Tech Solution 519.2

DuPont™ Styrofoam™ Brand Extruded Polystyrene (XPS) Foam Insulation with Dark Roofing Coverings and Adjacent Reflective Surfaces

Introduction

DuPont™ Styrofoam™ Brand XPS Foam Insulation has a maximum use temperature of 165°F (74°C). There have been rare occasions when distortion of the insulation has occurred during installation under dark-colored roofing membranes, filter fabrics, and black plastic drainage boards. In these rare occurrences, excessive heat can cause damage to the insulation in as little as 30 minutes. Darker colors can absorb more solar energy from direct exposure or shiny reflective surfaces leading to excessive heat build-up. This can be exacerbated in roof surface areas where solar reflection concentrates this heat, especially reflections from adjacent glazing. The same behavior can occur in similar situations when insulating with any expanded or extruded polystyrene products. A few, simple, precautionary steps can help prevent excessive temperature situations and decrease the potential for thermal distortion to Styrofoam™ Brand XPS Foam Insulation.

Installation Considerations and Guidelines:

- Always cover stored insulation with a light-colored tarp or film if it will be exposed to direct sunlight.
- Avoid storing insulation next to reflective surfaces, such as glazing, high parapet walls, counter flashing etc.
- Insulation positioned next to reflective surfaces should be covered as it is being installed. Recommended products for covering Styrofoam™ Brand XPS Foam Insulation include white or opaque polyethylene film, common blue tarp (5 mil or greater in thickness).
- Never cover the insulation with clear plastic film.
- In lieu of covering the insulation, a non-reflective material such as black filter fabric can be used to temporarily cover glazing and adjacent reflective surfaces. This covering should be draped in front of the glazing units and not in direct contact with them to reduce any potential damage to the sealed glazing units.
- If heat distortion does occur:
  1. Flip the board over. In many cases this will relax some of the distortion and make installation of subsequent materials much easier.
  2. Cool down the surface with water. When distortion initially occurs, it is sometimes reversible if cooled quickly. Water sprayed on the insulation board within the first few hours of distortion occurring may reverse the distortion.

Solar Reflection Effect

In addition to direct solar exposure, adjacent reflective surfaces, like glazing, metallic surfaces, and light-colored walls can direct additional solar energy onto horizontally placed insulation boards and excessively increase the surface temperature. These surfaces have been known to increase surface temperatures by as much as 72°F (22°C). The impingement of the additional solar heat is illustrated in (Figure 1 A). The ensuing effect is a concentration of heat over the area subject to surface reflection.

It should be noted that solar reflection, even at ambient temperatures as low as 60°F (15°C), can result in surface temperatures in excess of 165°F (74°C) on dark roof surfaces adjacent to the reflective surfaces. The risk of concentrated solar energy is greatest on south, southeast, and southwest elevations. It is also most likely to occur during the summer months when the sun appears at its highest elevation. During the winter months, the solar reflection effect is less likely to occur when the sun is at a lower angle therefore eliminating the concentration of solar energy (Figure 1 B).

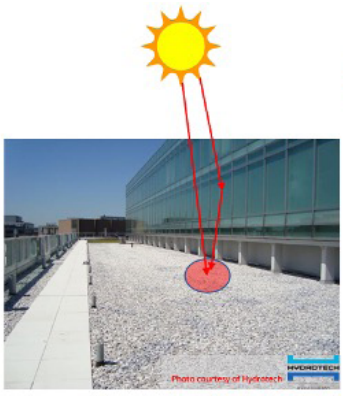

Figure 1A: Summer Solar Reflection Effect

Figure 1B: Winter Solar Reflection Effect

Roofing Assembly Types

PMR Assemblies

In a PMR assembly, the dark-colored membrane is placed under the insulation (Figure 2). At this location, the membrane is protected from UV exposure, freeze-thaw cycling, thermal cycling and mechanical damage from roof traffic during and after construction. The use of a UV-resistant filter fabric placed over the insulation and ballast consisting of appropriately sized stone or pavers offers the necessary UV protection. The ballast protects both the fabric and insulation from UV damage and offers a heat sink to help keep the insulation temperature lower than 165°F (74°C). Unless the ballast is to be installed concurrently with the fabric the fabric should be light-colored. The use of a heavy (> 4.5 oz/yd^2) dark-colored filter fabric installed on the insulation and left exposed before installation of the PMR ballast is not recommended. Overheating is possible when the XPS insulation is located under dark drainage fabrics and/or dark plastic vegetative growth trays. Until vegetation is installed, a temporary white plastic film or light-colored tarp protection may be required especially in areas subject to solar reflection.

