DEMILEC (USA) LLC.
POLYURETHANE SYSTEMS MANUFACTURER

SPRAY APPLICATION GUIDE
HEATLOK 217-0

Heatlok 217-0 is rigid closed cell polyurethane spray and one of the most effective insulating materials available today. The popularity of this product is growing with insulation contractors, builders, and architects because of the ease and speed of application. The application of an expanding adhesive with high thermal insulation allows the construction of energy efficient building easy and affordable. This product uses the zero ozone depletion potential blowing agents (245FA) approved by EPA for the protection of the environment.

HEATLOK 217-0 has been developed and is ideally suited for use such as:

- Insulation of walls, ceilings and other buildings structures
- Insulation of storage tanks and pipe
- Insulation of highway vans, railroad cars, trucks, trailers etc.
- Insulation of cold storage and walk-in freezers

APPLICATION TECHNIQUES

To achieve the best results from these systems, good spraying practices must be followed. The following recommendations are provided as a guide only.

SUBSTRATE PREPARATION
All surfaces to be sprayed must be free of oil, grease, waxes, rust scale, loose dirt and water.

Some metal surfaces may require sandblasting and priming prior to foam spraying to ensure adequate adhesion. See Demilec USA sales representative for additional information on surface preparation.

The temperature of the substrate has a major effect on foam density and adhesion. Certain compromises are necessary to spray in cold weather. The section in “COLD WEATHER SPRAYING” offers more information on this topic. If in doubt about the substrate temperature or surface conditions, a trial application should be made to check foam quality and spray performance. Water on the surface from rain, fog condensation etc. will react chemically with the isocyanate, adversely affecting the foam and resulting properties, particularly adhesion. If necessary, the applicator should protect the area to be sprayed with a temporary cover to keep rain, snow, dew, etc. Heatlok should not be sprayed when the relative humidity is 80% or above, as high relative humidity can adversely affect the physical properties of the foam.
Wind velocities greater than 10 miles per hour will result in high loss from overspray and may result in excessive loss of exotherm affecting foam density and thermal properties.

Openly, spraying foams under high wind condition should not be done. The employment of wind breaks could be used especially when spraying on the exterior of buildings. The surface finish of the resultant foam will also be affected under these conditions due to overspray and material loss.

COLD WEATHER SPRAYING

Although urethane foam spraying normally should be carried out at ambient and substrate temperatures of 70°F or above, it is practical to spray at the temperatures well below 32°F, provided that suitable precautions are taken and that the correct foam system is used.

Urethane foam formation is initiated by a chemical reaction between an isocyanate and the resin, when they meet in the mixing chamber of the spray gun. This reaction is exothermic i.e., it gives off heat. The heat produced by the chemical reaction causes the blowing agent to vaporize and expand the reacting chemicals into foam. The whole process must be controlled by proper formulating, so that foam rises fully before the foam hardens into its rigid form. If the foam hardens before the complete rise, this leads to creep. Creep can lead to improper adhesion to the surface.

Low temperatures affect the foaming process in two ways.

1. Chemical reactions can be slowed down due to reduced temperature rise within the expanding mass; this could lead to dripping on the wall.
2. The reduced temperature can prevent the physical blowing agent from expanding; this could lead to reduced yield.

The temperature of the substrate has a greater influence of the heat withdrawal from the reacting chemicals than does the temperature of the air, because the heat transfer from liquid to air is as much slower than the rate of heat transfer from liquid to solid. If the substrate temperature is too low, or it is highly conducting substance such as most metals, the heat produced by the chemical reaction may be withdrawn into the substrate so rapidly that the blowing agent will not vaporize and therefore little or no foam will be produced. It is not a good practice to use the heated chemicals to warm up the surface. The reversion, the non-expansion of the blowing agent, in the reacting polyurethane mass may eventually expands when the temperature of the surface increase. This can be seen as voids the following summer on metal buildings after direct sun exposure.

Polyurethane foams such as HEATLOK 217-0 winter version can be sprayed at temperatures as low as 25°F. The chemical makeup of this formulation has been adjusted with catalyst to compensate for cold weather spraying. Special precautions should be taken when spraying various substrates in cold weather. Spraying too thin or too thick can result into reduced yield or cracking. When the urethane foam is processed, the reaction may appear to be completed within a few minutes after application, it actually takes from 24 to 48 hours for the foam to develop its full a strength and the lower temperature, the longer process takes.

