PREFERRED SOLUTIONS, INC.

Cold Weather Processing Guide

General Information

Temperature is one of the most important considerations when applying/spraying two-component spray polyurethane foam (SPF). There are three temperatures to consider:

1. Chemical temperature – temperature of the chemicals in the drums
2. Ambient temperature – temperature of the immediate air/environment
3. Substrate temperature – temperature of the surface to be sprayed

Optimal temperatures for all three of the above considerations are 70°-90°F. Failure to observe the recommended temperature ranges can result in SPF performance issues.

SPF can be successfully applied when actual temperatures differ from optimal temperatures if the proper precautions and preparations are taken. However, experience and practice are the best teachers. We are not providing detailed recommendations for every cold weather application.

Although it is preferable to apply spray polyurethane foam when the ambient and substrate temperatures are at least 70°F, application can be performed at colder temperatures. Temperature of the substrate is a key element as it affects both the density and adhesion of the foam.

Cold temperatures affect reactivity in two ways:

1. They slow down chemical reactions. Cold SPF chemicals may not dispense "on ratio."
2. The heat of the thin chemical product layer is absorbed by the substrate upon contact.

In terms of heat loss, substrate temperature will have a much more pronounced effect than will ambient air temperature, since the liquid- to- air heat transfer process is much slower than liquid-to-solid. Consequently, if the substrate temperature is excessively low, reaction heat will be absorbed so quickly by the substrate there will be no time for the foaming agent which is activated at 90°F to vaporize thus preventing the creation of good foam.

Ambient temperature is only a secondary factor among problems related to cold weather spraying. It is not, however, the case at temperatures of 40°F or lower. Although the reaction appears to take no more than a few minutes following application, the foam will generally not attain complete cure for another 24-48 hours. The lower the temperature, the longer the cure time.

The foam produces an exothermic reaction and its component cells are filled with hot gas during this process. In cold weather conditions, the foam cools quickly, resulting in the compression and then liquefaction of the gas. This creates a void in the cells and, due to the extremely slow passage of air through the cell walls, considerable tension is applied through atmospheric pressure on the mass of the foam. Since the foam is at this stage only partly cured and is still in a non-rigid plastic state, it ends up shrinking under pressure.

Since the foam has not yet completely adhered to the substrate at this point, it has no capacity for resistance to the forces of shrinkage and therefore detaches itself from the substrate. The thicker the foam layer, the greater the problem. If the foam has been applied in a thin layer, it will better resist shrinkage. Consequently, the degree of adhesion of the foam layer depends on its thickness. Since a greater degree of retraction occurs along the outer edges of the foam layer, the tendency is to curl up at the edges and then to detach itself from the substrate.

<u>Guidelines for cold weather application</u>

1. Ensure chemical drums are uniformly warm (70°F+) since cold SPF chemicals will not properly dispense on-ratio if too cold. Poor quality foam may result and excess chemical may remain in one of the drums. Chemicals stored or shipped below recommended temperatures may require a minimum of 48 hours in a warm environment (>70°F.) to achieve proper operating temperatures. Core chemical temperature must be the correct temperature inside the drum, not just on the outside of the drum. Drums originally brought to proper application temperatures may lose heat during transport, sitting on the jobsite awaiting use, or sitting in shade. Keep drums warm and insulated from wind, cold ambient temperatures and cold substrates. Keep drums on pallets and off concrete floors since cold surfaces are heat sinks that draw heat out of the chemicals.

2. Un-insulated chemical hoses exposed to cold air or laying on cold substrates (plywood floors, concrete, etc.) will lose heat and the dispensed chemicals will not be at the appropriate temperature. Protect the chemical hoses from heat loss by insulating the hoses from cold ambient temperatures and cold substrates whether in use or during periods of non-use. Assure hoses are well insulated and in good condition; repair tears or voids in the insulation and jackets.

3. Make sure the proportioner is in good working condition and is able to deliver chemicals at balanced pressures and on-ratio. Unbalanced pressures can be an indication of worn seals, clogged lines, etc. Ensure the transfer pumps are working properly, particularly the Component A transfer pump, which can become inoperative due to crystallized material buildup around the shaft. Ratio is easily verified by examining the foam’s appearance – if the foam is dry and brittle, this indicates the foam is isocyanate rich and if it is soft and spongy, this indicates the foam is resin rich.

4. Make sure spray guns are clean and working properly.

5. Check regularly for condensation on substrates.

6. “Picture frame” the wall first, as this will help reduce shrinkage of the foam applied to the “field” of the wall.

7. Spray the foam in strips (12-18 inches wide or narrower) holding the gun perpendicular to the substrate. The narrower the strip, the less shrinkage and lateral movement.

8. Spray the foam in several thin layers rather than fewer, thick layers in order to reduce shrinkage as the adhesive bond to the substrate may not yet be fully developed to sufficiently resist the shrinkage force which can cause the foam to pull away from the substrate. While the foam reaction may appear to be completed within a few minutes of application, SPF usually takes 24-48 hours at 70°F to completely cure and develop full

physical properties. Longer cure times occur when substrates or air temperatures are colder.

9. Apply first layer of foam to the substrate 1/4 – 1/2” thick and wait 20 minutes for foam to cool.

10. Apply additional layers 1-1.5” thick and allow foam to cool (20 minutes) before additional layers are applied. If unacceptable shrinkage occurs, increase cure time of each pass and/or reduce pass thickness. To make an accurate assessment of adhesion, check after foam has fully cured (typically 24 - 48 hours or longer).

11. Allow foam to fully cure before trimming foam around windows, doors etc.

12. If possible, keep the ambient air temperature during the cure cycle as close as possible to the temperature during application to avoid “thermal shock” to the foam.

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