
Intro to Coatings

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Appalachian Underground Corrosion Short Course

Coatings

- Corrosion control is not a perfect science.
- There is not one instrument that does everything.
- There is not one test that tells us everything.
- There is not a perfect coating that will work in every scenario.



Coatings

- Most integral part of the cathodic protection system.
- Required to create a cost effective corrosion control program.
- Extends pipeline design life.



Coatings

- A pipeline coating acts as a barrier between the pipe and the electrolyte.
 - NACE definition of a coating:
 - A coating is film forming material that protects the surface to which it is applied.
- What are the 4 components of a corrosion cell?
 - Anode
 - Cathode
 - Electrolyte
 - Metallic Path
- The coating breaks the circuit by isolating the pipe from the electrolyte.



Good Coating Characteristics

- **Good Adhesion to Pipe**
 - Adhesive strength is the measure of how well coating is bonded to pipe.
- **Good Cohesive Strength**
 - Cohesive strength is the measure of ability of coating film layer not to pull apart internally or stay bonded to itself.



Good Coating Characteristics

- Ease of application
- Resistance to Damage
- Flexibility
- Resistance to Flow
- Good Electrical Resistance
 - Dielectric Strength
- Water Resistance
- Chemical & Physical Stability
- Resistance to Soil Bacteria
- Resistance to Marine Organisms
- Resistance to Cathodic Disbondment
- Resistance to Soil Stress

