When is High Temperature ZIP System™ Peel and Stick Underlayment Necessary?

This technical tip will help determine when to use ZIP System™ peel and stick underlayment HT. High temperature (HT) underlayments are often necessary for roof assemblies that experience temperatures above the tolerance of a standard ice barrier underlayment. ZIP System™ peel and stick underlayment is rated for service temperatures up to 180°F, whereas ZIP System peel and stick underlayment HT can sustain higher temperatures up to 260°F.

ZIP System peel and stick underlayment may be used to satisfy ice barrier requirements at eaves, provide increased coverage and protection for valleys, or as an underlayment over the entire roof. In all these applications, several factors can affect the service temperature of the roof system. Some key factors are solar irradiance, air temperatures, and design decisions such as roof coverings, ventilation, and interior thermal control. Factors to consider before using ZIP System peel and stick underlayment HT rather than standard ZIP System peel and stick underlayment will vary from build to build. Therefore, the final decision must be made by the designer of record, builder, or installer. Always consult the manufacturer of the finished roof covering for their specific underlayment requirements, as some manufacturers require an HT underlayment in all climates.

Location

The location of the build is often the most influential factor affecting the service temperatures experienced throughout the construction process and the life of the home. The factors below may all be affected by the build location.

Solar Irradiance

Solar irradiance is the amount of solar radiation received per unit area. Solar irradiance will increase the temperature of a roof assembly beyond the air temperature and, in some cases, can cause roof temperatures to exceed 180°F. Exposure to solar radiation will generally be higher at locations closer to the equator, but it is also affected by the exposure angle of the roof, altitude, and humidity. The National Renewable Energy Laboratory provides maps of average yearly exposure to solar irradiance, as shown in Figure 1, which can help determine if a build will need ZIP System peel and stick underlayment HT. Areas of red and orange on the map will more likely require a high temperature underlayment.

