REASONABLE INTENTIONS AND INSTALLATION TEMPERATURES; A CAUTIONARY TALE

BY JEFF CRAMER, RRC

Introduction

The following story describes an event with less than desirable consequences. An effort has been made to make this article more practical than scientific, the idea being that similar consequences could easily be avoided by remembering the steps that led to this unique problem and not repeating them. It is important to remember that the conditions described are not unique to any particular manufacturer.

The problem

A project manager called our offices to say that extruded polystyrene insulation that had just been installed on a re-roof project had begun to lift and warp. He felt that the manufacturers of the products being installed should be advised. He noted he didn't know what was causing the problem, but that he would like immediate assistance to help determine its cause, as he claimed he had "never seen anything like it."

Arrangements were made to visit the project site the next day. Photos were taken, site personnel were interviewed, and samples of damaged insulation were obtained in the event that lab testing would be required.

The conditions

The words "lift" or "warp" do not adequately describe the condition of the insulation. It was curled similarly to potato chips. The curling was so pronounced that the deformation dislodged the 1/2-inch, glass-faced gypsum coverboard that had been installed with low-rise foam adhesive. Its movement in one location had pulled apart torched-down, modified-bitumen side laps.

Roof system assembly

The roof assembly was as follows: a metal deck; 15# felt; 5/8-inch, Type X gypsum board; a base layer of extruded polystyrene insulation; a tapered, extruded polystyrene insulation, 1/2-inch, pre-

Wrinkling and curling in the EXPS-tapered roof insulation below the 1/2-inch, glass-faced gypsum coverboard.

Left: An overview of an area where the reaction to heat build-up occurred.

Below: The curling was so pronounced that it dislodged the 1/2-inch, glass-faced gypsum coverboard that had been adhered with urethane adhesive to the top layer of the EXPS.

primed, glass-faced gypsum coverboard; and one layer of smooth (black), APP-modified bitumen. Another layer of granulated, APP-modified bitumen was to be installed later.

The 15# felt, gypsum board, and base layer of extruded polystyrene were mechanically fastened to the metal deck with metal screws and plates.

Subsequent layers of tapered extruded polystyrene insulation and the top layer of 1/2-inch, pre-primed, glass-faced gypsum coverboard were installed utilizing low-rise foam insulation adhesive.

Discussion

The same system with the same materials had been installed recently without any problems on another project. The only difference was that on the previous project, the deck was concrete.

The current project included an adjacent building on which the same system had also been installed, using materials from the same shipment without problems. That adjacent building also had a concrete deck. A urethane insulation adhesive manufactured by a different company was utilized to secure the tapered insulation system.

The materials used in the project appeared to be compatible, based on manufacturers' product descriptions and actual field experience.

Installation procedure

There was nothing unusual about the installation procedure, either. However, because the weather forecast reported a possibility of isolated showers in the nearby hills, the roofing crew had covered the first layer of APP-modified bitumen with loose-laid, black polyethylene sheeting (Visqueen™) so that they could continue installation the next morning without waiting for the roof to dry. The crew scattered unopened rolls of modified bitumen membrane randomly on top of the polyethylene.

Jobsite observations

1. Only tapered panels were warped or damaged.
2. No damage to the fill boards or base layer insulation was observed.
3. No damage to mechanically fastened insulation was observed.
4. There was adhesive on unaffected filler board insulation.
5. There was adhesive still in place on undamaged filler board under dam-

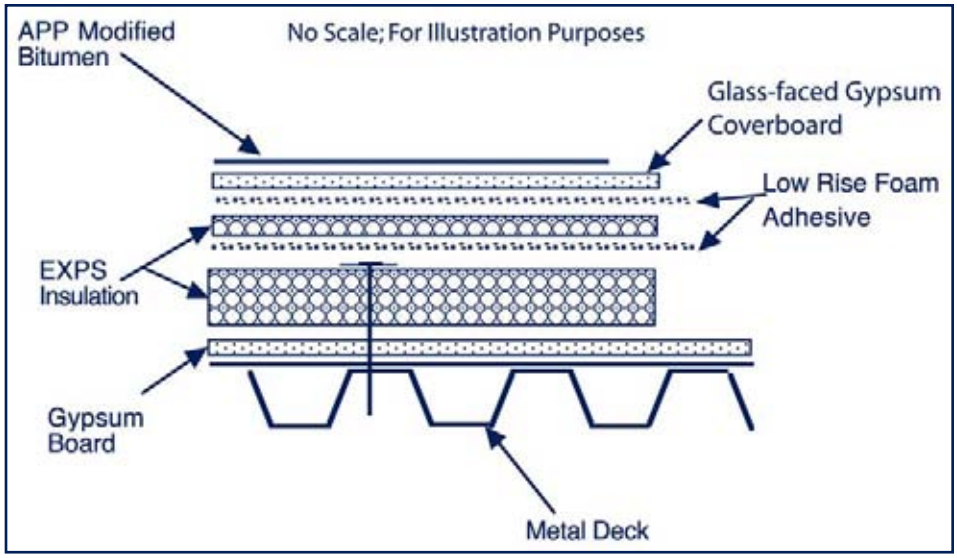
aged tapered insulation.

6. There was adhesive on damaged tapered insulation.
7. No evidence of incompatible chemicals or materials was found.
8. The damaged insulation changed shape but seemed to generally maintain its manufactured mass and thickness.

So what caused the tapered extruded polystyrene insulation to change shape, and could it reoccur?

Extruded polystyrene manufacturers call for their insulation to be protected from temperatures anticipated to exceed 165˚F. They require extruded polystyrene insulation, when stored, to be protected from solar loading by covering it with a light-colored, opaque material.

Installation instructions for EPDM-ballasted roof systems that utilize extruded polystyrene insulation require the immediate application of ballast to completely cover the black membrane to help prevent high temperatures due to solar loading. Solar loading can cause the temperature of black EPDM to exceed 180˚F.



It seems reasonable to believe that black, smooth, APP-modified bitumen could reach similar temperatures due to solar loading. However, based on previous field experience and because the extruded polystyrene was

A side view showing the profile of a lifted area prior to roof cuts for visual observation.

covered by a layer of 1/2-inch, glass-faced gypsum coverboard, it was not anticipated that solar loading would be sufficient to affect the extruded polystyrene insulation.

The only variable was the black polyethylene sheeting laid over the roof to keep its surface moisture-free. This appears to have prevented the dispersion of solar-generated heat, and thus, allowed the tapered insulation to reach temperatures in excess of the recommended service temperature.

The manufacturers of the roof system components were all saying, "Not me, not me." And, of course, they were right. The problem was not manufacturer-specific.

Consequently, the project manager decided to build a small model of the roof assembly using leftover materials. He put the model together and set it out in the sun at approximately the same time of day as when the black polyethylene sheeting had been installed. The next morning they found that the same warping of the tapered insulation had occurred on the model.

Conclusion

Putting a temporary covering over the modified bitumen to keep it dry may seem like a good idea, but the side effect of trapping solar-generated heat can be disastrous. It is always a good idea to pay attention to the temperature limitations of products that are part of the design; one never knows when they will become important to the system.

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