

Northeast Gas Association Gas Operations School

Basics of Field Applied Coatings

Presented By: Shane Quackenbush
Liberty Sales & Distribution, LLC
squackenbush@libertysales.net
Office: (877) 373-0118
Cell: (518) 441-5532

Pipeline Failures

▶ #2 Reason for Pipeline Failures:

- **CORROSION**

▶ #1 Reason for Pipeline Failures:

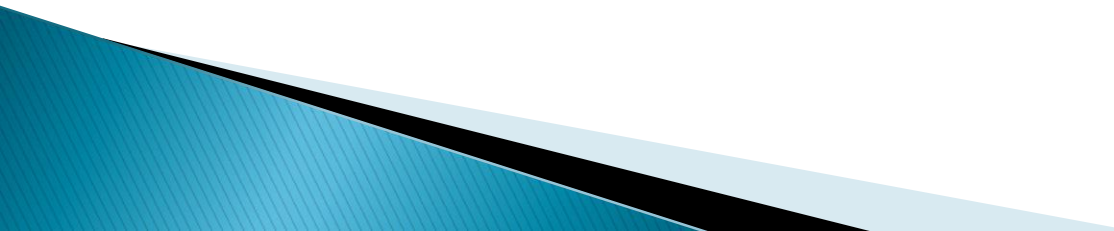
- THIRD PARTY DAMAGE

Materials Performance – 2001

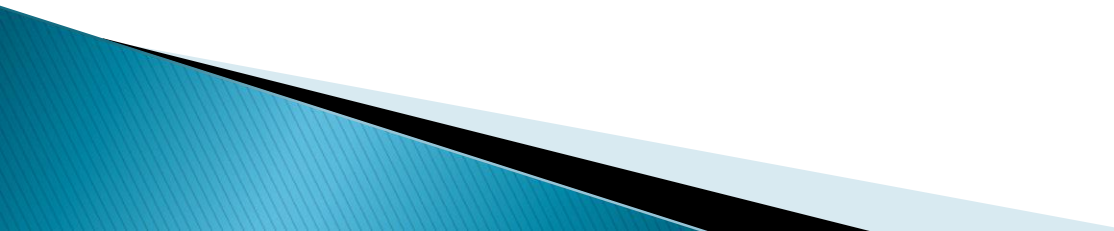


CORROSION PREVENTION

An effective coating system will reduce the potential for product loss, environmental contamination, and the related hazards to life, property and damage to the surrounding environment caused by a catastrophic failure due to active corrosion.



Why Do Coatings Fail?

- ▶ Improper or insufficient Surface Preparation
 - ▶ Faulty Application Procedure
 - ▶ Wrong Coating for conditions
 - ▶ Extraordinary Conditions
- 

Improper Surface Preparation



UV Damage on Below Grade Tape



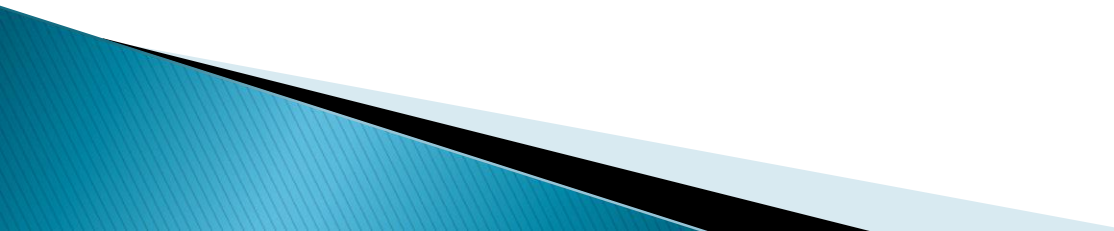
Application Procedure



Abnormal Conditions



Curriculum Outline

- ▶ Surface Preparation
 - ▶ Materials Selection
 - ▶ Application Procedures
 - ▶ Inspection & Backfill
- 

Surface Preparation

Surface Preparation

- ▶ All substances that could interfere or prevent the coating from *bonding* to the substrate must be removed prior to the coating.

Remove:

- o All loose Rust, Dirt and Dust
- o Moisture, Grease, Oil, Mill Lacquer & Shop Coating
- o Sharp Edges, Burrs, Weld Slag, Mill Scale

Clean: to NACE/SSPC-SP standard for desired coating

Pre-Heat: (when applicable) substrate to Mfg's specifications

Refer: to Manufacturers Installation Guides to determine the appropriate surface preparation procedures for the coating you are using.

Without PROPER surface preparation the coating will FAIL

Surface Preparation Standards

<u>SSPC</u>	<u>NACE</u>	<u>Description</u>	<u>Detail</u>
SP1		Solvent Cleaning	Removal of oil, grease, dirt, soil and contaminants by cleaning with solvent, vapor, alkali, emulsion or steam.
SP2		Hand Tool Cleaning	Removal of loose rust, loose mill scale and loose paint by hand chipping, scraping, sanding and wire brushing.
SP3		Power Tool Cleaning	Removal of loose rust, loose mill scale and loose paint by power tool chipping, descaling, sanding, wire brushing and grinding
SP10	2	Near White Blast Cleaning	Blast cleaning until at least 95% of each square inch is free of all visible rust, mill scale, paint and foreign matter.

Surface Preparation Standards

<u>SSPC</u>	<u>NACE</u>	<u>Description</u>	<u>Detail</u>
SP6	3	Commercial Blast Cleaning	Blast cleaning until at least two-thirds of each square inch is free of all visible residues.
SP 7	4	Brush Off Blast Cleaning	Blast cleaning of all except tightly adhered residues of mill scale, rust and coatings.
SP 8		Pickling	Complete removal of rust and mill scale by acid pickling, duplex pickling or electrolytic pickling.
SP5	1	White Metal Blast Cleaning	Removal of all visible rust, mill scale, paint and foreign matter by blast cleaning.

SP3



SP 2-3 Visual Guides



SP10 Near White Blast



Materials Selection

Types of Coating Materials

▶ Cold Applied Coatings

- Cold Applied Tapes
- Wax Tapes

▶ Hot Applied Coatings

- Shrink Sleeves
- Hot Applied Tapes

▶ Liquid Coatings

- Epoxies (Two part and single coat systems)
- Paints (Multi layered systems)
- Mastics (single coat systems)

▶ Specialty Coatings

- Repair Patches (Hot & Cold)
- Exothermic Weld Coatings
- Wire Splice Kits

Know your Application Parameters and Coatings Selection Capabilities

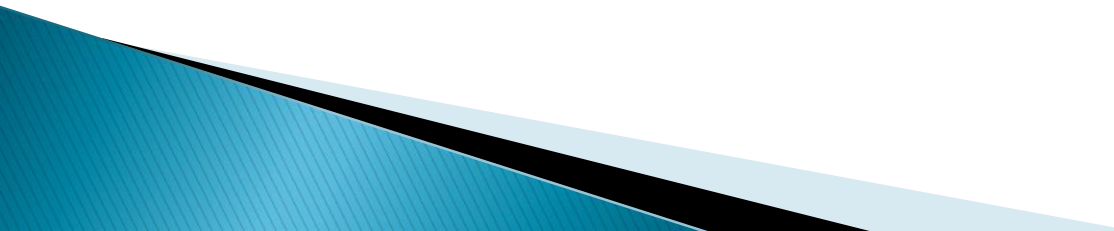
Good Coatings Characteristics

Per: NACE SP-0169

- ▶ Sufficient Dielectric Strength to be an Effective Electrical Insulator
- ▶ Effective Moisture Barrier
- ▶ Good Adhesive and Cohesive values, to the Substrate (pipe surface) and coating itself.
- ▶ Ability to Maintain these Qualities over the Service Life of the Pipe