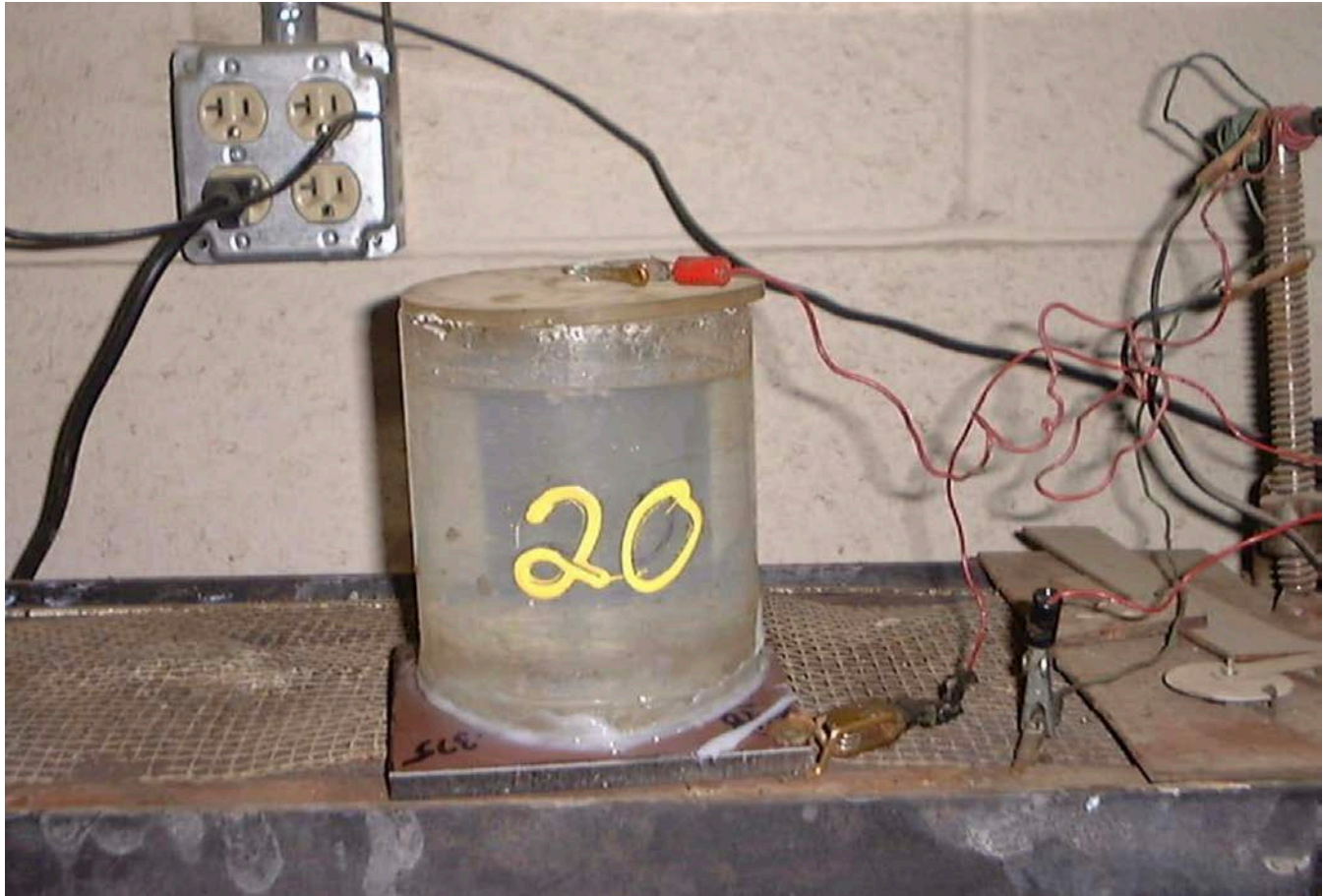


Laboratory Tests

- Some of the laboratory tests
 - Salt Crock Cathodic Disbondment Test
ASTM G-8
 - Dielectric resistance is the amount of voltage necessary to break down a given coating of specified coating thickness.
 - ASTM G-9 lab test is for water penetration.



Salt Crock Cathodic Disbondment Test ASTM G-8



Salt Crock Cathodic Disbondment Test ASTM G-8



Holiday Detection

- Holiday is a coating defect.
- Holiday detector is sometimes called a jeep spring or brush type.
- ASTM G-62 is the test procedure for setting a Holiday detector.
- Typical criteria for detection is 100-125 VDC per mil of coating.
- When in doubt of setting, create a holiday in existing coating.



Holiday Detection



Jeeping Pipe at Mill



Holiday Detection



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Checking Holiday Detector

- Check batteries at least once a day.
- Verify calibration, the voltage you set is the voltage you get.
- Verify calibration, the voltage you set is the voltage you get.
- Make sure the detectors tail is grounded.
 - Pipe should be grounded
 - Detector should be grounded to pipe
 - If possible
- Caution High Voltage!!



Coating Application

Coatings may be applied at a coating facility or in the field



Coating Application: Surface Prep

- Surface preparation is determined by:
 - Coating Type
 - Wax, Liquid Epoxy, Shrink Wrap, etc.
- Field conditions if applied in the field
- Owners Coating Specification
- Manufacturer's recommendations
 - Manufacturer's Application Data Sheet