The initially applied foam is hot due to the heating of the chemicals from the equipment and heat from the chemical reactions resulting into hot gases within the cells. In cold weather conditions, the foam cools rapidly causing the gases to contract and eventually to condense into a liquid. This creates a full or partial vacuum in the cells resulting into considerable stress within the foam itself. The partially cured foam without achieving its maximum properties could shrink and eventually crack during the curing process. The spraying of foams at thicknesses about one inch per pass could assist in the reduction of the internal stresses. Furthermore, in cold weather conditions, the adhesive bond of the foam to the substrate may not be fully developed so it cannot resist the shrinkage forces, causing the foam to pull away from the substrate. The greater the foam thickness laid down in one pass, the more critical is the problem. If the foam layer is thin, the substrate adhesion has a greater chance to resist the tendency to shrink. As the foam thickness increases, the adhesive forces have less and less effect. The outer edge of the foam layer shrinks more than the inner one causing the foam to curl up at the edges. This curling could lead to the pulling away of the foam from the substrate. To overcome the shrinkage and cracking in cold weather, spraying thin layers rather than the full thickness in one pass could be the applicable technique of choice.

Spraying Thick Sections

Spraying HEATLOK rigid polyurethane foams with thick sections over two inches requires careful control and considerations, in order to avoid splitting, loss of adhesion and even fire. The heat produce by the exothermic reaction of the reacting materials could cause a build up of heat within the insulation. This problem could be aggravated in cold weather. DEMILEC recommends that the foams be applied not more than two inches in a single pass and adequate time be allowed, a minimum of 20 minutes, for the heat within the foam to escape. In applications requiring multiple passes the time required between the passes should be even extended beyond the 20 minutes. In the event that the heat is not allowed to escape the temperature within the foam shall increase resulting in reduced mechanical properties and scorching. In extreme cases, a rapid application of the rigid polyurethane foam with thick sections could lead to a possible fire conditions.

HEATLOK 217 has been tested in accordance to the ASTM E84 and a Class I rating has been obtained for 3 inches. In applications requiring ICC code compliance, the maximum thickness allowed is 3 inches since this product has been tested to three inches.

COLD STORAGE

Cold Storage facilities require vapor barriers! Vapor barriers typically go on the warm side of the insulation system.

Make sure your total system selection conforms to building codes and FDA requirements PRIOR to starting work. Building codes require Class I or Class II foams per ASTM E-84* depending on occupancy, usage, square footage and what is being installed over the foam.

Freezers require 2.0 lbs/ft^2 foams. Use one-inch lift passes in foam application. Thicker passes in deep freezers can lead to SEVERE CRACKING. Using too low of a density foam or an over catalyzed foam also leads to severe cracking.

Proper surface preparation and priming may be necessary prior to the application of HEATLOK in cold storage. Please contact your technical sales representative for additional information on surface preparation and priming.

COLD STORAGE FACILITY –COOL DOWN SCHEDULE

Materials used to construct refrigerated rooms, like all materials used in building structures (i.e., steel frames, metal decks, etc.) are affected by temperature changes. Gradual lowering of the temperature is designed to eliminate problems stemming from these temperature changes while at the same time withdrawing construction moisture, and testing the vapor barrier and mechanical systems.

Time Period	Max. Temp. Reduction	Min. Room Temp.
First 24 hours	-	75º
Second 24 hours	15ºF	60ºF
Third 24 hours	15ºF	45ºF
Fourth 24 hours	10ºF	35ºF
Until room is dry	0ºF	35ºF
(Watch moisture on coils as indicator)		

Temperature Reduction After Attaining Dry State

First 24 hours	5ºF	30ºF
Second 24 hours	10ºF	20ºF
Third 24 hours	10ºF	10ºF
Fourth 24 hours	10ºF	0ºF
Fifth 24 hours	10ºF	-10ºF

EQUIPMENT

Follow the spray equipment manufacturer’s safe operation guidelines for all spray operations. Every spray unit is slightly different and you will need to adjust your preheater and hose temperatures accordingly for each Polyurethane Foam System In addition, adjust your impingement pressures to have desired spray pattern. Use a fixed ratio (one-to-one) having positive displacement pumps connected to a common drive.