Material coating selection is a critical step in protecting against external corrosion

Material Selection Considerations

- ▶ Surface Preparation Limitations
 - ▶ Operating Temperatures (Hot & Cold)
 - ▶ UV Exposure
 - ▶ Damp or Wet Surfaces
 - ▶ Irregular Shaped Pipe Configurations
 - ▶ Size and Weight of Pipe
 - ▶ Extraordinary Application Conditions
- 

Compensating for Abnormal Conditions



Application Procedures

Follow Manufacturers Application Guidelines

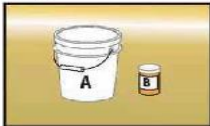
Application Guide

Manual / Kit Application

Powercrete® R-95

Powercrete R-95 is a 100% Solids Epoxy used for corrosion and abrasion protection. This coating is applied over clean, bare steel and adjacent plant applied or mainline coatings. The application is fast and easy. Simply follow these guidelines.

1. Product



1. The 2-component epoxy coating is supplied in pre-measured kits. Part A (large container) is the base and Part B (small container) is the curing agent.

2. Application Kit (OPTIONAL)



2. The "Application Kit" contains a mask, Wet Film Gauge, Gloves, trowels, a PE stir stick, and abrasive paper.

3. Surface Preparation



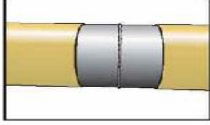
3. Insure that surfaces are clean of grease, oil, salts and other contaminants. If necessary, use Acetone, MEK or other suitable solvent. Perform cleaning when pipe is 3°C (5°F) above dew point.

4. Surface Preparation



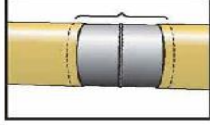
4. Blast clean surfaces to a near white ISO-8501, NACE No. 2, SA-21/2 (SPC-SP 10) or better using particle blasting (sand or other). Sweep blast adjacent FBE or CTE coating. 50 mm (2") to either side of cutback (the bare steel area).

5. Surface Preparation



5. A 2.5-4 mil (63.5-101.6 micron) surface profile with sharp angularity. Burnishing or polishing must be avoided. Surface preparation can be controlled using surface profile tape. Dry surface and insure ideal surface preparation.

6. Surface Preparation



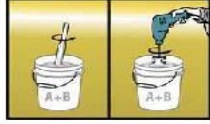
6. While not always necessary, preheating can be useful just prior to application.
A. To eliminate moisture, preheat the cutback area to approximately 40°C (104°F).
B. To accelerate curing, preheat the cutback area to approximately 90°C (194°F).

7. Combining & Mixing



7. Warm parts A & B to 20°C (68°F) and mix by pouring all of part B into part A. Thoroughly scrape container and lid of B. Slowly begin mixing to avoid introducing air into the mixture.

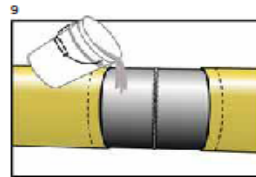
8. Mixing



8. Use a mixing speed that uniformly blends the 2 parts, but does not create a vortex in the mixture or spillage.

Note: Between 20°C (68°F) & 40°C (105°F), mix for 2 - 3 minutes with a drill mixing paddle or 4 - 5 minutes with the stir stick. Blend both parts to create a uniform color with no streaks.
*Berry Plastics does not supply these kits.

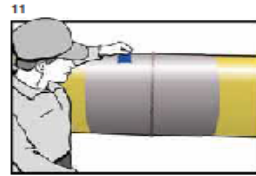
AG-PC-R-95-MANUAL-REV-10
Page 1 of 2



9. Reconfirm that the application temperature is above 10°C (50°F) & 3°C (5°F) above the dew point. Then slowly pour mixed epoxy onto pipe. See "Tips" below for additional suggestions.

Tip: Masking tape may be applied to left & right 50mm (2") beyond cutback (see dotted lines) and later removed while the coating is still tacky to create a straight edge and neat appearance

*Note: Powercrete R-95 may be applied and cured at colder environmental temperatures if the pipe is heated during the application and cure..



11. Use a Wet Film Gauge to measure that the desired minimum thickness has been achieved. Double check around the weld to insure minimum desired thickness.

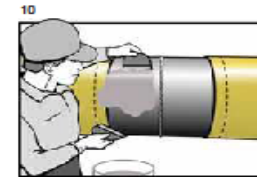
Storage

For optimum performance, store Powercrete® Epoxy products in a dry, well-ventilated area. Maintain products in original packaging and sealed until just before use. Avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental conditions or contaminants.

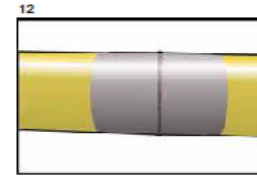
NOTE: Avoid prolonged storage at temperatures above 40°C (104°F) or below 5°C (40°F).

Safety Guidelines

Important: Read the MSDS prior to using the products. Product installation should be done in well-ventilated area and in accordance with local health and safety regulations. These application guidelines are intended as a guide for standard products. Consult your Berry Plastics representative for specific projects or unique applications.



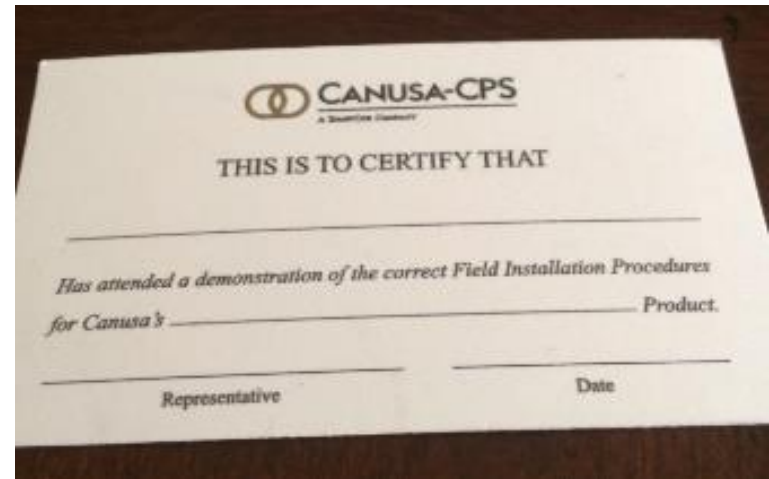
10. Use trowels, brush or roller to apply required minimum thickness of coating to the Field Joint. Cover at least 50mm (2") of the adjacent mainline coating.



12. The curing rate* will vary according to pipe and ambient application temperature. Refer to curing rate chart to determine when to perform a Shore D check.

Training – Certification – Documentation

- ▶ Training Cards v Certifications
- ▶ PHMSA/STATE Regulatory Requirements
- ▶ Certification PRIOR to Project Start Ups
- ▶ Training by Authorized Manufacturer's REP
- ▶ Use of Proper Tools & Equipment
- ▶ Abnormal Operating Conditions
- ▶ Documentation
- ▶ NACE Coating Inspectors



Certification Letter

- ▶ KEY Factors for Certification:
 - Knowledge
 - Skill
 - Ability
- ▶ Witness Physical Installation
- ▶ Abnormal Operating Condition



LIBERTY SALES & DISTRIBUTION

2880 Bergey Road, Suite F • Hatfield, PA 19440 • Ph: 877-373-0118 • Fx: 888-850-3787

August 16, 2016

Dear Utility Co.