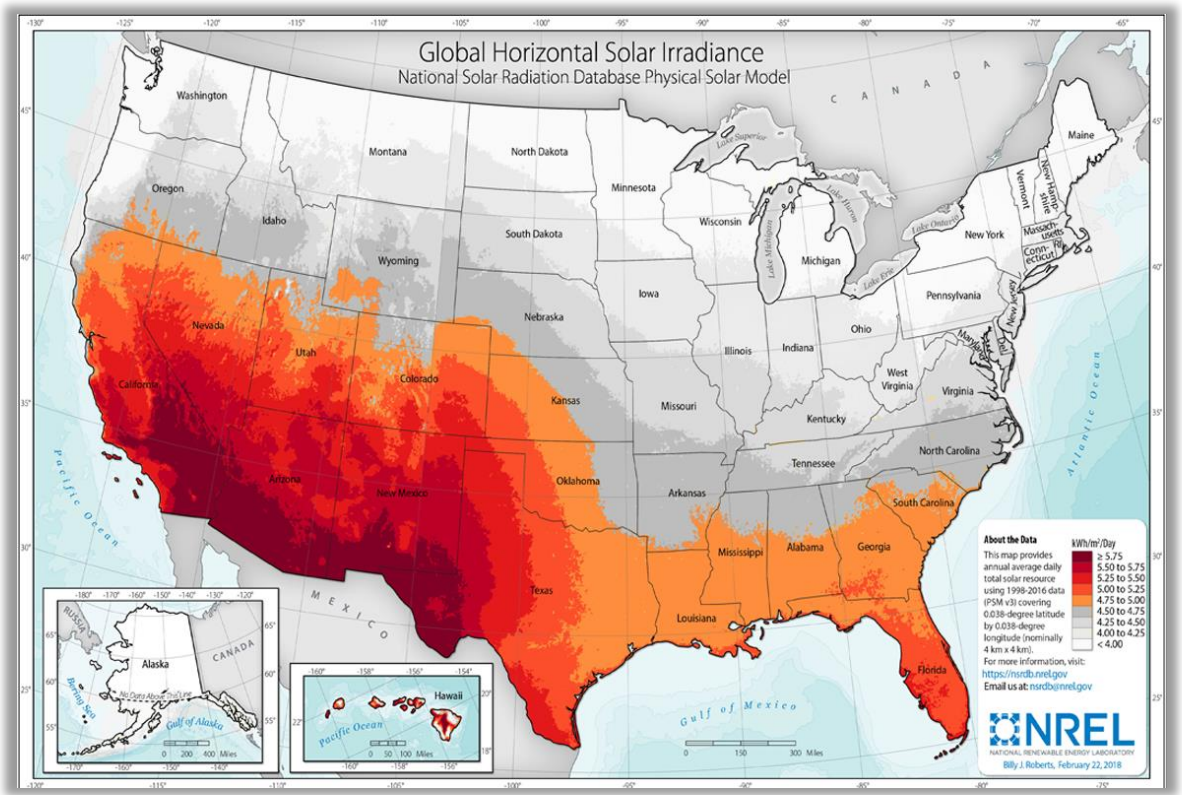

Figure 1: Global Horizontal Solar Irradiance according to the National Renewable Energy Laboratory[1]

Air Temperature

Air temperature will have a large effect on the maximum service temperature a roof will reach. Determining the climate zone for the build is a common practice to determine the necessity of a high temperature underlayment. Climate zone maps can be found in Chapter 3 of the International Energy Conservation Code (Figure 2). Roofs in climate zones 1-3 are more likely to experience high maximum temperatures during the summer, therefore ZIP System™ peel and stick underlayment HT would be recommended in these areas.

Along with service temperature, the air temperature affects the workability of the product while it is being installed. Standard underlayment adhesive will lose viscosity at a lower temperature. This can inhibit repositioning of the underlayment if a mistake is made during the initial application and can make the underlayment feel less stationary underfoot. HT underlayment is designed to remain viscous at higher temperatures, therefore it is less likely to experience these issues on hot days.

