LAYFIELD

Cold Temp Handling Guide

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Although it is preferable to avoid installing lining materials in cold temperatures, occasionally it can not be avoided. Cold weather usually requires a modification of installation techniques, or may involve substitution of materials to ones which have superior cold weather handling capabilities.

Plastic lining materials are designed for installation in moderate temperatures. Most lining materials become rigid and brittle in the cold climates and seaming, handling, and testing require additional care. In most cases it is better to wait for a break in the weather rather than to attempt an installation in cold/poor weather. If site conditions or construction schedules require installation in cold temperatures please take into account the information in this Tech Note, and call Layfield prior to proceeding.

There are a number of complications that may result from installing geomembrane in cold weather. First of all, most lining materials become progressively stiffer and become much more difficult to handle. It becomes more difficult to place the liners over complex subgrades and attaching stiff liners to pipes and appurtenances can be very difficult if not impossible.

Lining materials that are designed to be backfilled often have low temperature handling restrictions. A regular flexible PVC lining material may crack if folded and impacted at less than -10°C (0°F). This PVC lining material was designed to be backfilled, and relies on the backfill to prevent movement at very low temperatures. Once backfilled, the lining is prevented from flexing and much lower temperatures can be handled. HDPE is a very difficult to handle in cold weather and normally has a has a practical welding restriction of -25°C (-13°F). Other materials with a low temperature handling restriction are Polyurethane (ester based types) and the unsupported grade of Arctic Liner (U). A practical guide to the handling of lining materials is contained in Table 1.

Table1. Cold Temperature Handling Guide

Material	Tested Value (ASTM Method)	Practical Low Temp. Handling Limit
Regular PVC 20 mil	-26°C, -15°F (D1790)	-5°C, +23°F
Regular PVC 30 mil and up	-30°C, -22°F (D1790)	-5°C, +23°F
HAZGARD 100 30mil (U)	-30°C, -22°F (D1790)	-10°C, +14°F
HAZGARD 250 38mil (S)	-40°C, -40°F (D2136)	-15°C, +5°F
HAZGARD 1000 (S)	-40°C, -40°F (D2136)	-20°C, -4°F
HAZGARD 5000 HT (S)	-30°C, -22°F (D2136))	-10°C, +14°F
HDPE 60mil	-70°C, -94°F (D746)	-25°C, -13°F (Welding Limited)
EPDM 45mil	-45°C, -49°F (D746)	+5°C, +41°F (Issues with sealant tape)

Some lining materials may have been designed to be left exposed but may not be appropriate to your location. Exposed linings employing some materials may not be practical in northern Canada, Alaska, the Prairies, the Canadian Shield, and many parts of the northern Midwest States. **As a general rule of thumb, a liner should not be left exposed where the temperature can be expected to go below its**

practical handling temperature.

All lining materials are tested for cold temperature performance. The tests used vary by material, each type of material may have a different test. Only when we gain experience by handling lining materials in the field can we gauge how the test values relate to field results. There are many problems associated with field installations that will affect the comparison between the tested value and field performance. One of the most dramatic changes is caused by solar heating. Even on a -30°C (-20°F) day dark lining materials can reach a surface temperature of over +30°C (+80°F) through solar heating. By waiting until later in the day, a liner can often be placed in otherwise prohibitive temperatures. Cloud cover, wind, snow, and ice can all reduce the ability to handle the liner in cold temperatures.

Seaming of lining materials in adverse weather conditions can be a real challenge. Solvent bonding techniques used for PVC and Arctic Liner welding cease to work at temperatures below +10°C (+45°F). At temperatures below this the solvent does not evaporate fast enough to create a good bond. Application of heat to a solvent bonded seam until the liner is warm to the touch will normally create a good seam (Caution; Solvents are inflammable and extreme care should be taken whenever heat is applied in the vicinity of solvents). Glues and tapes used for repairs are also subject to cold temperature limitations and may not work at less than +10°C (45°F).

Heat welded seaming of lining materials can take place at much lower temperatures. In cold weather installations the presence of moisture in the form of snow, frost, or ice is a bigger problem than actual ambient temperature. Most heat welding techniques do not make good welds when moisture in present. The material most sensitive to this is HDPE which must be completely dry before welding begins. In practical application this usually means waiting until the sun has driven the frost off the liner later in the day before welding. Extreme cold weather can also lead to problems with HDPE in that the seams can be cooled too quickly which can lead to internal stresses in the seams. HDPE installations are typically limited to temperatures above -25°C (-13°F) and can usually only proceed on sunny days at these temperatures.

Heat welding of Polyurethane, Arctic Liner (U) and (S), XR-5, Hypalon, and and Polypropylenes can take place at lower temperatures than gluing or solvent bonding. Usually a hand-held hot air welder is used, and frost and moisture are driven off with the hot air as the weld is made. Cold temperature welding is normally limited to repairs and short joints because it is a slow and labor intensive process.

Probably the most important practical limit to cold temperature installations is the requirement that backfill be finely divided and free flowing. Use of backfill that is frozen, or that contains lumps of frozen fill or ice is not recommended as it can cause damage to the liner. Often it is the freezing of the backfill which brings the winter lining project to a halt. The use of tarpaulins and heaters to keep backfill dry and unfrozen may help extend the temperature range of the project.

In placing backfill it is important to remember that the lining material becomes more sensitive as the temperature drops. Extreme care needs to be taken in placing backfill at low temperatures so that the fill is not dropped, or otherwise permitted to “shock” the liner. Dumping the backfill on an area off the liner and then rolling into place is the preferred method. Please see the Layfield's Tech Note on Backfill for further details.

If installation must go ahead in extreme cold then there are a number of techniques that may help. First of all, keep the liner panel warm until the moment before installation. Keep the panel in a heated building or under a tarpaulin with a heater. Use a heater directed at the panel to keep the liner material a few degrees above the air temp. Do not attempt to place the liner on an overcast day or on a day with extremely high wind chills. Heat your backfill so that it is warm and free flowing. The final technique to install liners in extreme cold weather is to use a low temp material. Table 2 contains a list of materials that are suitable for extended cold temp installation.

Table 2. Low Temperature Materials

Material	Tested Value (ASTM Method)	Practical Low Temp. Handling Limit
Arctic Liner**NT**® 30mil (U)	-50°C, -58°F (D1790)	-30°C, -22°F
Reinforced Polyethylene (RPE)	-55°C, -67°F (D2136)	-40°C, -40°F
Enviro Liner 20, 30mil (U)	-40°C, -40°F (D746)	-30°C, -20°F
GeoFlex (U)	-40°C, -40°F (D1790)	-30°C, -22°F

HAZGARD 535	-40°C, -40°F (D746)	-30°C, -22°F

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