



ENERGY CODES AND STANDARDS

Owens Corning® Enclosure Solutions has a variety of insulation, air barrier, and air/water-sealing accessory options that make it easy to specify compliance with energy codes and standards. ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings,¹ establishes minimum energy efficiency requirements for most commercial buildings, including larger residential buildings. Excluded are single-family, multi-family three stories or less above grade, 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 it 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 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. Compliance paths in general include either a combination of prescriptive/mandatory thermal performance specifications, a combination of mandatory/building envelope trade-off options, or the Energy Cost Budget Method variations on the compliance paths, including prescriptive minimum R-values, maximum U-factors, as well as conducting actual thermal testing on assemblies. The IgCC and ASHRAE 189.1 are not as widely adopted, but some architects/owners, such as the United States Army Corps of Engineers (USACE), choose to design to their goals of greater sustainability.

LIMITING AIR LEAKAGE

ASHRAE 90.1 (2013 edition, Section 5.4.3.1), the IECC (2015 edition, Section C402.5.1), and the IgCC (2012 edition, Section 605.1.2.1) require that the building envelope be designed and constructed with a continuous air barrier.

The ASHRAE 90.1 and IECC standards require wall assemblies to demonstrate an air leakage rate to not exceed 0.04 cfm/ft² at a pressure of 75 Pa (1.57 psf) when tested in accordance with ASTM E2357.⁵ Owens Corning® Enclosure Solutions provides multiple options for air barrier systems that meet these requirements while also meeting other requirements such as NFPA 285 resistance to fire propagation. It is always recommended to

verify performance with the air barrier manufacturer. For complete information about installing Owens Corning® FOAMULAR® XPS with taped joints to perform as the air and water-resistive barrier, see the Owens Corning® Enclosure Solutions technical bulletin SS-02 regarding ASTM E2357 and ASTM E331 testing.

The IgCC requires the air leakage rate be determined for the entire building thermal envelope. The leakage rate must be less than 0.25 cfm/ft² at a pressure differential of 75 Pa (1.57 psf) when tested in accordance with ASTM E779.⁶ Entire building thermal envelope testing is conducted after rough-in and after installation of penetrations of the building envelope, including but not limited to utilities, HVAC, plumbing, and electrical service and equipment.