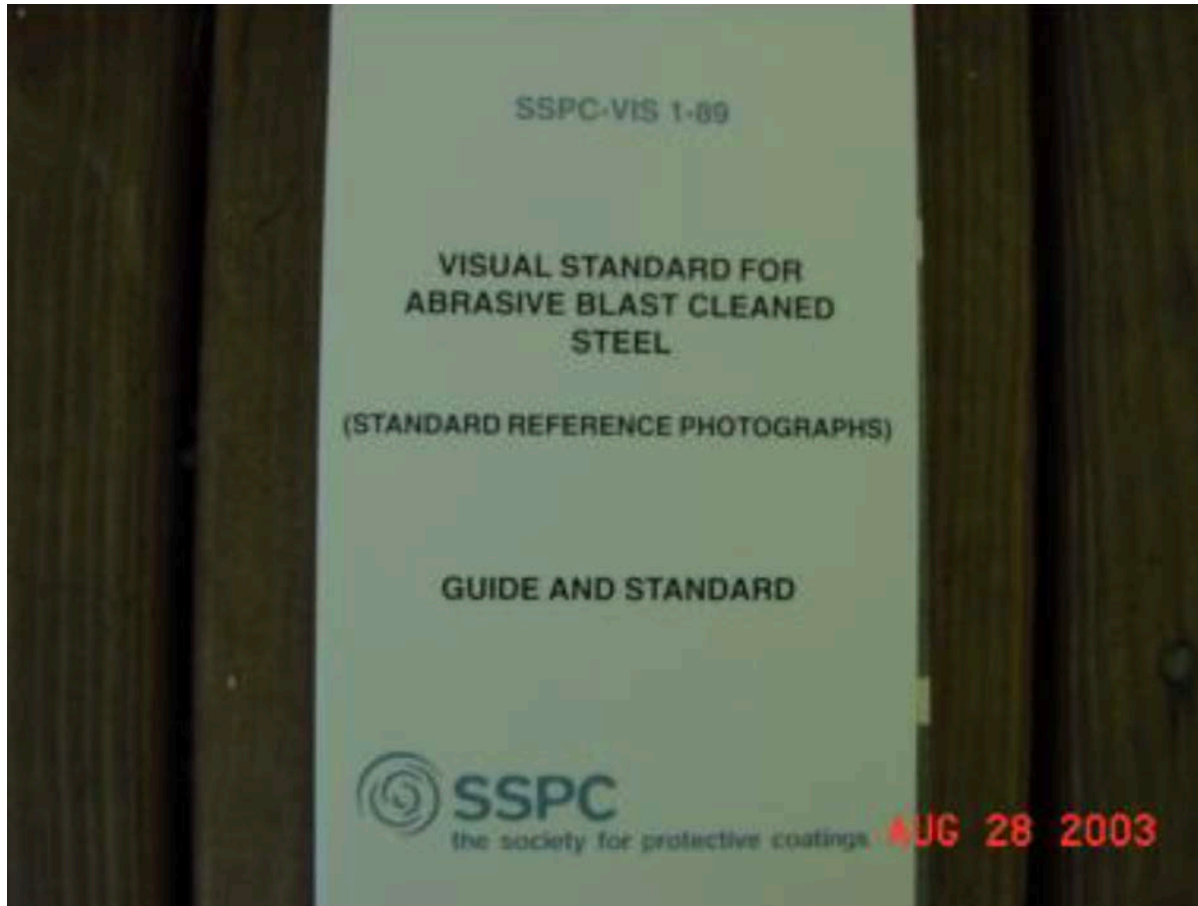


Coating Application: Cleanliness

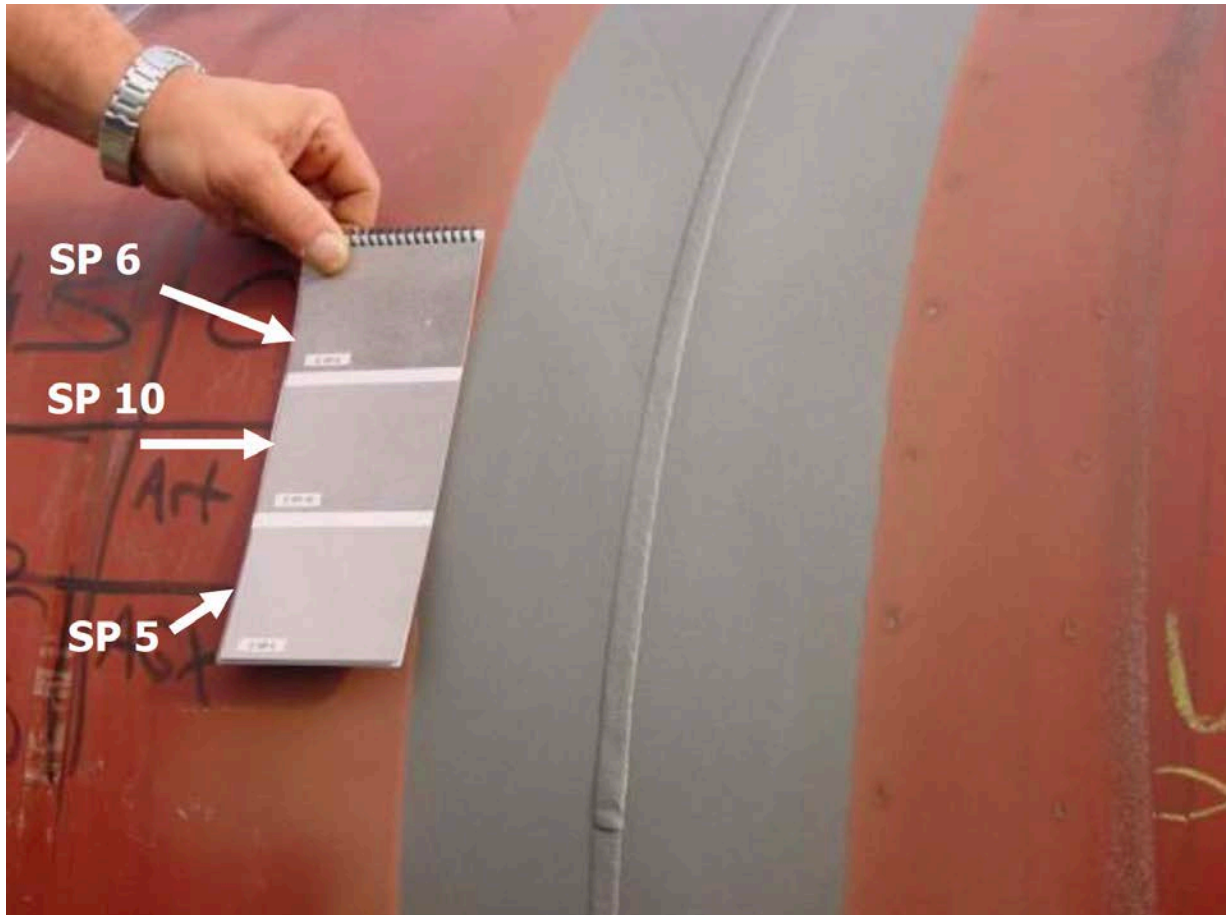
- SSPC list various specifications. NACE has comparable specifications.
- SSPC SP 7- Brush Off Blast
- SSPC SP 6 - Commercial Blast
- SSPC SP 10 – Near White
- SSPC SP 5 – White
- SSPC SP 1, 2, 3 – Solvent Cleaning, Hand Tool Cleaning and Power Tool Cleaning.



