

Figure 1. Canusa-CPS Wrapid Shield PE.

Added MECHANICAL protection

Commonly used pipelay methods can severely damage a pipeline's protective coating.

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Increasing demand for oil and gas energy means new infrastructure projects and, ultimately, construction of new pipeline networks. During design and construction of these new pipeline networks, asset owners and contractors must be mindful to protect the external pipeline coating. External coatings act to protect the pipeline by interfering with corrosion mechanisms, thus providing an effective barrier against corrosion. Since most of these pipeline networks are often expected to last for more than 20 years, under a wide range of operating service temperatures, protection of the pipeline coating during the construction phase should be taken just as seriously as the initial pipeline coating design.

The primary objective of a pipeline coating is to provide long-term corrosion protection for the underlying carbon steel pipe. The long-term anti-corrosion properties of a protective coating are determined by the coating's ability to withstand forces associated with



soil stresses, thermal cycling, hydrothermal ageing, moisture ingress, penetration, resistance to peel, resistance to shear, resistance to cathodic disbondment, and various other forces. The anti-corrosion properties remain as long as the coating remains fully intact. However, aggressive pipelay construction methods present risk of coating damage, hence the need for added mechanical protection.

Factory-applied coatings

External coatings on a pipeline network are considered to be either factory-applied or field-applied. Generally, factory-applied coatings are those applied to the longer sections of the mainline pipe and are coated in a factory-type setting. Field-applied coatings are applied to the welded sections of the mainline pipe in a field-type environment.

Typically, factory-applied protective coatings can be classified into three different coating types: 3-layer polypropylene (3LPP); 3-layer polyethylene (3LPE); and fusion bonded epoxy (FBE). The 3LPP and 3LPE mainline coatings are comprised of a primary anti-corrosion FBE layer, a chemically modified polypropylene (CMPP) or polyethylene (CMPE) copolymer layer, and a PP or PE outer sheath (top coat), respectively. The CMPP or the CMPE layers of a 3-layer system act as the tie-in layer between the PP or PE top coat and the underlying FBE coated surface. The PP and PE top coat along with the CMPP and CMPE tie-in layers provide exceptional mechanical protection to the underlying FBE coated steel surface. FBE can be found as a standalone single layer system, or with an optional secondary layer typically acting as an abrasion resistant overcoat. Although FBE can be used as a standalone system with or without a dual-layer, in most cases a 3-layer PP or PE factory-applied solution over FBE is recommended for optimal mechanical protection.

Field-applied coatings

Field-applied coatings are applied to the exposed steel ends (i.e., cutbacks) of the mainline pipe with an overlap onto the factory-applied coating. These girth weld field joint sections should be coated with the same or similar protective coating type as the factory-applied mainline coating. The concept here is to create end-to-end protective coating performance



Figure 2. Canusa-CPS Wrapid Shield XL.

for the newly constructed pipeline network. For consistent end-to-end pipeline coating performance, the field-applied coatings on the field joints are required to have the same long-term corrosion and mechanical protection properties as the factory-applied mainline coating.

Pipelay construction methods

Industry standard pipelay methods put the integrity of pipeline coatings at risk of damage. Depending on the geological terrain, pipelay methods such as backfilling, thrust boring and directional drilling can place immense stresses directly unto the protective coating. In some cases, these stress levels may extend beyond the intended design parameters of the coating. These high-risk pipelay construction requirements should be clearly identified prior to the start of construction and call for additional mechanical protection systems to the specific pipeline section.

Pipelay methods can either be trenchless or open trench. Trenchless operations, such as directional drilling and thrust boring, are often used to avoid various obstacles such as roads, railway tracks, steep slopes and watercourses. During trenchless operations, the protective coating on a pipeline can come in contact with, or be pulled through, area of dense bedrock, gravel, cobble stone, and/or boulder fragments. As a result, the trenchless pipelay method can be very harmful to the external coating. The severity is based on the surrounding terrain and the contractor capabilities to operate in such terrain. The open trench method of pipelay construction also risks damage to the protective coating. A pipe section is first placed into an open trench depth and subsequently buried or backfilled with the same material used to make the trench. It is the presence of rocks, stones or boulders within the backfill material that can cause damage to the coating. Note that, typically, backfill material can fall from heights up to 6 ft (1.8 m) creating very high impact forces.