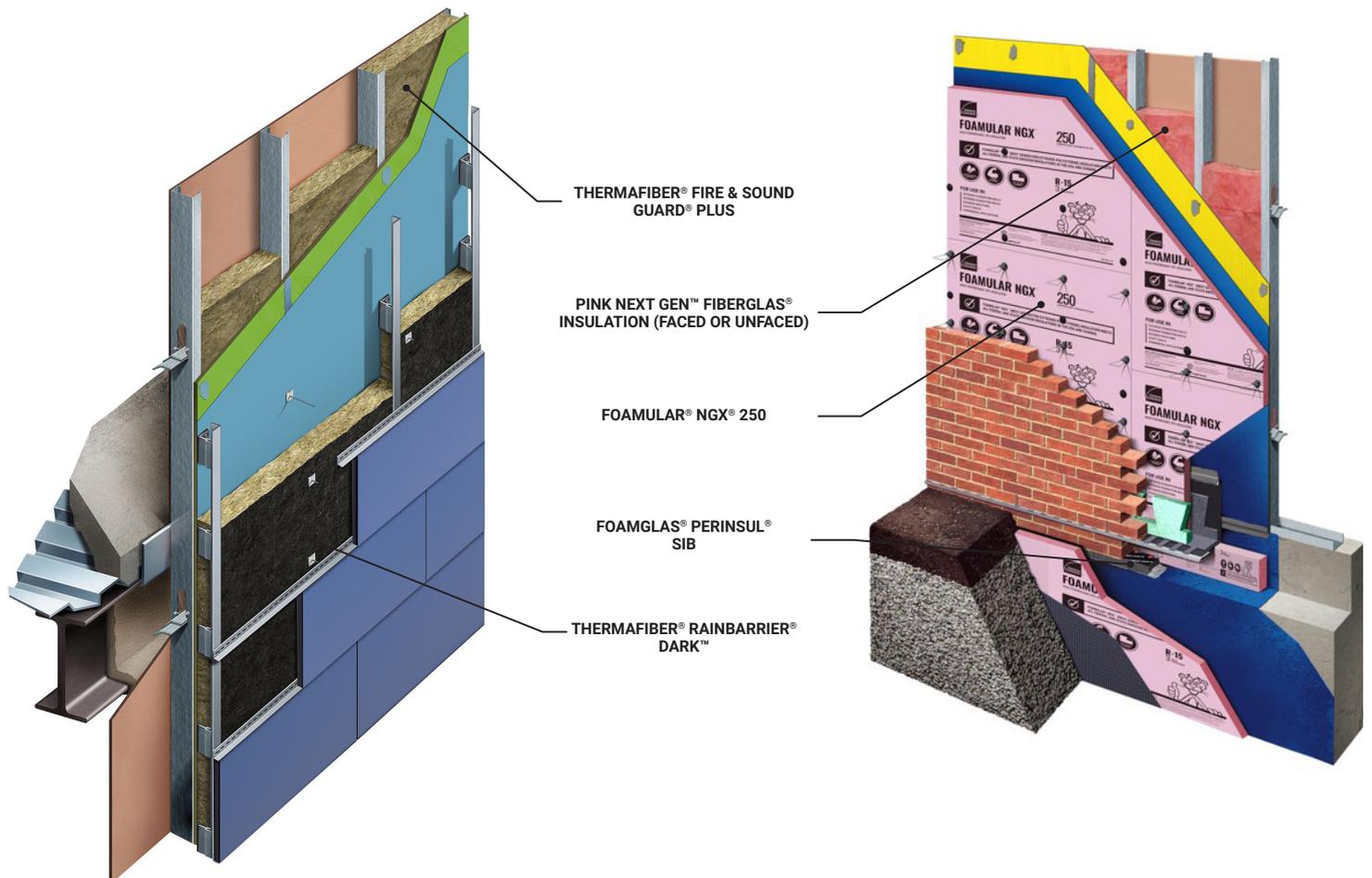
ENVELOPE THERMAL PERFORMANCE

The table "Prescriptive R Requirements for Steel-Framed Walls, Above Grade" charts thermal resistance (R-Value) by climate zone for steel-framed walls 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 editions are summarized unless noted with "ci" for continuous insulation. Table 1 shows prescribed stud cavity R-value as the first number, and continuous insulation R as the second number. (Example: 13 + 7.5). Table 1 shows only the prescriptive requirements for "non-residential" (commercial) and "residential" buildings (as defined in their respective code) and 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 R (MINIMUM) REQUIREMENTS FOR STEEL-FRAMED WALLS, ABOVE GRADE
TABLE 1