Conventional Roofing Assemblies

A conventional roofing assembly has its waterproofing membrane located on the upper side of the assembly (Figure 3). White or cool roof membranes with or without light-colored ballast are not expected to result in insulation temperatures above 165°F (74°C) and are preferred. When installing loose-applied dark-colored membranes concurrent installation of the ballast is recommended. If concurrent installation is not possible, covering the dark membrane with a white polyethylene film or light-colored canvas cloth until the ballast is installed is recommended. The common practice of installing a fiberboard or gypsum coverboard between the membrane and the insulation will also act as a heat sink to help keep the insulation temperature lower than 165°F (74°C).

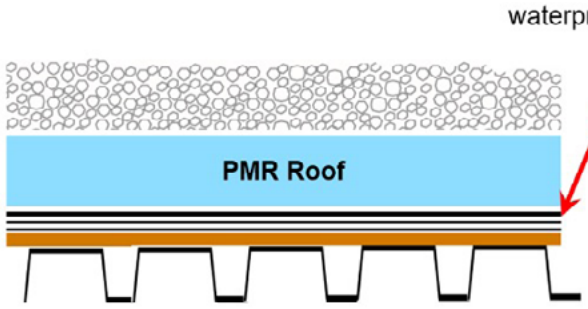

Figure 2: PMR Roof

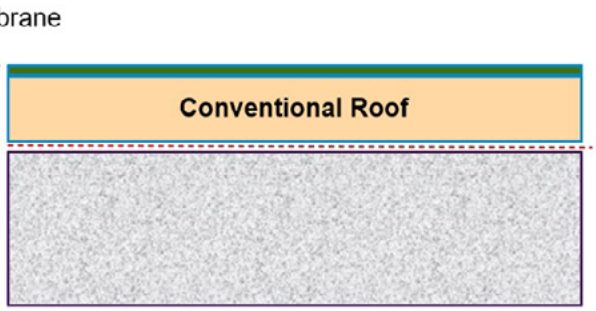

Figure 3: Conventional Roof

Standing Seam Metal Roofing (SSMR) Assemblies

Sloped metal roofing systems like standing seam metal roofing can also lead to thermal distortion of DuPont™ Styrofoam™ Brand XPS Foam Insulation if proper precautions to protect the foam from excessive surface temperatures are not taken (Figure 4). To prevent this, a protection layer (gypsum or fiberboard) can be installed between the metal cover and the insulation layer. Alternatively, furring to create an air space of 1/2" to 3/4" (13 mm to 19 mm) prior to metal roofing installation is also acceptable. Recent cool roof technology used in metal roof panels has altered the solar reflectance of the metal roof surface, resulting in cooler surface temperatures even with the darkest color. As a result, if a cool roof surfacing for the metal is used, any color of metal roof can be used over Styrofoam™ Brand XPS Foam Insulation.

Figure 4: Standing Seam Metal Roofing (SSMR) Assemblies

Summary:

Using Styrofoam™ Brand XPS Foam Insulation in conventional, PMR and SSMR systems provides the owner with proven, durable, and energy-efficient constructions. Depending on the type of roof assembly and the sequence of its installation in areas of a roof where excessive temperatures are possible, use of the precautions in this document will help ensure that these assemblies are installed without damaging the insulation – a key element to the thermal efficiency of this part of the building envelope.

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DuPont™ Styrofoam™ Brand:
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WARNING: Rigid foam insulation does not constitute a working walkable surface or qualify as a fall protection product.

Building and/or construction practices unrelated to building materials could greatly affect moisture and the potential for mold formation. No material supplier including DuPont can give assurance that mold will not develop in any specific system.

43-D100910-enNA-0123 CDP