CAN'T BE STOPPED BY THE COLD

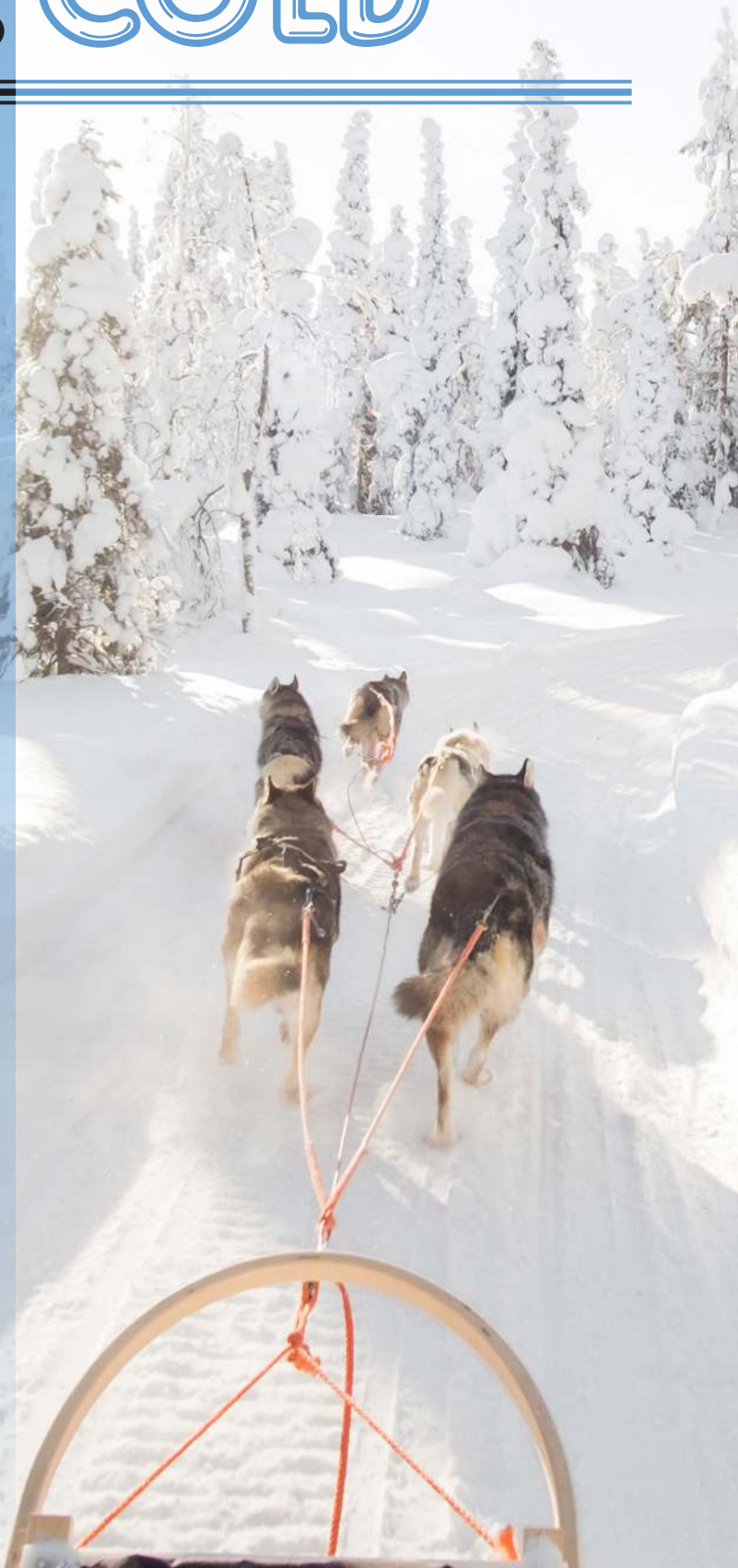
John Strong, Richard Norsworthy and Dave D'Ambrosio, Polyguard Products, USA, describe the factors to consider when coating pipelines in cold weather, from application technique to the choice of coating.

Coating underground pipelines in cold weather is a common occurrence for most pipeline operators. For the buried pipeline industry as it relates to field applied coatings, a project is typically defined as cold weather application if temperatures dip below 40°F (4°C). There are many ways to address the cold weather temperatures and to properly apply a coating in the field on the pipeline. These are very expensive and time-consuming, but must be followed if the coating is to perform as intended.