Coating Application: Cleanliness



Coating Application: Cleanliness



Coating Application: Profile

- Profile is the roughness of the surface as measures in mils (1/1000 inch)
- Increases surface area
- Profile is determined by coating manufacturer
- Profile is measured by various methods
 - One method commonly used is replica tape

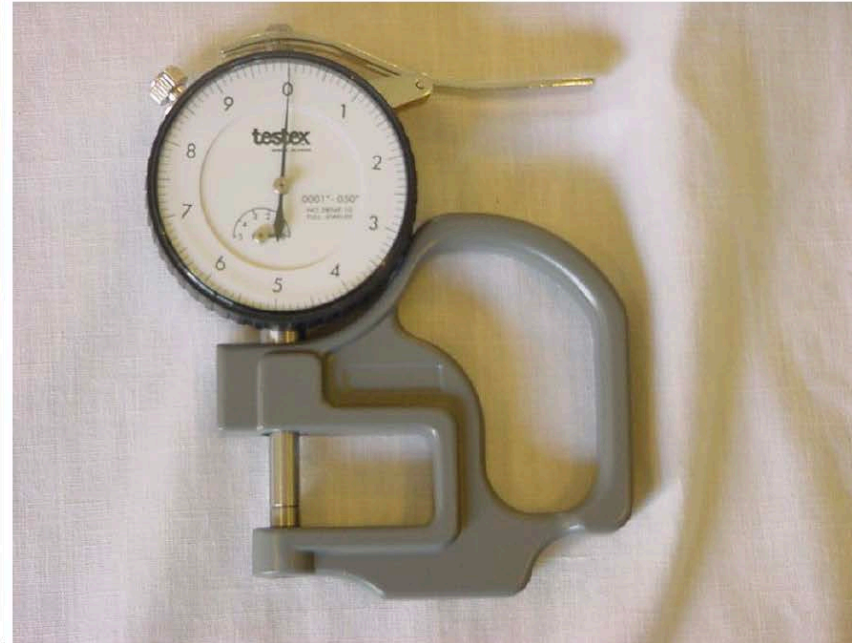


Coating Application: Profile

Replica Tape



Spring Micrometer



Coating Application: Profile



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Coating Types: Surface Prep

Over 60% of all coating failures are due to improper or poor surface preparation!



Coating Types: Mill Applied Coatings

- Fusion Bond Epoxy (FBE)
- Liquid Epoxy
- Crosshead Die Extruded Polyethylene
- Calendar Type Multi-Layer Tape
- A variety of specialty type coatings



Coating Types: Mill Applied FBE Coatings

- Applied 12 – 16 mils thick (per owner spec)
- Preparation is critical.
- All chlorides or soluble salts must be removed with an acid wash.
- The acid must be removed by de-ionized water wash.
- Water must be removed by heating.
- A near white blast surface is required. SP 10
- Pipe is heated to 450 – 500 degrees F, sprayed on as a powder and melts onto the pipe.