Please find this letter as certification that on August 10, 2016 I witnessed Joe Brown of Install, Inc. demonstrate the **Knowledge, Skills and Ability** to apply 2-part liquid epoxy coatings in accordance with the Manufacturers Field Installation procedures for DENS0 7200 and POWERCRETE R-95.

Thank you and please do not hesitate to contact me should you have any questions or concerns.

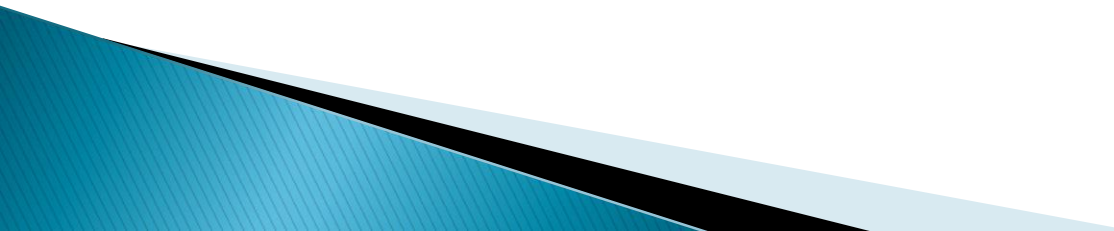
Sincerely,

Shane Quackenbush


Shane Quackenbush
Regional Sales Manager – Northern
Liberty Sales and Distribution, LLC
2880 Bergey Road
Hatfield, PA 19440
Office: 877-373-0118
Cell: 518-441-5532
squackenbush@libertysales.net
CC: Wally Armstrong – Liberty Sales and Distribution



Cold Applied Tapes

- ❑ Mil Thickness
 - ❑ Primer Requirements
 - ❑ UV Resistance
 - ❑ Temperature Limitations
 - ❑ Chemical Resistance
- 

Primers for Cold Applied Tape

- ▶ Why do you need a primer?
 - ▶ Use the Primer specified by the Coating Manufacturer.
 - ▶ Apply Primer as soon as possible after surface preparation
 - ▶ Allow Primer to get Tacky or Dry, as specified. When ready apply the Tape.
 - ▶ Some Tapes are primer optional.
- 

Wrapping Methods

- ▶ **Spiral Wrap** (The preferred method)
 - The tape with a pressure sensitive adhesive can be applied with a more uniform tension giving the coating a better bond to the pipe surface
 - A Spiral Wrap has fewer exposed tape ends, eliminating areas of potential problems
 - 2", 4" and 6" width tape are best handling for spiral wrapping
- ▶ **Cigarette Wrap**
 - Coating with strips of tape around the circumference of the pipe
 - Use when conditions do not allow clearance for Spiral Wrapping







TAPE COATING TIPS

Surface Prep

- ▶ Clean Dry Surface
- ▶ The coating should be applied as soon as practical after cleaning to keep dirt and rust bloom from re-contaminating the pipe surface.

Tape Width

- ▶ 2" & 4" wide tape are the easiest to hand apply.
- ▶ Applying the tape spirally, use a tape width that is not greater than the diameter of the pipe.

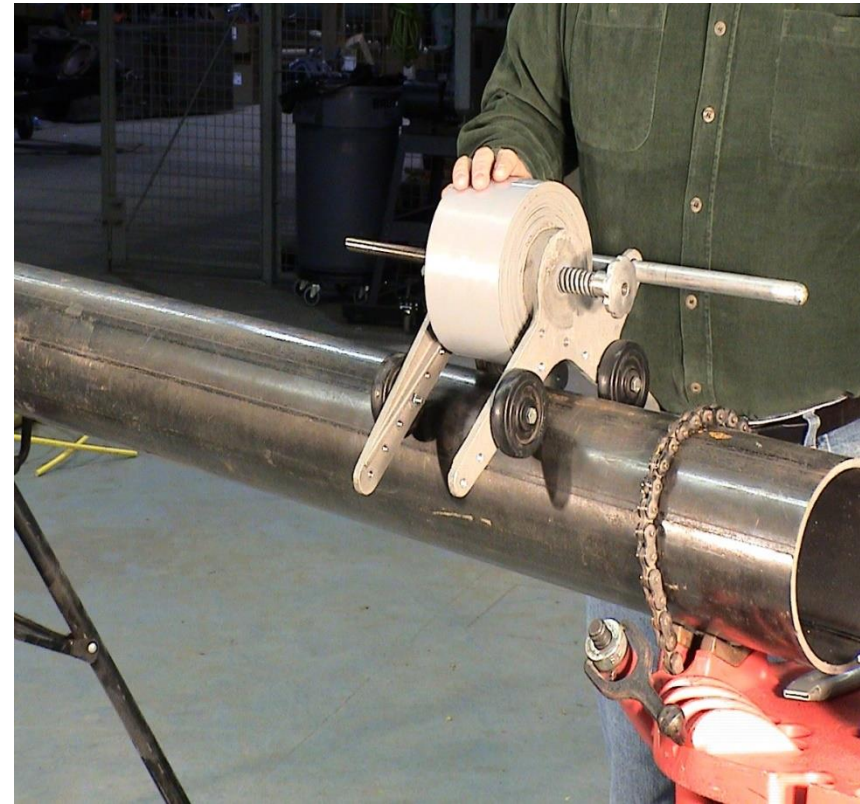
- ▶ Use narrower width tape for wrapping difficult angles.
- ▶ Back wined the tape to smaller rolls if the roll is too large to comfortably handle.

Wrapping

- ▶ Remove the release liner as the tape is being applied.
- ▶ Keep the roll close to the pipe to avoid wrinkles.
- ▶ **Tape Tension is critical**
- ▶ End the wrap on the down side of the pipe.

Tape Wrapster

- ▶ Wrapping tools or machines make larger coating jobs easier and faster
- ▶ They apply the tape spirally with a uniform tension and a controlled overlap



Cold Tapes for Irregular Surfaces

Tapes designed for wrapping Tees, Fittings, Irregular Surfaces and small diameter pipe

- ❑ Backing should be very flexible
- ❑ Highly moldable and conformable
- ❑ Adhesive more forgiving and self healing

Caution: Because these tapes are softer by design they should not be used as standard coating tapes on larger or heavier piping



Wax Tapes

Wax Tape Characteristics

- ▶ **Encapsulation Coating System**
- ▶ **Extremely Pliable**
- ▶ **Excellent for Irregular Shaped Surfaces**
- ▶ **Minimum Surface Preparation**
- ▶ **Excellent in Wet environments**
- ▶ **UV Stable – Above & Below Grade**
- ▶ **Immediate Backfill**
- ▶ **High Temp & High Tack Tapes available for Structural Surfaces**



Above Grade (Exposed) Applications

- ▶ Bridge Crossing
- ▶ Service Risers
- ▶ Piping & Fittings in Buried Vaults
- ▶ Extreme Wet Conditions
- ▶ When the Pipeline can't be Properly Dried