Another issue is choosing the proper coating for the field joints or replacement coatings applied in cold weather. Some coating options and issues are discussed in this article. One coating type provides applicators with an excellent choice for cold weather coating because it requires less heating, less application time, and once applied needs no further heat or cure time.

Cold weather issues

Most pipeline coatings are not well adapted to cold weather applications because the cure mechanisms require a minimum temperature for a certain duration, to complete the cure. Snow (cold), freezing rain (cold plus liquid moisture), frost (cold plus solid moisture) and other issues contaminate the surface and lower temperatures.



To overcome these issues, pipeline companies use various techniques such as tenting combined with heating (Figure 1). Not only does the air temperature have to be correct to avoid problems with dew point, etc., but the substrate or pipe itself must be kept within the temperature range specified by the coating manufacturer in its application for the specific type of coating to be used.

The coating products must be stored in a warm environment, as per the manufacturer's recommendations, before and during the application process. This includes transportation from storage to the application site. The material must be kept warm in the cab of a truck or in heated containers until use. It must be emphasised that the coating material must never be left exposed in the back of the truck or containers overnight, unless it is covered and properly heated.

Preheating the pipe is a critical step in the process and should be carefully performed by experienced applicators. Preheating the pipe must keep the pipe in the proper curing range for the required time without causing damage to plant applied coating or the pipe itself. If the preheat temperature is too hot, this can cause some coatings to cure too quickly. If snow or ice is inside the pipe, it will act as a heat sink and cool the area, not allowing proper cure.

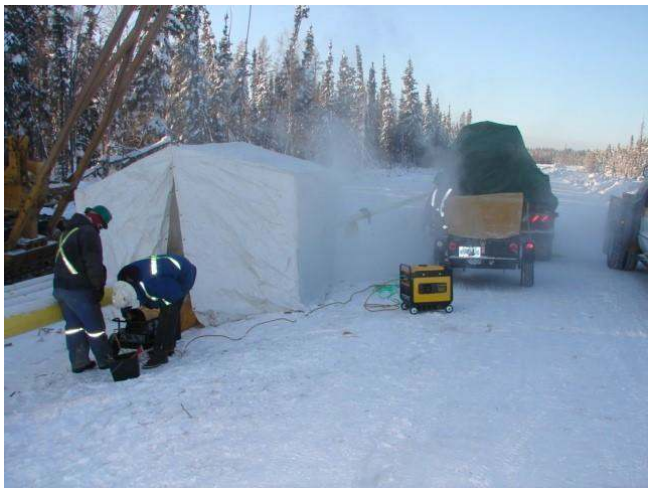


Figure 1. Heated tent in cold environment coating applications.

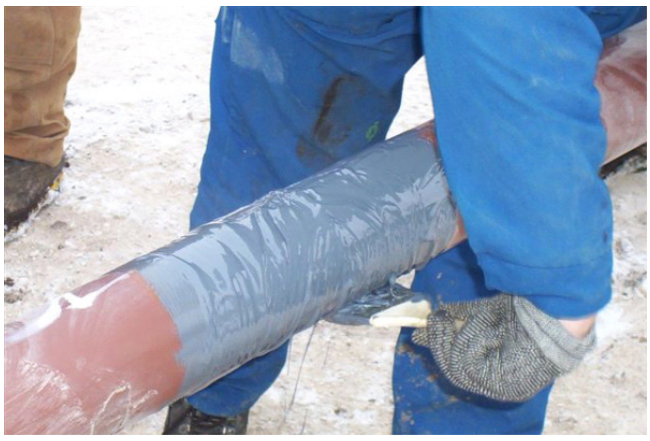


Figure 2. Applying two-part epoxy in a cold weather environment.

In-service pipeline product temperature must also be considered. Pipelines cannot be properly heated if cool product is flowing through the pipe. If the product is not flowing, the pipe may be heated to allow the coating to cure, but if the product begins to flow, the heat will dissipate, and the coating may not properly cure.

Coating choices

Two-part epoxies and other liquid coatings

Most liquid applied coatings will either take a long time to cure or will not cure at all at colder temperatures. If the temperature on the pipe and atmosphere are not held in the correct range for the proper time – as required per the manufacturer's application specifications – there may be only partial cure, leading to coating failure.