Additional protection

Canusa-CPS has been successful in providing a wide range of field-applied coating solutions for over 40 years. Due to the company's extensive and longstanding track record, it is recognised as the global leader of field-applied protective coating technologies supplied to the pipeline industry. Although Canusa-CPS' primary focus is field-applied coatings for long-term corrosion protection, the company has since developed and launched first-class performing systems for added mechanical protection for use in directional drilling, thrust boring and backfilling operations.

Currently, Canusa-CPS offers the following mechanical protection systems to protect the factory-applied and field-applied protective coatings from unforgiving construction methods.

Wrapid Shield™ PE

Wrapid Shield™ PE is an advanced extruded and blown polyethylene Rock Shield system engineered to provide high impact resistance and compressive strength when used

as a protective layer over top of anti-corrosion coatings. The material resists high impact damage due to rocky backfill materials. Wrapid Shield PE is more economical, lighter weight and easier to install than alternate methods of backfill protection. The chemically inert open mesh design allows water to flow around the pipe ensuring that it will not shield cathodic protection, even when applied in multiple layers. Moreover, the Wrapid Shield PE material is light weight and easy to handle in the field while providing superior mechanical protection performance. Such performance characteristics tested against industry recognised Rock Shield standards include, but not limited to, compressive strength (ASTM D1621), falling weight impact (ASTM G14) and limestone drop (ASTM G13) tests.

Wrapid Shield™ XL

Wrapid Shield™ XL is a high performance and easy-to-apply spiral wrap system designed to provide mechanical protection to field joint coatings for directional drill, thrust bore or severe backfill scenarios. Wrapid Shield XL is a moisture curable polyurethane pre-impregnated fibreglass outer wrap applied directly over the field joint coating. The pre-impregnated resin can be activated by saltwater or freshwater to coat and protect any diameter of pipe within minutes. The system provides effective protection against high abrasion and shear forces. The system is fully compatible with cathodic protection systems, resists cathodic disbondment, is designed for a wide range of operating temperatures and can be applied over field-applied and factory-applied coatings. For the intended use, Wrapid Shield XL was tested successfully against relevant test standards including, but not limited to, shore D hardness (ASTM D2240), gouge resistance (CSA Z245.20) and impact resistance (ASTM G14).

HBE™ -DX

HBE™-DX is a robust two-component liquid epoxy coating system, which has been specifically formulated for directional drilling and thrust boring applications. The high build formulation design presents high gouge resistance, high tensile elongation, high impact resistance and sufficient flexibility properties to be compatible in tough environmental conditions. Applied as a standalone coating system, or in combination with other Canusa-CPS' field-applied coating systems, HBE-DX has proven to withstand high mechanical forces associated with various pipelay methods while providing excellent anti-corrosion performance. HBE-DX is predominantly used for protection of pipeline field joints or as an FBE over coating. This environmentally friendly, 100% solids, novolac epoxy system can either be spray applied or brush applied to the intended substrate.

DDX™

DDX™ provides advanced girth-weld protection for pipes used in directional drill applications. In addition to providing effective protection against pull-through forces that occur during the directional drilling operation, the DDX is a multi-



Figure 3. Canusa-CPS HBE-DX.



Figure 4. Canusa-CPS DDX.

layer system that provides superior corrosion protection at pipeline weld joints. It employs a force-cured liquid epoxy layer, applied direct to steel, followed by the application of a primary and sacrificial DDX coating system. The DDX is an all-in-one 3-layer solution for corrosion and mechanical protection. The primary DDX system overlaps and chemically bonds to the ends of the factory-applied coating and to the epoxy coated steel surface. The narrow sacrificial DDX system is applied at the leading edge of the direction of pull which provides added protection to the most aggressive point of the directional drill or thrust boring process. Although the DDX system provides exceptional mechanical properties as a standalone system, for added mechanical protection during a directional drill or thrust boring application in rocky terrain, Wrapid Shield XL or HBE-DX can be applied on the DDX's leading edge as an overcoat.

Successful protection

Canusa-CPS' Mechanical Protection Product Platform aims to serve the needs of the pipeline construction industry by providing leading edge technologies. Although the Wrapid Shield PE, Wrapid Shield XL, HBE-DX and DDX were only launched in recent years, they are quickly becoming the preferred choice(s) for added mechanical protection to factory-applied and field-applied pipeline coatings. 