| ZONE | ASHRAE 90.1 2013 ² | | IECC 2015 ⁴ | | ASHRAE 90.1 2016 ⁵ | | IgCC 2018 ⁷ | | IECC 2018 ⁸ | | ASHRAE 90.1 2019 ⁹ | | ASHRAE 189.1 2020 ¹⁰ | | IECC 2021 ¹¹ | | ASHRAE 90.1 2022 ¹² | |
|------|-------------------------------|-------------|------------------------|-------------|-------------------------------|-------------|------------------------|-------------|------------------------|-------------|-------------------------------|-------------|---------------------------------|-------------|-------------------------|-------------|--------------------------------|-------------|
| | Non-Residential | Residential | Non-Residential | Residential | Non-Residential | Residential | Non-Residential | Residential | Non-Residential | Residential | Non-Residential | Residential | Non-Residential | Residential | Non-Residential | Residential | Non-Residential | Residential |
| 0 | N/A | N/A | N/A | N/A | 13 | 13 | 13 | 13 | N/A | N/A | 13 | 13 | 13 | 13 | 13+5 | 13+5 | 13 | 13 |
| 1 | 13 | 13 | 13+5 | 5+13 | 13 | 13 | 13 | 13 | 13+5 | 13+5 | 13 | 13 | 13 | 13 | 13+5 | 13+5 | 13 | 13 |
| 2 | 13+3.8 | 13+7.5 | 13+5 | 13+7.5 | 13+3.8 | 13+7.5 | 13+3.8 | 13+7.5 | 13+5 | 13+7.5 | 13+3.8 | 13+7.5 | 13+3.8 | 13+7.5 | 13+5 | 13+7.5 | 13+3.8 | 13+7.5 |
| 3 | 13+5.0 | 13+7.5 | 13+7.5 | 13+7.5 | 13+5 | 13+7.5 | 13+5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+5 | 13+7.5 |
| 4 | 13+7.5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+12.5 | 13+12.5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+12.5 | 13+12.5 | 13+7.5 | 13+7.5 | 13+7.5 | 13+7.5 |
| 5 | 13+10.0 | 13+10.0 | 13+7.5 | 13+7.5 | 13+10 | 13+10 | 13+12.5 | 13+12.5 | 13+7.5 | 13+7.5 | 13+10 | 13+10 | 13+12.5 | 13+12.5 | 13+10 | 13+10 | 13+10 | 13+10 |
| 6 | 13+12.5 | 13+12.5 | 13+7.5 | 13+7.5 | 13+12.5 | 13+12.5 | 13+15.6 | 13+15.6 | 13+7.5 | 13+7.5 | 13+12.5 | 13+12.5 | 13+15.6 | 13+15.6 | 13+12.5 | 13+12.5 | 13+12.5 | 13+12.5 |
| 7 | 13+12.5 | 13+15.6 | 13+7.5 | 13+15.6 | 13+12.5 | 13+15.6 | 13+15.6 | 13+18.8 | 13+7.5 | 13+15.6 | 13+12.5 | 13+15.6 | 13+15.6 | 13+18.8 | 13+12.5 | 13+15.6 | 13+12.5 | 13+15.6 |
| 8 | 13+18.8 | 13+18.8 | 13+7.5 | 13+17.5 | 13+18.8 | 13+18.8 | 13+21.9 | 13+21.9 | 13+7.5 | 13+17.5 | 13+18.8 | 13+18.8 | 13+21.9 | 13+21.9 | 13+18.8 | 13+18.8 | 13+18.8 | 13+18.8 |