SPRAYING

Always spray perpendicular to the surface in one inch lifts. Spraying perpendicular to the surface helps to minimize overspray. One inch foam lifts give optimum foam performance and yield. Thin foam lifts give poor chemical reaction since not enough exothermic reaction will be present. Too thick foam lifts, while giving great yield, leads to weak foam, cracking and scorching. Allow foam lifts to cool somewhat before successive foam lifts are applied. (Exception: High Density foams may require smaller foam lift thickness.) Do not walk on foam immediately after application – this can cause blisters.

How to Avoid Over-Spray?

Over-spray occurs from a variety of reasons. Spraying under windy conditions and not spraying perpendicular to the surface are the two main reasons for over-spray. Spraying the over-lap edges at an angle could result in very rough surfaces – AVOID SUCH PRACTICES! Over-spray does not have enough exothermic reaction present to properly cure. Excessive over-spray may lead to blisters or delaminating of additional passes of foam or coating. Over-spray can travel long distances to coat objects left unprotected e.g. windows, buildings and automobiles to name a few. Excessive over-spraying of objects can result by spraying over the edge of a building. Cover objects nearby to prevent to prevent over-spray

SAFETY PRECAUTIONS FOR SPRAY APPLICATIONS

1. If possible, spray when the building is uninhabited.

2. If the building is occupied, notify maintenance and a person in authority of the process.

3. Employees in job area must wear appropriate safety equipment. Positive pressure breathing apparatus, respirators, safety glasses, gloves, coveralls, etc., as needed to avoid breathing vapors, overspray and skin or eye contact.

4. Seal off all building penetrations and turn off ventilation systems within 100 feet of the spray area. Make sure proper building personnel are notified so allowances can be made.

5. Post warning signs at all doorways exiting into the job area.

6. Rope off area where overspray may drift.

7. Clear area of cars and other objects to prevent overspray problems. Protect what cannot be moved.

8. Do not spray during high wind conditions. Overspray, tough surface and poor cure can result.

9. Minimize overspray.

10. Employees on job site must follow good safety and health practices.

11. Review with personnel on job site all MSDS, safety and handling information and labels. Keep it available for reference on the job site.

12. Do not expose cured foam or liquid component containers to heat sources.

13. Dispose of all foam scraps in a prompt and safe manner in accordance with all federal, state and local regulations.

14. Avoid moisture contamination. DO NOT seal the isocyanate component container if moisture has been introduced into it.

15. Dispose of used containers in accordance with federal, state, and local regulations. Do not leave empty containers on the job site. Decontaminate empty non-returnable isocyanate component containers and puncture or crush to prevent reuse.

16. Clean up all spills immediately; refer to MSDS and safety and handling information.

17. Contact the coatings manufacturer for appropriate guidelines for the safe handling and use of the coating system.

SPRAY FOAM TROUBLE SHOOTING HINTS

Poor Yield	Too cold for system. Doesn't get full rise. It is substrate that counts. Order faster system or winter system. Too hot for system-cures too fast to allow full rise. - Hose or unit heat too high. - Blowing agent boiled off in opened containers. - Order slower reactivity system or seal containers or order summer system. Off Ratio Foam - Check Equipment. - Surface contamination; water, solvent. Poor Mix – Use correct impingers and or mixing chambers Wind conditions – Wind taking heat from substrate and foam before cure. - Use a windscreen, tighter pattern, less heat to reduce overspray, or stop work.
Crawling/ Creep	Substrate temperature too cold for the system. Wind conditions too high for system. Off ratio foam, check equipment and check for surface contamination. Check for adhesion to substrate or primer.
Reversion or Disappearing Foam	Substrate too cold for system. Off ratio resin rich foam. Check equipment. Poor mix - use correct impingers or chambers.
Spongy Foam	Off ratio resin rich foam. Also can exhibit large cells. Check equipment. May later revert to some extent. Next pass may blow off or "disappear". Poor adhesion of next pass. Tear off and refoam. Check for moisture, humidity and surface contamination.
Dark Yellow Glassy Foam	Off ratio isocyanate rich foam. Poor yield, poor adhesion, glass eyes. Next pass may "blow off" and have poor adhesion.