Below Grade Applications

- ▶ Irregular Shapes:
Coupling, Tees, Valves & Fittings
- ▶ Pipelines
- ▶ Underwater or when substrate can NOT be dried properly
- ▶ Immediate Backfill



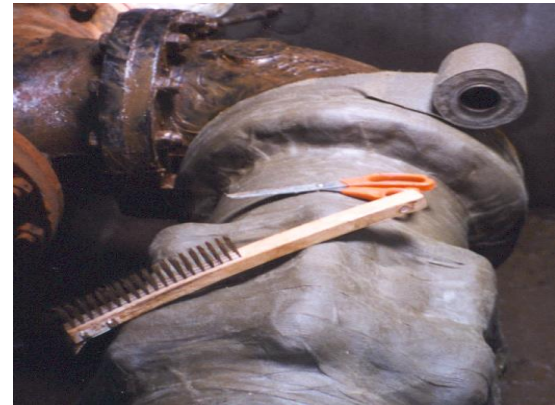
Surface Preparation

▶ Minimal Surface Preparation:

- SSPC – SP2 – Hand Tool Cleaning
- SSPC – SP3 – Power Tool Cleaning

▶ Remove

- Loose Scale
- Loose Rust
- Loose Paint
- Disbonded Coatings



Wax Tape Primer

- ▶ First Line of Defense in Corrosion Protection
- ▶ Apply Immediately after Cleaning Surface Area
- ▶ Hand Apply by Gloved Hand in a Continuous Thin Film
- ▶ Rub & Press into Substrate
- ▶ Apply with a 3" overlap to Existing Coating



Specialty Products

- Profiling Mastic
 - Used to Smooth Out Irregular Shapes – i.e. couplings, flanges & valves for easy application of tape



Applying Wax Tape

- ▶ Spiral Wrap (Preferred)
- ▶ Cigarette Wrap
- ▶ Minimum of 1" Overlap on Seams w/ a 55% Overlap on high corrosive environments
- ▶ Overlap 3" on Mainline Coating
- ▶ Make Intimate Contact to Substrate
- ▶ Smooth Out All Lap Seams
- ▶ Remove Air Pockets and Repair Holiday's / Voids
- ▶ Apply Outerwrap on 10" > Below Grade Applications





Protective Mechanical Wraps

- ▶ Additional Mechanical Strength
 - Soil Stress
 - Backfill
 - Rocky Conditions
 - Ledge
 - Rollers and Supports
 - HDD
- ▶ Types
 - Poly Wraps
 - Fiber Glass Wraps
 - Fiber Glass Shields
 - Rockshield
 - Select Fill