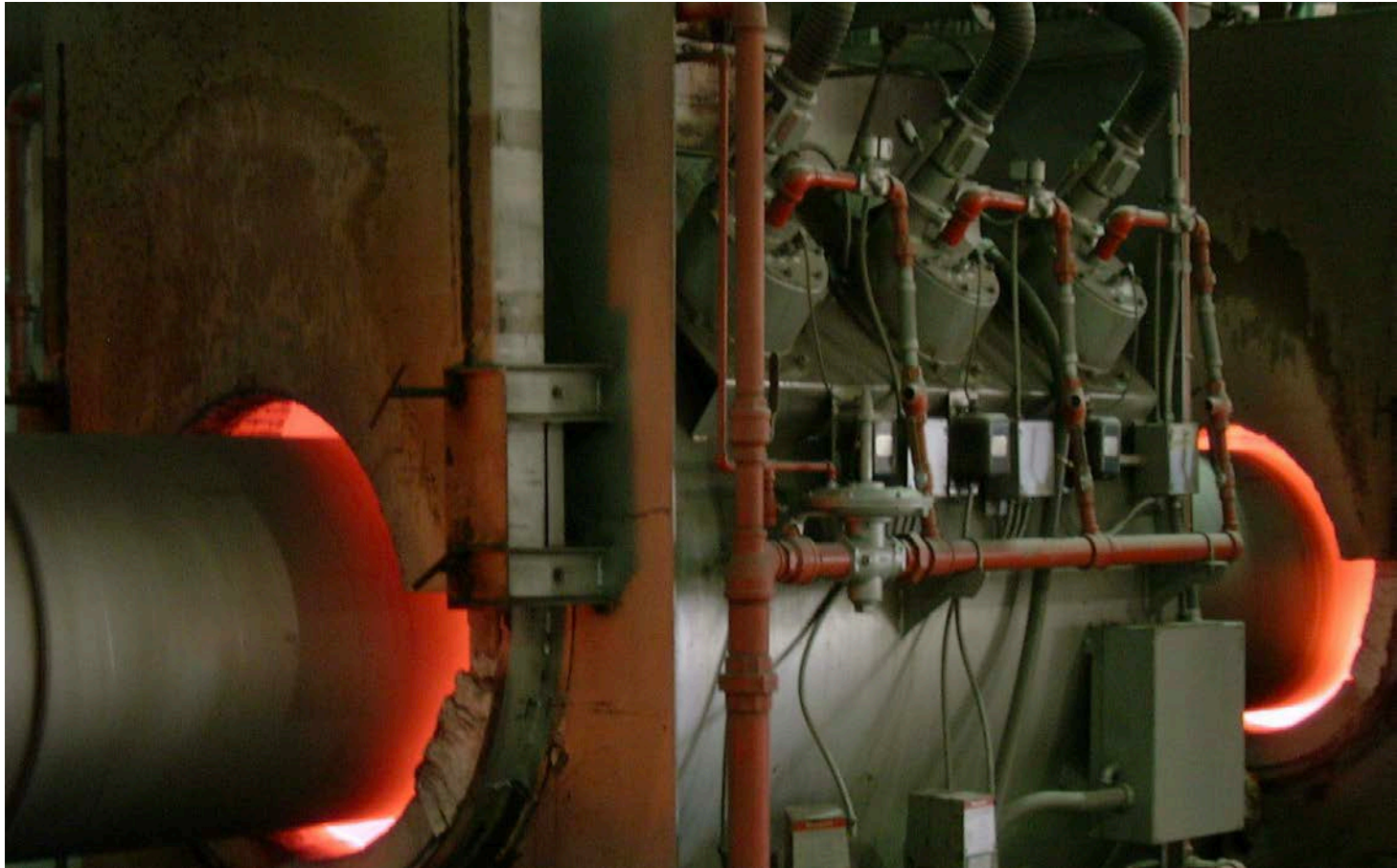


Pipe Starting on the Coating Line

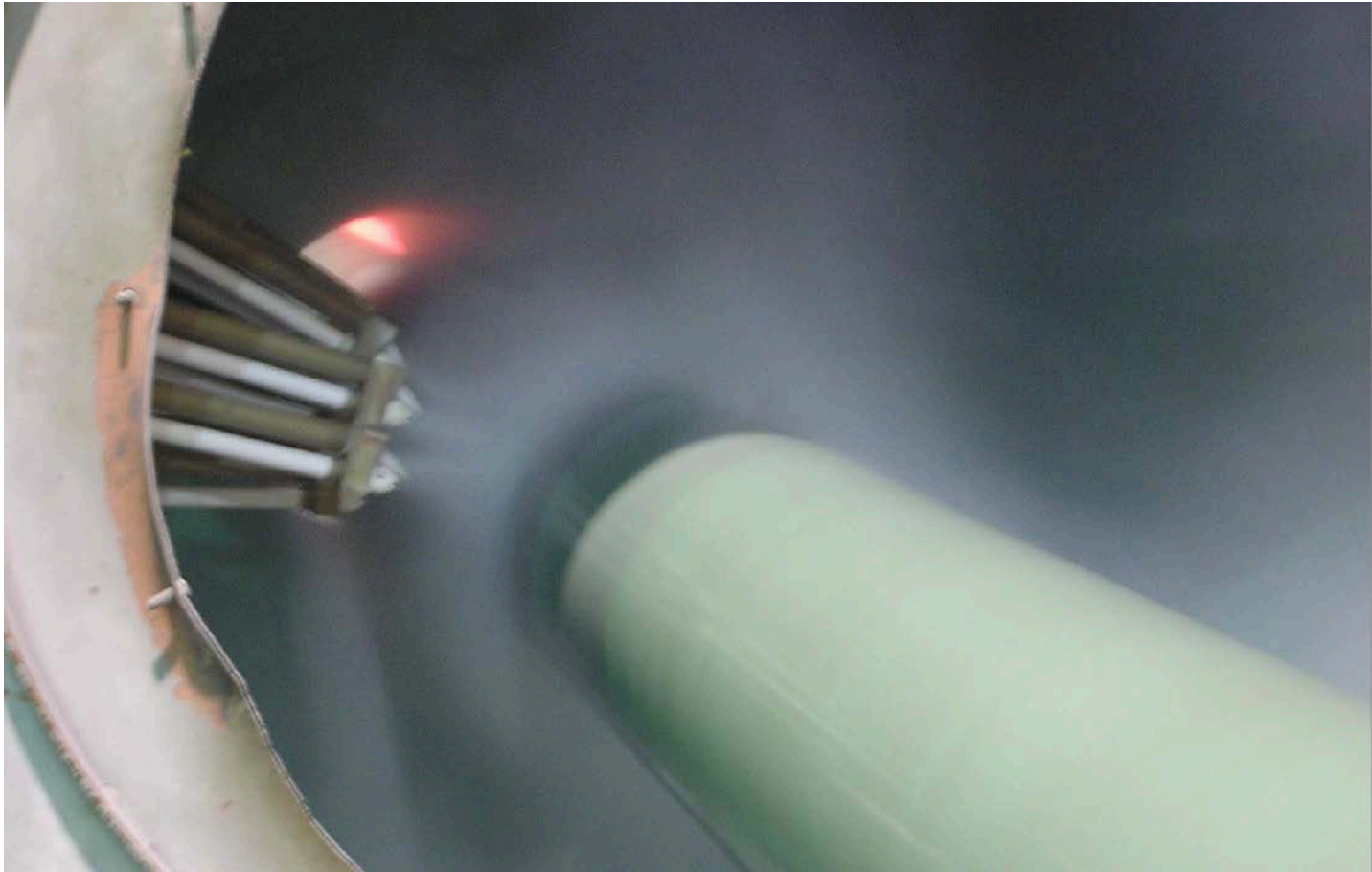


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