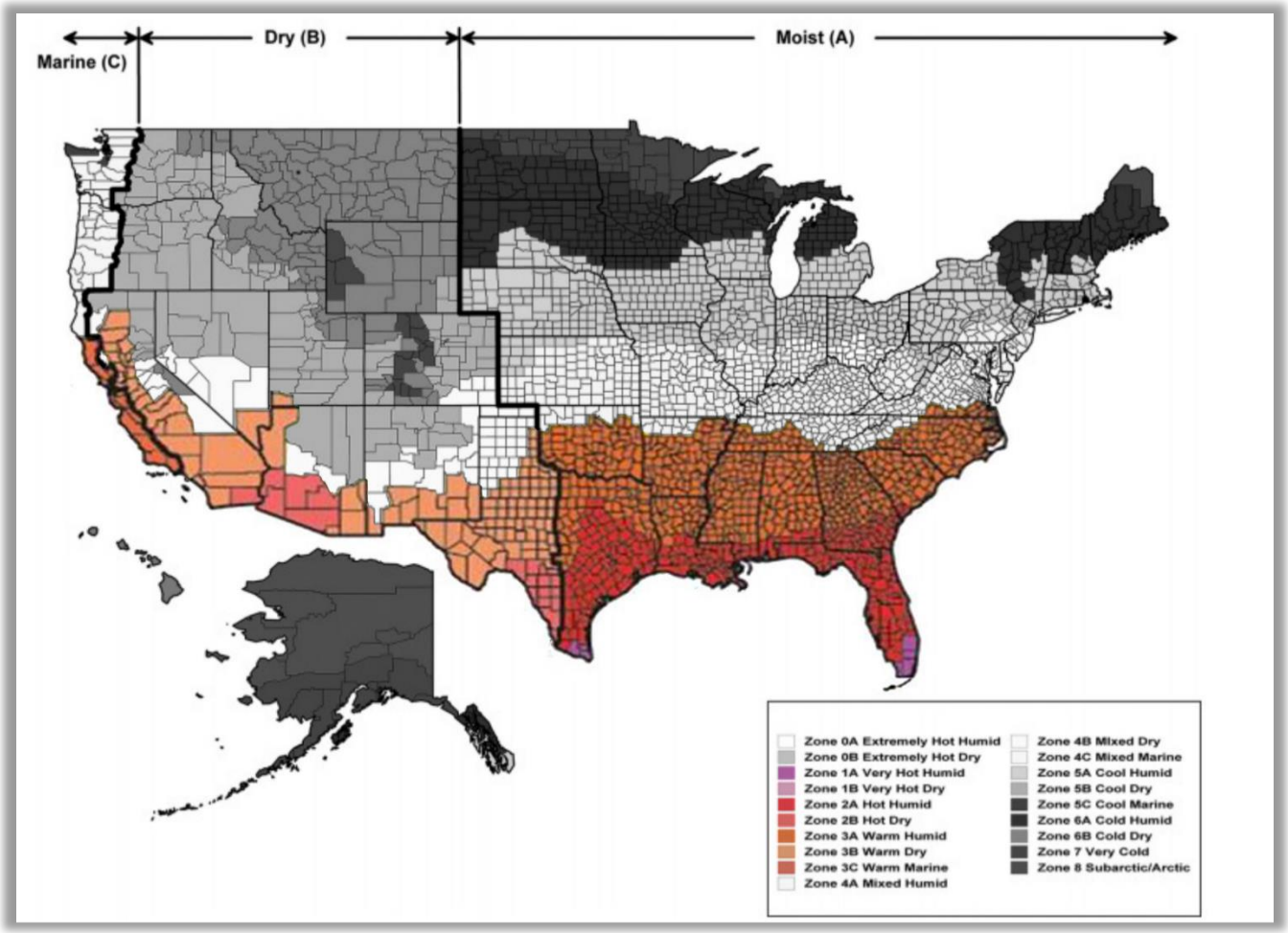

Figure 2: Climate zones 1-3 according to IECC Chapter 3

Roof Angle and Azimuth

Roof pitch and azimuth (direction the roof is facing relative to north) will also affect the amount of solar radiation a roof receives. Solar irradiance is highest when the roof is directly perpendicular to the sun's incoming rays, also known as the optimal angle. In general, solar irradiance will be highest on south-facing roof decks in North America.

Altitude and Humidity

Solar irradiance is also dependent on the air the solar radiation must travel through before reaching the roof. Air and water vapor molecules will absorb solar radiation, reducing the amount of energy that ultimately reaches the roof surface. As reflected in Figure 1, dry climates at high altitudes will have much more direct solar irradiance. Builds located in climate zones 4B and 5B are more likely to require a high temperature underlayment because of their high altitude and low humidity.

Build-Specific Design

Another group of factors that may affect the service temperature of the roof assembly includes the specific roofing materials used on a build, the ventilation techniques used in the roof assembly, and thermal resistance elements under the structural decking.

Roof Covering

The reflectance, absorptance, and long wave emittance of the finished roofing material will affect the service temperature of the underlayment. Darker roof coverings will have higher heat absorption from solar radiation, creating greater exposure to higher temperatures than lighter, reflective roof coverings. The conductive properties of the materials in the roofing assembly will also affect the service temperature of the underlayment. Many metal roof manufacturers require a high temperature underlayment even in colder climates due to their high thermal conductivity and solar absorptance compared to other roof coverings. Certain asphalt shingles are manufactured with highly emissive granules to decrease the amount of heat the shingles retain. The Cool Roof Rating Council® is a non-profit 501(c)(3) organization that specializes in the rating of roof coverings' radiative properties.

Ventilation

Though many factors may increase the temperature of a roof assembly, ventilation can effectively decrease the service temperature of the roofing membrane. Ventilation between the finished roofing material and the ZIP System peel and stick underlayment may offer convective cooling properties, leading to reduced heat transfer. Heat transfer by conduction from the finished roofing is also reduced because it is not in direct contact with the underlayment.

Insulation and Radiant Barrier

Insulation or radiant barriers installed directly under the roof deck are designed to reduce the heat gain from the roof into the interior conditioned space. When the insulation or radiant barrier resists heat, it can lead to more heat being stored in the upper layers of the roof assembly, resulting in increased service temperature for roofing materials.

Please visit Huberwood.com or contact our technical department at 800-933-9220 Ext 2716 or at techquestions@huber.com with any questions or comments.

[1]Sengupta, M., Y. Xie, A. Lopez, A. Habte, G. Maclaurin, and J. Shelby. 2018. "The National Solar Radiation Data Base (NSRDB)." *Renewable and Sustainable Energy Reviews* 89 (June): 51-60.