Diversity of field-applied pipeline coating technologies

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Overview of Canusa-CPS

Global projects providing field services & training

Saudi Arabia, Scotland, Algeria, The Med, Kazakhstan, China

The perfect coating...

• Has no flaws
• Allows no water (electrolyte)
• Will not allow any current flow between the anode and cathode, but...
• Most coatings will be damaged
• Most coatings allow some water (some more than others)
• Regional conditions affect selection

Field applied coatings

Some basics...
4.2 External Corrosion Control

4.2.1 External corrosion control must be a primary consideration during the design of a piping system. Materials selection and coatings are the first line of defense against external corrosion. Because perfect coatings are not feasible, CP must be used in conjunction with coatings. For additional information, see Sections 5 and 6.

4.2.2 New piping systems should be externally coated unless thorough investigation indicates that coatings are not required (see Section 5).

Mainline coating properties & characteristics

- Resist impact, abrasion, penetration (transport, construct, operate)
- Flexible
- Long term adhesion to the substrate
- Resist environmental conditions
- Resist cathodic disbondment
- Remain functional under operating conditions

Field applied coating properties & characteristics

- Perform at P/L operating temperature
- Withstand soil stress
- Resist impact damage
- Compatible with mainline coating
- Resistant to construction handling
- Withstand environmental conditions during application
- Economics

Typical field joint recommendation

- Field joint systems must meet or exceed mainline coating requirements:
  - FBE: HSS, Liquid Epoxies or FBE
  - PP: Polypropylene systems
  - 3LPE: 3-layer polyethylene systems
  - Pre-Insulated Pipe: Corrosion protection, insulation, sealing system, mechanical protection

ISO activities: Field applied coatings

Table I – Field applied coatings

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Pre-welded longitudinal seam</td>
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<tr>
<td>B</td>
<td>Prevention tape</td>
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<tr>
<td>C</td>
<td>FBE: Fusion Bonded Epoxy</td>
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<tr>
<td>D</td>
<td>PP: Polypropylene Jacket</td>
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<tr>
<td>E</td>
<td>3LPE: Three Layer Polyethylene</td>
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<tr>
<td>F</td>
<td>Pre-Insulated Pipe</td>
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<tr>
<td>G</td>
<td>Insulation</td>
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<tr>
<td>H</td>
<td>Sealing system</td>
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<td>I</td>
<td>Mechanical protection</td>
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<tr>
<td>J</td>
<td>Insulation, mechanical protection</td>
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<tr>
<td>K</td>
<td>Pre-insulated pipe</td>
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<tr>
<td>L</td>
<td>Insulation, mechanical protection</td>
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<tr>
<td>M</td>
<td>Field joint</td>
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<td>N</td>
<td>Pre-Insulated Pipe</td>
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<td>O</td>
<td>Insulation</td>
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<td>Y</td>
<td>Mechanical protection</td>
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<td>Z</td>
<td>Pre-Insulated Pipe</td>
</tr>
</tbody>
</table>

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NACE activities:
Field applied coatings

- Polypropylene for 3LPP
- Polyethylene for 3LPE
- Ultra high impact resistant systems
- High-build, force-cured epoxy
- Liquid epoxy systems
- High-strength coatings
- Visco-Elastic coatings

Polypropylene
The GTS-PP system
Crosslinked Polypropylene Backing
Adhesive Fuses Directly to Mainline Coating
Pre-attached Closure for Wraparound Configuration
Force-cured Epoxy on Steel Only

Polyethylene
The GTS-PE system
Advanced PE copolymer adhesive technology
- Very low installation temperature
- Fusion to 3LPE factory coating
Pre-manufactured components
Easily installed by trained contractor

The GTS-PE technology
3-Layer Product Design:
- Anti-Corrosion Layer: Force cured liquid epoxy
- Adhesive Layer: PE Copolymer
- Backing Layer: Cross-linked HDPE
Comprised of the same materials and provides equivalent performance to 3LPE factory coating
Performance in accordance with highest standards for 3LPE factory coatings

Impact resistant coatings
3-Layer HSS with High build force cure epoxy

Force curing liquid epoxy with induction heat

Completed 3-layer HSS

High strength coatings for directional drilling

Liquid epoxy for repair & rehabilitation

“Visco-elastic” adhesive based products

• Most adhesives are considered “visco-elastic”
• Balance adhesion & cohesion
• Basic premise:
  - sticks
  - will not fail adhesively
  - leaves some protection in place
• “Visco-elastic” is a generic term for the coating type
• Primarily rehabilitation focus
• Niche markets

Saudi Arabia

A unique challenge

Coating damage (after excavation)
Coating damage (after excavation)

Visco-elastic description

- Wraparound coating (tape)
- Modified and reinforced visco-elastic adhesive on a carrier film
- Impermeable barrier to water and air
- Supplied in roll form
- Two layer coating system
  - Inner layer of Wrapid Bond™
  - Outer layer of Wrapid Coat™
- Compliant with EN 12068 and Shell requirements for Visco-elastic materials
- ISO standards being developed
- Manufactured to ISO 9001 standards

Wrapid Bond™

- Adhesive formulation based on Canusa’s adhesives experience and latest raw materials
- Base product, Wrapid Bond™
  - 2mm adhesive, embedded mesh, 75µm PE backing
- Complimentary products include:
  - outer wrap PVC tape for soil stress resistance
  - high impact fiberglass outer wrap
  - a filler / seam tape
  - others being developed

Emerging coating option

Conclusions

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Thank you