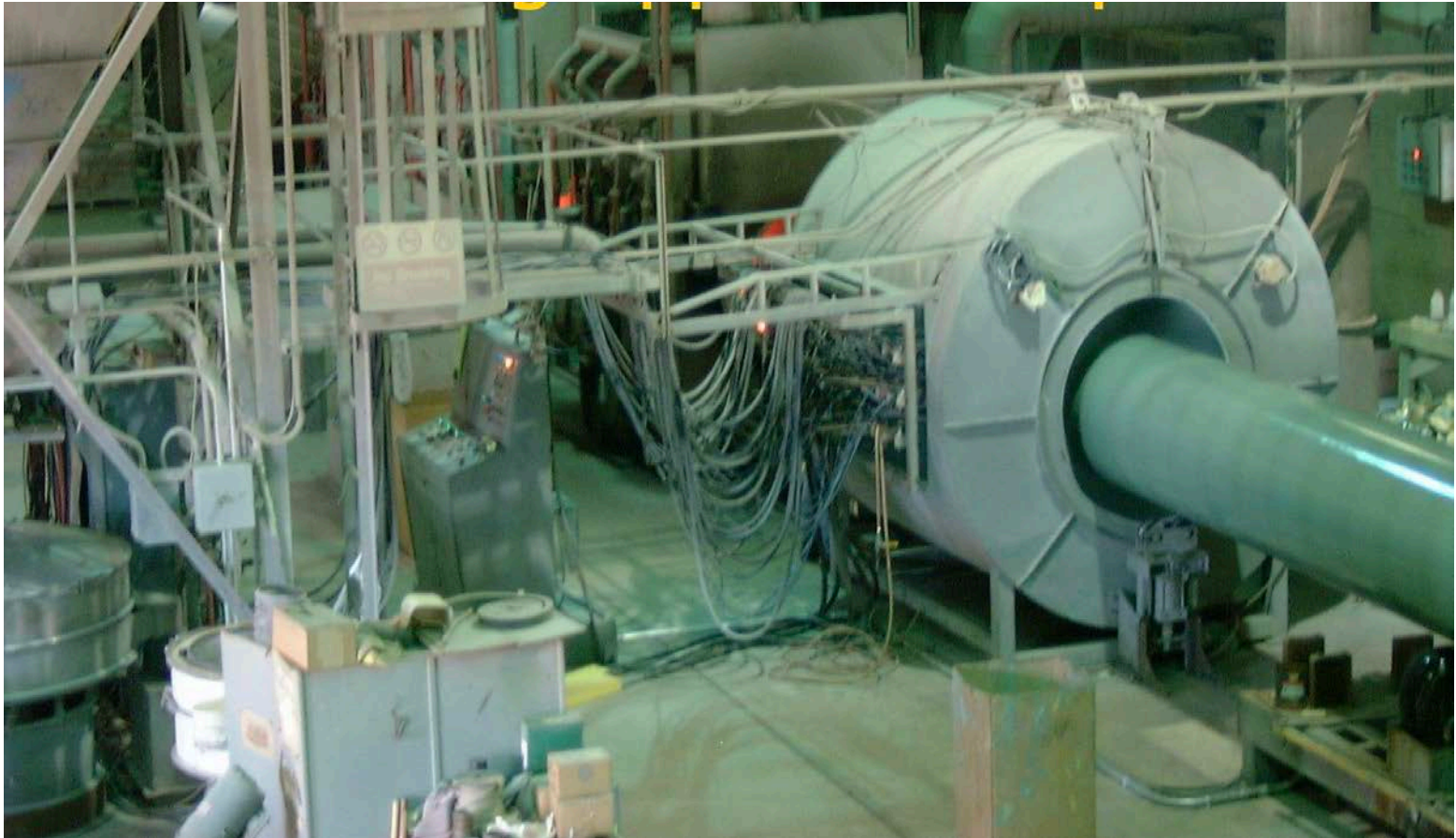
Preheat Ovens



FBE Being Applied To Pipe



FBE Being Applied To Pipe



Coating Types: Mill Applied Liquid Epoxies

- Liquid epoxies are normally applied externally for corrosion protection or as an ARO with an average thickness in mils of 20