At this low temperature point the coating applicator will need to employ expensive preheat, tenting and/or encapsulation to speed up the cure for the coating. If these methods are not used, most liquid coating is susceptible to damage from remaining viscous on the pipe (Figure 2). Holidays, drips, and sags are common imperfections that may result from incomplete cure due to the ambient and/or substrate temperature being below the acceptable low temperature application limit. If the liquid coating does not cure properly, the first coat will have to be removed and pipe recoated.

Some two-part liquid coatings are formulated for cold weather application. This means the formulation has been changed from the ones used at higher temperatures. If these are used, they should be subjected to the same testing as the others, but testing should be performed on samples that were coated and cured at the lower application temperatures.

Solid film backed tapes

These products have been used for many years to coat pipelines around the world. They are relatively easy to apply and like mesh backed tapes (MBT), require less overall heat and are ready for holiday detection and backfill almost immediately. They have been used to coat entire lengths of pipe, field joints, and used for repairs. Most require a primer.

Solid film backed tapes stretch much easier than MBT, which allows soil stress and other mechanical damage to cause the solid film backing to stretch easily, causing wrinkling of the tape. This is a major problem with these products. Once the backing stretches and wrinkles, water can penetrate these void areas and cathodic protection (CP) shielding usually occurs, allowing external corrosion on those pipelines. The problem of CP shielding with solid film backed tapes has caused many companies to stop using them.

Viscoelastic

Viscoelastic tape coatings can be used in cold weather. Because of their nature, these coating types remain relatively soft in cold weather, but do require all the same efforts to keep the coating material and pipe surfaces warm – as with other coating systems. They are easily applied and can be used on somewhat irregular shapes.

Since these coatings are relatively soft, they are easily damaged by rocks and other hard objects in the backfill. Because of solid film backings, CP shielding can be a problem if disbonding occurs and electrolytes penetrate.

Figure 3. Liquid adhesive applied to heated pipe in cold weather application.

Figure 4. Beginning application of Polyguard RD-6 with approved wrapster.

Figure 5. Completion of Polyguard RD-6 application with wrapster.

Heat shrink sleeves

Heat shrink sleeves (HSS) are field applied coatings normally used for field joints where the pipe can be heated, and it requires heat shrink and cure. The low temperature issues mentioned earlier are also a concern for shrink sleeve applications, and may lead to inconsistent heating. Heat shrink sleeves are well known for CP shielding if adhesion failures occur.

Mesh backed tape

MBT coating is a proven option to address cold weather application on field joints or repairs. The MBT can be applied in low temperatures by storing the MBT materials in a temperature controlled environment of 70 - 100°F (21 - 38°C). At these temperatures, the MBT can be applied to the blasted and primed pipe surface at much lower temperatures than other products. If the MBT is stored below the mentioned temperature range, the pipe can be preheated to 70 - 100°F (21 - 38°C), primed, and coated.

Once the MBT coating has been properly applied, no more heat is required. The MBT coating system will 'wet' the surface on contact and remain bonded when applied within the acceptable temperature range. The bond to the surface will also be dependent upon correct tension during application. For this reason, using a company-approved manual operated machine for proper tension during application is strongly recommended for an MBT system. In special circumstances, as with all coatings, it is recommended to contact the manufacturer for guidance.

Once the application of MBT is complete the coating may immediately be inspected for holidays and backfilled. The MBT coating will not require continued monitoring, heating, or encapsulation.

A successful application of an MBT in cold weather is not a difficult task when using the methods recommended by the manufacturer. The project will be complete the first time and will not require a reapplication to correct any problems due to the low temperatures. The last thing people want to do in the cold is repeat something they have already done.

Conclusion

Coating field joints or replacing coatings during rehabilitation in cold weather is always challenging and expensive. The use of heated tents, encapsulation, and heating the pipe to provide an environment conducive for proper curing of the coating is always required. All coating materials must be kept in properly heated containers and in the proper temperature range until applied.

Unlike liquid coating, the Polyguard RD-6 coating system is easier to apply in cold weather, requires less overall heating, does not require lengthy cure times, and can be inspected, holiday detected, and buried soon after application. Combined with over 30 years of excellent field performance and proven non-shielding to CP currents (if adhesion failure were to occur), this coating is designed to provide an alternative to liquid and other coating types to be applied in cold weather.