Mechanical Protection for HDD



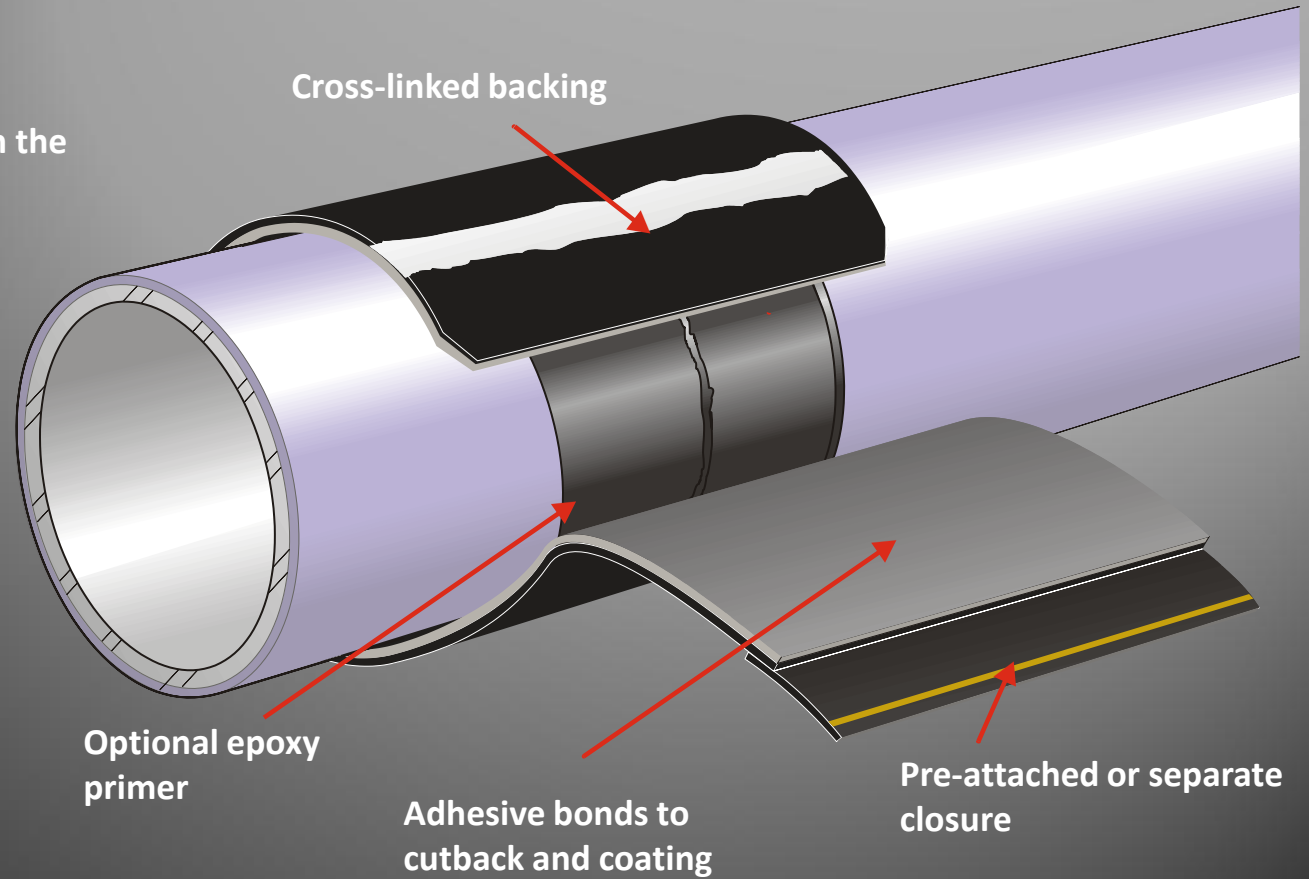
Sacrificial Wrap Over Corrosion Coating



Hot Applied Coatings

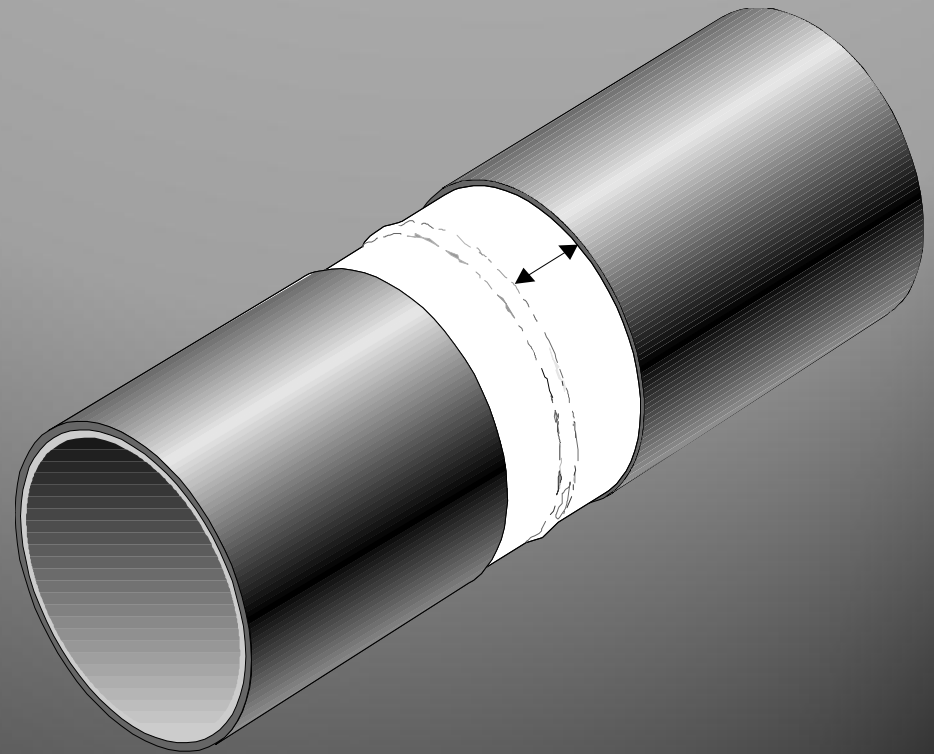
Heat-Shrinkable Sleeve System

Must be compatible with the mainline coating




Selecting the Proper Sleeve

- ▶ Pipe operating temperature
- ▶ Pipe coating type
- ▶ Cutback distance
- ▶ Outside pipe diameter
- ▶ Adverse soil conditions
- ▶ Climate conditions
- ▶ Surface preparation
- ▶ Mechanical resistance



Keys to Successful Installation:

- ▶ Proper Surface Preparation
 - ▶ Use of the proper tools (Pyrometer, Torch, Gloves, Rollers)
 - ▶ Primer/Epoxy Application (if required)
 - ▶ **Achieve the correct Pre-Heat**
 - ▶ Center Sleeve to the cutback
 - ▶ Allow 2”-3” minimum overlap to mainline coating
 - ▶ Closure Tab installation
 - ▶ Follow correct procedure for shrinking
 - ▶ Visual Inspection & Holiday Test
- 

Heat Shrink Sleeve Application

Surface Preparation:

- ▶ **SSPC – SP2 Wire Brush** substrate to remove all rust, loose & foreign materials. Power wire brush may be used.
- ▶ **SSPC– SP10/NACE 2 Near White Blast** preparation may be required for hot melt adhesive sleeves used for HDD
- ▶ Lightly abrade (sweet blast) 2”–3” mainline coating



Heat Shrink Sleeve Application

“Pre-Heating” the Substrate:

- ▶ Preheat area to Mfg’s required temperature:
 - Mastic Adhesives (140°–150°F)
 - Hot Melt Adhesives 190°F/+
- ▶ Remove moisture & wet out the adhesive
- ▶ Verify Preheat Temperatures on Weld Joint and Coating using a Contact Thermometer
- ▶ Verify required preheat temperatures at 12/3/6/9 o’clock positions
- ▶ Use the proper heating device for ease of application



Heat Shrink Sleeve Application

- ▶ Center sleeve and wrap Loosely on field joint
- ▶ Allow for approx 1" of recovery to sleeve
- ▶ Assure 2"-3" of overlap onto adjacent coatings



Heat Shrink Sleeve Application

- ▶ With **low intensity** heat flash 3"–4" of Underlap adhesive to Wet Out the adhesive
- ▶ Secure to substrate using a gloved hand (roller) to remove all air pockets and tack to substrate



Heat Shrink Sleeve Application

- ▶ Wet out adhesive on Overlap and Window Weld Closure Tap and secure to substrate
- ▶ Press Closure Tab firmly to Remove any air pockets or wrinkles



Heat Shrink Sleeve Application

- ▶ Begin shrinking the sleeve in the CENTER of sleeve.
- ▶ Allow sleeve to SHRINK down to substrate and work air out in advance of HEAT.
- ▶ Use broad brush strokes circumferentially around pipe
- ▶ Assure mastic bleed out 360° around end of sleeve and in closure tab
- ▶ Repeat process on opposite end starting in center of sleeve.



Heat Shrink Sleeve Application

- ▶ While the sleeve is still warm press or roll the overlap area and the weld bead to remove any air voids.
- ▶ Sleeve is successfully applied when sleeve has a smooth service, weld bead profile can be seen through the sleeve, sleeve has conformed to the pipe and adjacent coating
- ▶ After sleeve has cooled, mastic flow is evident on both edges of the sleeve and in the closure tab.





AMBER P-501L DR-150-03

©2011 AMBER P-501L DR-150-03

✓ Mark
8/15/110

316



AIR: 65
SURF: 68
DP: 51
RH: 57

LH: 01
9/10/2018

MA 13-B-319 SL





STANDARD KLIN/L GA 1/ 0-00



DOWNSH K-50T OH 17-8-314

DOWNSH K-50T OH 17-8-314

DOWNSH K-50T OH 17-8-314

24-014

DOWNSH K-50T OH 17-8-314

DOWNSH K-50T OH 17-8-314

DOWNSH K-50T OH 17-8-314

DOWNSH K-50T OH 17-8-314

DOWNSH K-50T OH 17-8-314

DOWNSH K-50T OH 17-8-314

24-014

DOWNSH K-50T OH 17-8-314

DOWNSH K-50T OH 17-8-314

DOWNSH K-50T OH 17-8-314

0
305-17
287989
NORTH-29.6

OK
L1111
SEGA



SA K-60/L QA 17-A

Hot Applied Tapes

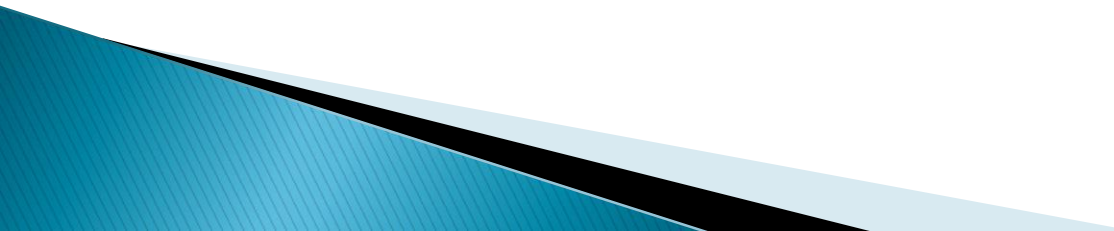
- ▶ Coal Tar or Bitumen based heat applied tapes
- ▶ Surface preparation: Wire Brush
- ▶ Pre-Apply Primer to substrate and allow to tack
- ▶ Apply Tape using a propane torch by wetting out adhesive on the contact surface side of the tape
- ▶ Keep tape taunt and tight to substrate
- ▶ Wrap with minimum 1" overlap
- ▶ Finish by applying heat to outer surface to form gloss over tape



