

Heat-Shrinkable Sleeve Systems Provide Long Term, Reliable Protection

Heat-shrinkable sleeves are the most widely used technology in the world today for field girth-weld corrosion protection because they're easy to install, provide excellent protection, and are cost-effective.

The first heat-shrinkable sleeves were introduced over 35 years ago when polyethylene pipeline coatings started to replace bituminous or tape coatings in the oil and gas industry. Back then, the processing for polyethylene to make the sleeve backing was new technology and the adhesives used in sleeves were much the same as those used on pipeline coatings.

The technology behind cross-linking polyolefin materials (polyethylene and polypropylene) to make sleeves has advanced since then, and adhesives used today are formulated to provide performance under demanding pipeline conditions. Epoxy primers are also used for 3-layer systems for maximum corrosion protection.

Polyolefin Backings

Heat-shrinkable means just that, heat them up and they shrink, or more correctly, they recover in length. A heat-shrinkable sleeve starts out with a thick extruded polyethylene or polypropylene sheet that is formulated to be cross-linkable.

After extruding the thick sheet, it is taken to the "beam" where it is passed under a unit that subjects the sheet to electron irradiation. This irradiation process cross-links the polyolefin and improves the molecular structure such that it will work as part of a heat-shrinkable sleeve. It makes it perform more like a tough, heat-resistant, elastic material, than like a plastic material.

After cross-linking, the sheet is stretched by feeding it into a machine that heats it up, stretches it and cools it down. Because the sheet has been cross-linked, after stretching, it will want to recover to its original length when re-heated.

Adhesives and Functions

An adhesive is then applied to the sheet, which is the key to ultimate performance of the installed system. The adhesive has many functions. It adheres the installed sleeve to the steel cutback and mainline coating, it resists shear forces imparted by soil pressure after the pipeline is buried and provides long term corrosion protection to the steel. The choice of which adhesive to use is based on the pipeline design and operating conditions. The adhesive needs to be cho-



Offshore application of heat-shrinkable sleeves.



Onshore application of heat-shrinkable sleeves.

sen based on its compatibility with other pipe coating materials, corrosion protection properties, adhesion strength, and resistance to shear forces imparted by pipe movement and the effects of soil pressures.

The coated sheet is then cut into individual sleeves suitable for application on a pipeline. As mentioned before, the sheet is stretched and wants to recover when heated, so a sealing strip or "closure" is applied during sleeve installation so that the sleeve will stay in place during and after recovery.

Epoxy Primers

Three-layer polyolefin-based pipeline coatings are common today and the field joint must also be installed as a similar 3-layer system. This requires an epoxy primer. Primers for heat-shrinkable sleeves work in the same manner as an FBE primer does when it is specified on 3-layer pipeline coatings and is typically applied between 150µm and 300µm thick. The most common method of applying this primer is by using a 100% solids, 2-component liquid epoxy that is mixed, applied and force-cured prior to application of the heat-shrinkable sleeve.

Heat-Shrinkable Sleeve Systems

The choice of which type of sleeve to use on a project rests with the specifier who may consult with the sleeve manufacturer for recommendations. Pipelines are constructed under a variety of conditions; onshore, offshore, cold climates, hot climates and even hostile environments. Recommendations are made based on pipeline environmental and geographical construction conditions along with consideration of operating and in-service performance requirements.

Properly specified and applied heat-shrinkable sleeves can provide corrosion and mechanical protection that is equal to or superior to the mainline coating, be it a tape, epoxy or multi-layer polyolefin.

Best Practices

For any size of project, best practices need to be followed when specifying the product, during installation and for inspection. These are:

- **Product selection.** Consult with the sleeve manufacturer or a consultant who is knowledgeable about available grades of products on the market.
- **Contractor qualification & training.** Ensure that the contractor is fully trained in the installation of the product. Credible manufacturers will have the resources to send field service people to a job site to train the crew.
- **Ongoing inspection.** Confirmation that the proper level of surface preparation is being done plus a simple peel test will tell if the product has been installed properly.

As with any field-installed construction product, field-joint protection systems are reliant on proper selection and installation quality to attain optimum performance. For heat-shrinkable sleeves, ensure that a proven system is specified, manufacturer installation recommendations are followed and ongoing inspection is done to ensure quality of installation. ❖

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