35 | 35 | 35 | 35 | 35 | 35 |
| 8 | 20 | 20 | 20 | 20 | 35 | 35 | 35 | 35 | 35 | 35 |

Non-Res (Non-Residential) • Res (Residential)

* Section 605.1.1 of the IgCC-2012, regarding "Building Envelope Systems, Prescriptive Compliance", states that when the IgCC is used, the building thermal envelope R shall exceed the requirements of the IECC by not less than 10%.



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building envelope trade-off options, or the Energy Cost Budget Method with variations on the compliance paths. The paths include prescriptive minimum R-values, maximum U-factors, and the conducting of actual thermal testing on assemblies. The IgCC and ASHRAE 189.1 are not as widely adopted, but some architects/owners choose to design to their goals of greater sustainability.

Prescriptive Thermal Performance for Roof Decks

The table “Prescriptive R (minimum) Requirements for Roofs with Insulation Entirely Above Deck” charts R by climate zone for commercial low slope roofs as listed in ASHRAE 90.1, the IECC, and ASHRAE 189.1 when used as an alternate to the IgCC. Because the edition adopted varies by jurisdiction, several 90.1 editions are summarized, including 2004, 2007, 2010 and 2013. The IECC-2012, and ASHRAE 189.1-2011 are also summarized. The table shows only the prescriptive requirements for “non-residential” (commercial) and “residential” (as defined by ASHRAE 90.1) buildings. This table applies to buildings that are heated and/or cooled.

The standards also provide prescriptive insulation values for “semi-heated” buildings that are not shown in this table. This technical bulletin does not provide complete design requirements. See the applicable standard for complete building performance and design compliance requirements.

Prescribed insulation levels are based on the concept of achieving “optimum insulation”, which is defined as the “lowest life-cycle cost” (LLC) amount of insulation calculated at the time that particular version of the Standard was adopted. (For more information, see the Owens Corning data sheet that explains LLC. at www.owenscorning.com) Volatility in energy costs and ever-rising construction costs generally cause the LLC amount of insulation to trend upward. Therefore, specifiers should consider exceeding today’s minimum standards based on the expected life of the building and long term economic return on the investment in insulation. The ASHRAE 90.1 criteria for roof insulation installed entirely above the roof deck is: 1) it is installed above (outside of) the roof structure and, 2) it is continuous (i.e., uninterrupted by framing members.)

References

1. ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1791 Tullie Circle NE, Atlanta, GA 30329
2. International Energy Conservation Code; International Code Council, Inc.; 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795
3. International Green Construction Code; International Code Council, Inc.; 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795
4. ASHRAE 189.1, Standard for the Design of High-Performance Green Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1791 Tullie Circle NE, Atlanta, GA 30329

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