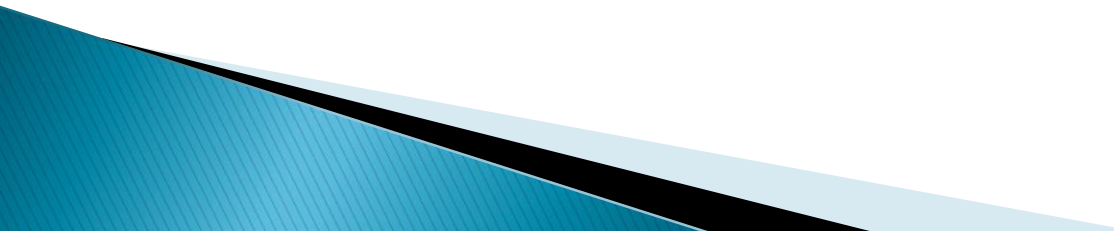
Liquid Coatings

Liquid Coatings

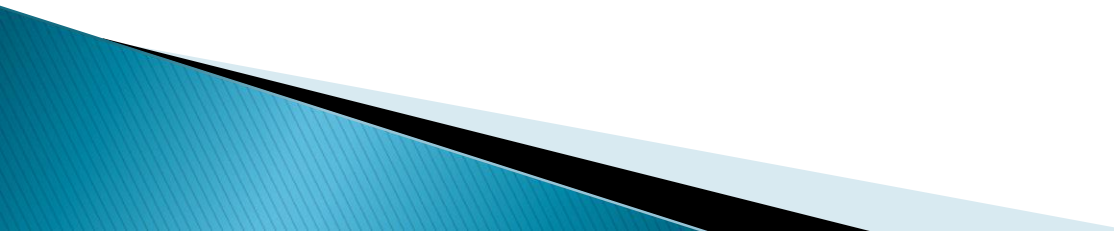
Mastics

- ▶ Coal Tar, Bitumen, Rubberized
 - ▶ For Irregular Fitting, Valves and Flanges
 - ▶ Brush Applied
 - ▶ Drying Time
- 

Liquid Epoxies

- ▶ Two Part & Single Coat Systems
 - ▶ Above & Below Grade
 - ▶ Surface Tolerant Epoxies
 - ▶ Brush, Pad or Spray Applied
 - ▶ Compatible with FBE coated pipe
- 

Keys to a Successful Application:

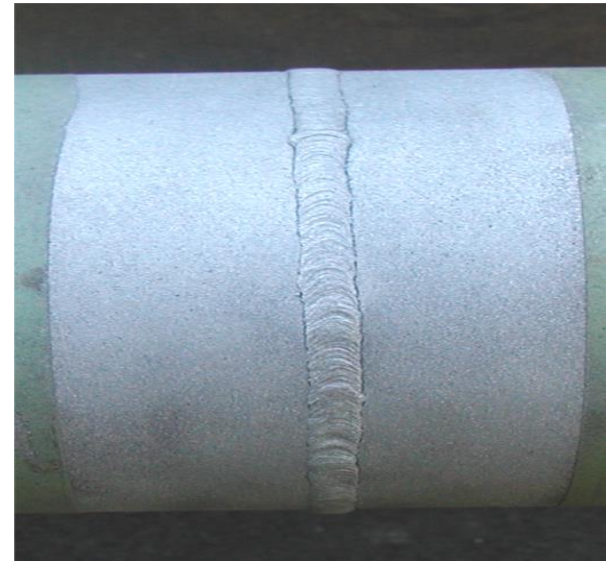
- ▶ Proper surface preparation
 - ▶ Understanding temperatures & cure rates
 - ▶ Proper equipment
 - ▶ Trained applicators
 - ▶ Quality control / quality assurance
- 

Liquid Epoxy Application Procedures

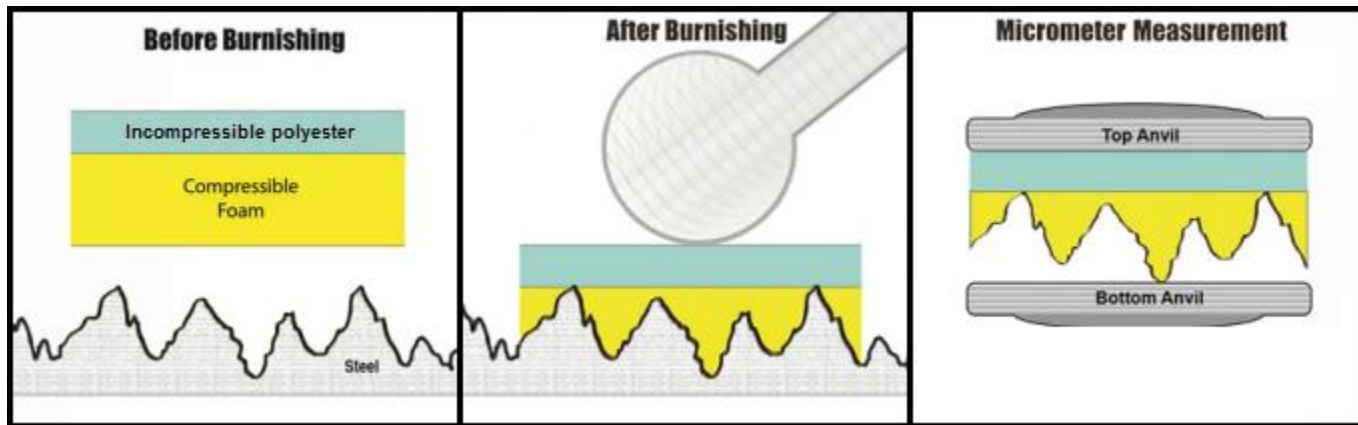
- ▶ **Surface Preparation:** Grit Blast to Near White Finish – SSPC SP10/NACE 2
- ▶ Preheat – if surface temp is $< 50^{\circ}$ F or ambient temp is $< 5^{\circ}$ of DEW Point. (optional to accelerate cure)
- ▶ Two Part Systems = mix **Part A** (base) with **Part B** (hardener) to a **CONSISTANT** Color – No Marbling
- ▶ Brush, Roller or Spray to Required Thickness (25 – 30 mil)
- ▶ Check mil thickness with WET Film Gauge
- ▶ **Pot Life** 5–7 Minutes of Working Time
- ▶ Allow~ 60–90 min for **Tack Free** coating
- ▶ **Cure Time** ~ 4–6 hours before Handling & Backfill
- ▶ Recheck coating thickness prior to backfill with **DRY** Film Gauge and Holiday Inspector

Surface Preparation

- ▶ SSPC, SP-10 or NACE 2
- ▶ Grit/Sand Blast to Establish 2.0 – 4.0 Anchor Profile
- ▶ Mechanical Tools Available to Establish Anchor Profile
- ▶ Use Test Strips & Micrometer to Check Anchor Profile



Measuring Surface Profile with Replica Tape



SURFACE PREPARATION – ABRASIVE BLAST

- ▶ Near-White Metal (SSPC-SP10, NACE 2, Sa 2 ½) or better.
- ▶ Blast profile should be 2–4 mils



Near-White Surface Prep



Testex Tape w/ micrometer

Preheating Weld Joint & Adjacent Coatings

- ▶ Cold Weather Applications
- ▶ Dry Surface Area
- ▶ Achieve Faster Cure Times



Mixing a Two Part System



Mix parts A & B together to achieve uniform color.