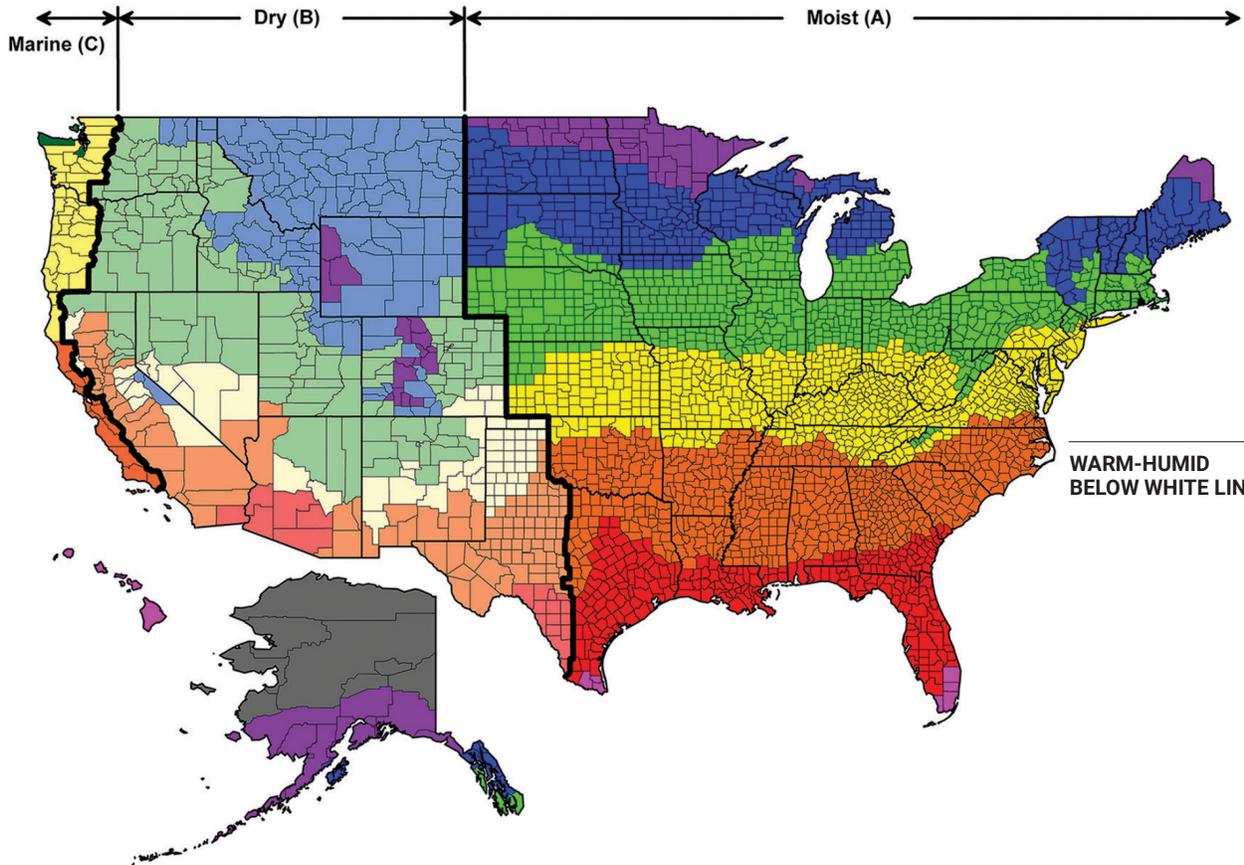
1. Second number is continuous insulation (ci)
 2. Per ANSI/ASHRAE/IES Standard 90.1 2013 Energy Standard for Buildings Except Low-Rise Residential Buildings Section 5.5
 3. Per ANSI/ASHRAE/USGBC/IES Standard 189.1-2014 Standard for the Design of High Performance Green Buildings Except Low-Rise Residential Buildings, Appendix E
 4. Per 2015 International Energy Conservation Code Section C402.1
 5. Per ANSI/ASHRAE/IES Standard 90.1 2016 Energy Standard for Buildings Except Low-Rise Residential Buildings Section 5.5
 6. Per ANSI/ASHRAE/USGBC/IES Standard 189.1-2017 Standard for the Design of High Performance Green Buildings Except Low-Rise Residential Buildings, Appendix E
 7. Per 2018 International Green Construction Code Appendix E
 8. Per 2018 International Energy Conservation Code Section C402.1
 9. Per ANSI/ASHRAE/IES Standard 90.1 2019 Energy Standard for Buildings Except Low-Rise Residential Buildings Section 5.5
 10. Per ANSI/ASHRAE/USGBC/IES Standard 189.1-2020 Standard for the Design of High Performance Green Buildings Except Low-Rise Residential Buildings, Appendix E
 11. Per 2021 International Energy Conservation Code Section C402.1
 12. Per ANSI/ASHRAE/IES Standard 90.1-2022 Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings Section 5.5
- * Marine Climates in Zone 4 use Zone 5 Requirements



OWENS CORNING® ENCLOSURE SOLUTIONS AND ENERGY CODE COMPLIANCE

Owens Corning® Enclosure Solutions includes components and details to create systematized compliant assemblies that meet energy codes and standards verified by the designer. PINK Next Gen™ Fiberglas™, Thermafiber® Fire & Sound Guard® Plus, , FOAMULAR®/ FOAMULAR® NGX®, and Thermafiber® RainBarrier® may be used to meet or exceed the thermal requirements of any of the energy codes. Owens Corning has one of the most thorough lists of air barrier options compatible in NFPA 285 Compliant Assemblies, including the use of FOAMULAR® XPS taped with JointSealR® to meet air leakage requirements. Owens Corning also provides a comprehensive list of detailed drawings and specifications to ensure successful installation and energy-efficient buildings.

UNITED STATES CLIMATE ZONES



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|-----------------------------|-------------------------|
| Zone 0A Extremely Hot Humid | Zone 4B Mixed Dry |
| Zone 0B Extremely Hot Dry | Zone 4C Mixed Marine |
| Zone 1A Very Hot Humid | Zone 5A Cool Humid |
| Zone 1B Very Hot Dry | Zone 5B Cool Dry |
| Zone 2A Hot Humid | Zone 5C Cool Marine |
| Zone 2B Hot Dry | Zone 6A Cold Humid |
| Zone 3A Warm Humid | Zone 6B Cold Dry |
| Zone 3B Warm Dry | Zone 7 Very Cold |
| Zone 3C Warm Marine | Zone 8 Subarctic/Arctic |
| Zone 4A Mixed Humid | |

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.
5. ASTM E2357-11, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.
6. ASTM E779-10, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.

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