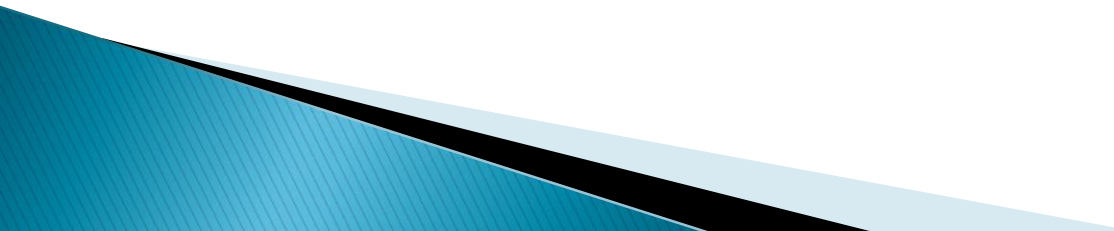
Pour onto top of pipe.



Brush or roll from top to bottom.

MIXING 2-PART EPOXIES

Do Not Allow “Road-Side” Chemistry!

- ▶ Cure heavy – will react too quickly and become brittle once it has kicked over
 - ▶ Cure light – may never react fully and will not protect the pipeline
 - ▶ Do not use thinners
- 

Applying Liquid Epoxies

- ▶ Apply by Brush, Roller or Plural Spray
- ▶ Apply to 25–30 mils
- ▶ For HDD apply to 35–40 mil
- ▶ Verify coating thickness with WET Film Gauge
- ▶ Allow Required Cure Time Before Handling or Backfill



QUALITY CONTROL

- ▶ SSPC VIS-1 surface prep comparison chart
- ▶ Testex for blast profile
- ▶ Wet Film Gauge
- ▶ Dry Film Gauge
- ▶ Durometer
 - Backfill after Shore D value of 75
- ▶ Holiday Detection
 - NACE RP0490-2001

QUALITY CONTROL

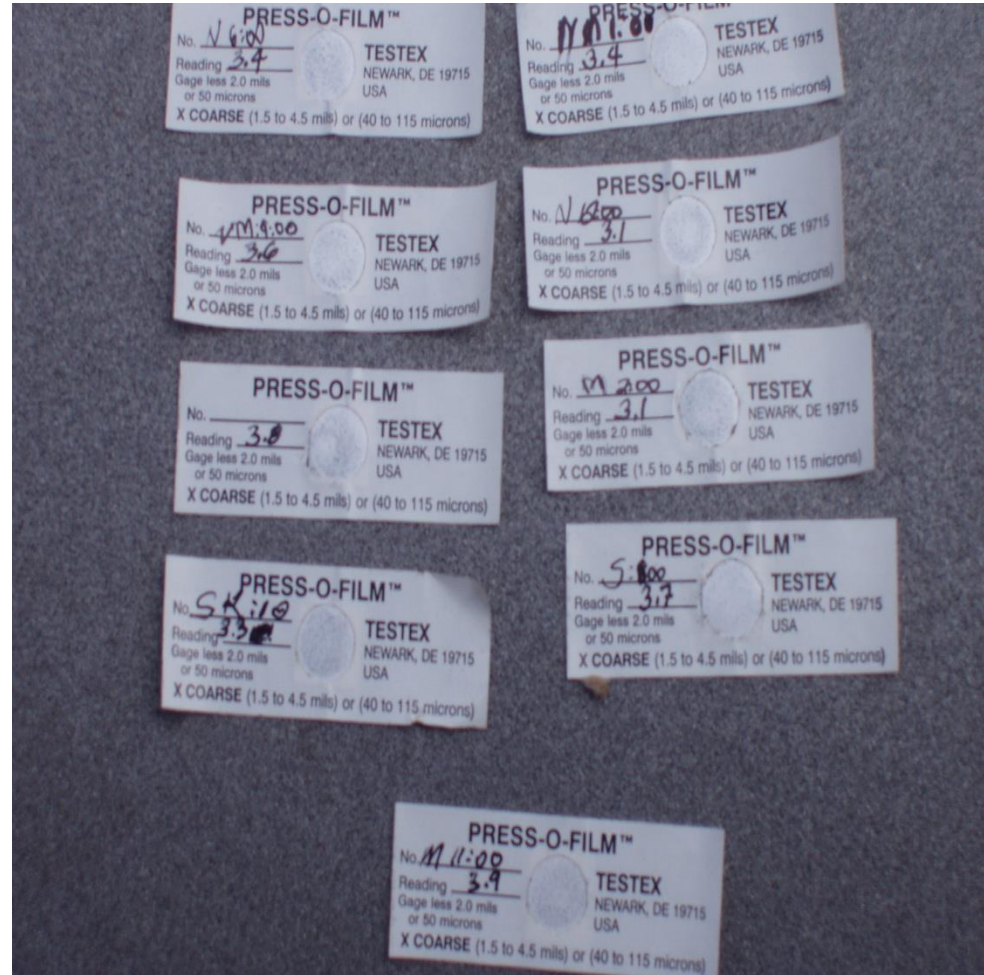
PosiTector *DPM*



- Relative Humidity
- Air Temperature
- Substrate Temperature
- Air / Steel Temp. Differential
- Dew Point Temperature

QUALITY CONTROL

Measuring Surface Profile



QUALITY CONTROL

– Measure & Record Blast Profile



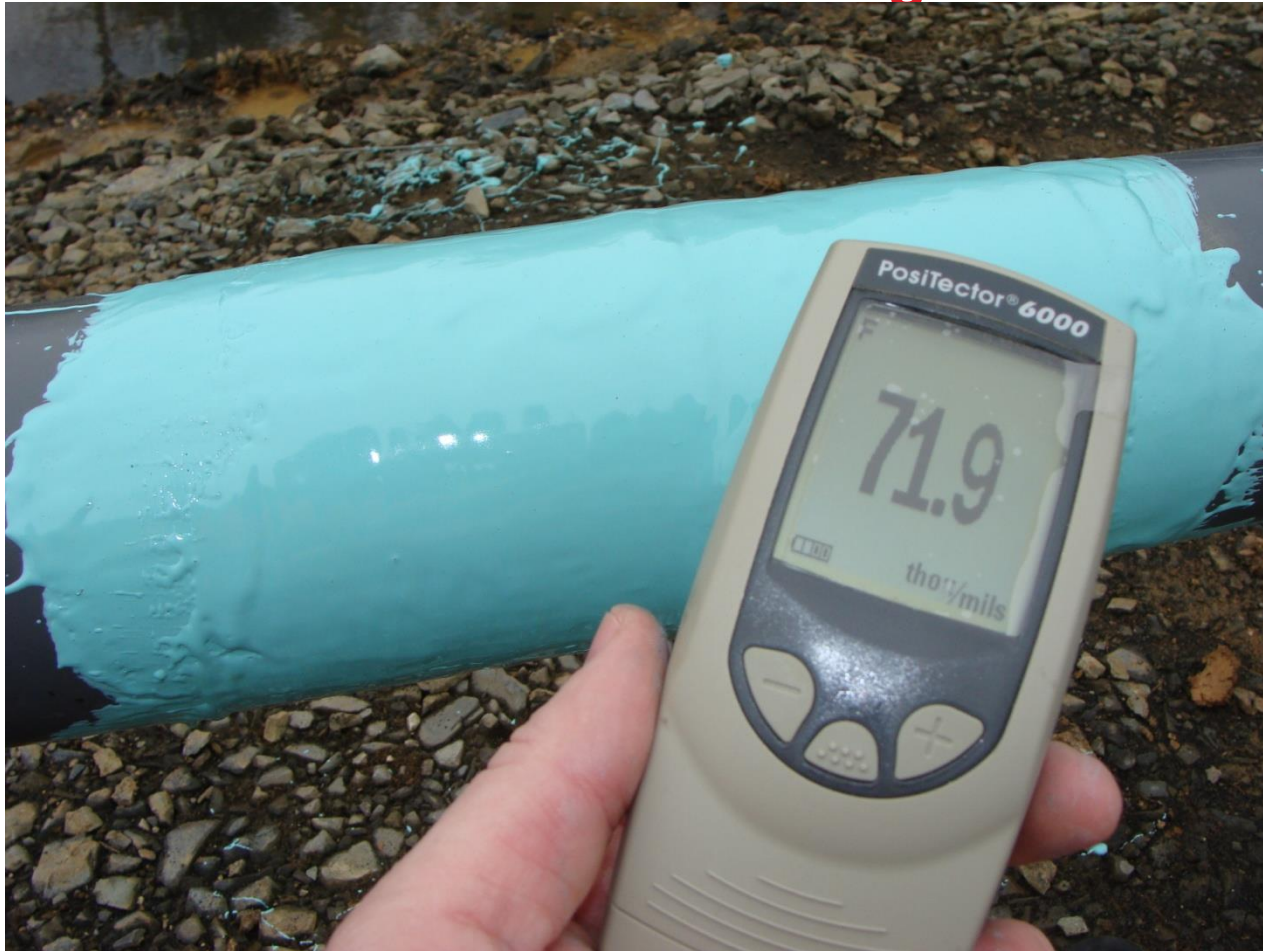
QUALITY CONTROL

Measuring Wet Film Thickness



QUALITY CONTROL

PosiTector – Measuring DFT



QUALITY CONTROL

Durometer – Measuring Shore D Hardness



75 Shore D

Inspection, Handling & Backfill

Inspection

- ▶ Visual & Touch
 - Disbondment
 - Holiday's
 - Air Pockets
 - Wrinkles
 - Loose or Damaged Coating
 - Cracking, Alligatoring, Blistering (Liquid Coatings)
- ▶ Electrical Holiday Detector (Jeeping)

NACE Specification for Jeeping

- ▶ Polyethylene Coatings

- PRITEC®
- Cold Applied Tapes
- Heat Shrink Sleeves

- ▶ Range 8000 – 12000 V

- ▶ Formula:

$$V = 1250 \times \sqrt{(T, \text{ in Mils})}$$

EXAMPLE: PRITEC® 10/40 = 50 Mil thick
 $V = 1250 \times \sqrt{(50) \text{ or } (7.071)} = 8,838$
Volts

- ▶ FBE/Liquid Epoxies

- FBE Coated Pipe
- Liquid Epoxies

- ▶ Range 1600 – 3000 V

- ▶ Formula:

$$V = 525 \times \sqrt{(T, \text{ in Mils})}$$

Example: FBE = 16 Mil thick
 $V = 525 \times \sqrt{(16) \text{ or } (4)} =$
2,100 Volts

Legend:

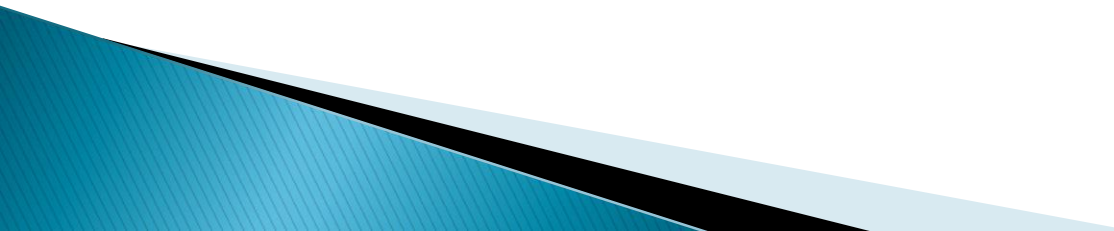
V = Test Voltage

T = Thickness

$\sqrt{\quad}$ = Square Root

1 Mil = .001 inches

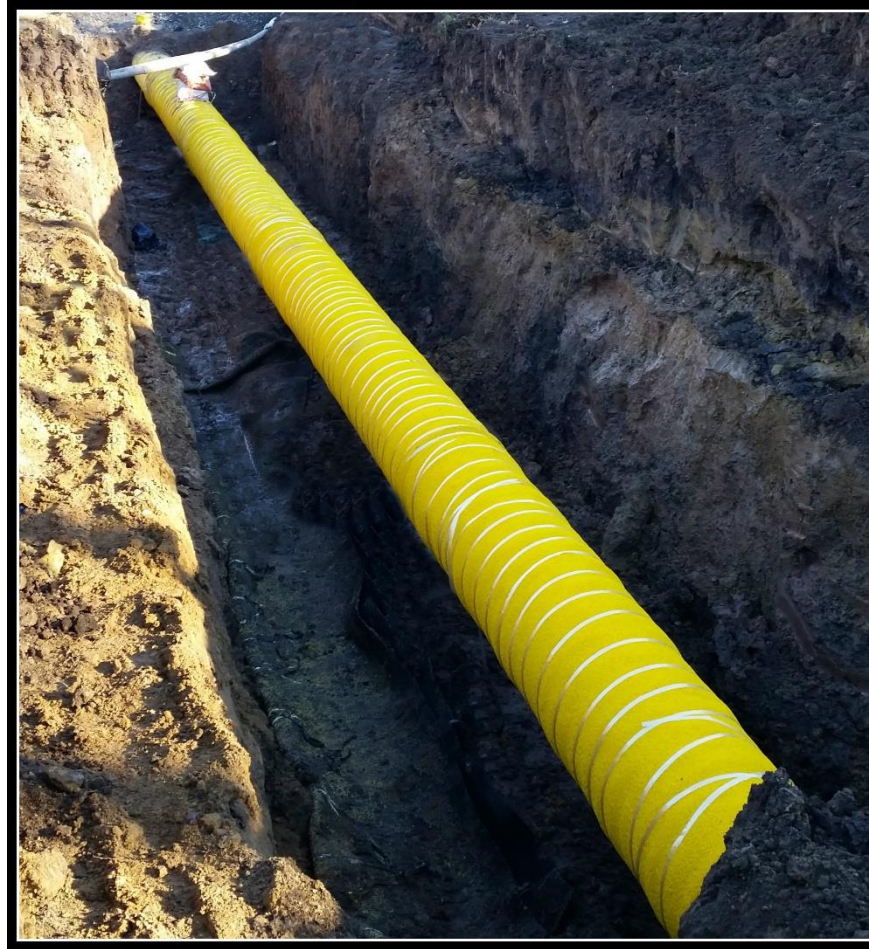
Handling

- ▶ Allow proper time for Coating to set up
 - ▶ Use Approved Slings and Harnesses
 - ▶ Stored, Transported and Handled Properly
 - ▶ Repair ALL damages related to Handling
- 

Backfill

- ▶ Time Dependant on Coating Selection
 - Field coating the pipe is usually the last thing done before the ditch/trench is backfilled.
- ▶ Backfill Should be Free of Any;
 - Large Rocks
 - Stones
 - Foreign Objects/Materials
- The pipeline coating should also be protected from all rigid earth conditions, where coating penetration would cause corrosion to the pipeline

Rockshield



Thank You!