Checking the Pipe for Holidays



Patching the Holidays using Melt Stick



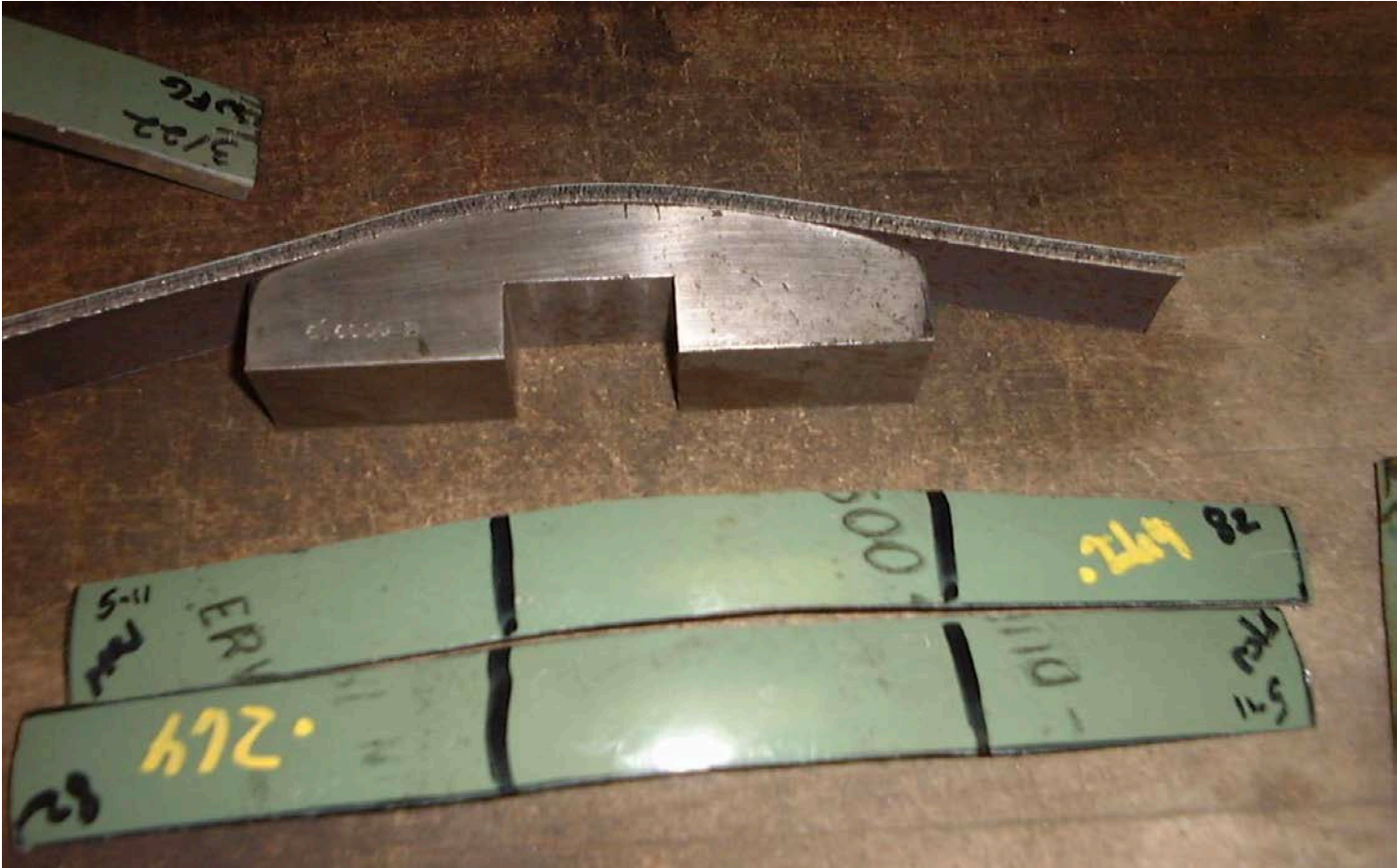
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Checking the Coating Dry Film Thickness



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Pipe Straps for Bend Test



Pipe Straps for Bend Test



Dolly's For Adhesion Test



Performing Adhesion Test



Performing Adhesion Test



Extruded Polyethylene Coating

- Requires commercial blast
- 10 mils of asphalt based rubberized adhesive
- Extruded polyethylene is normally 40 mils in thickness



Pipe on the Grinding Rack



Applying Extruded Polyethylene



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Extruded Polyethylene Coated Pipe



Calendar Type Multi-Layer Coating

- Requires a commercial blast
- Applied at 50-80 mils
- Not used very often



Calendar Type Multi-Layer Coating



Coal Tar Coating

- Used extensively in the past.
- Now used very little due to environmental and health concerns.
- Applied approximately 120 mils thick.
- In the past, coal tar was covered with asbestos felt wrap.
- Major concerns over large disbondment areas.

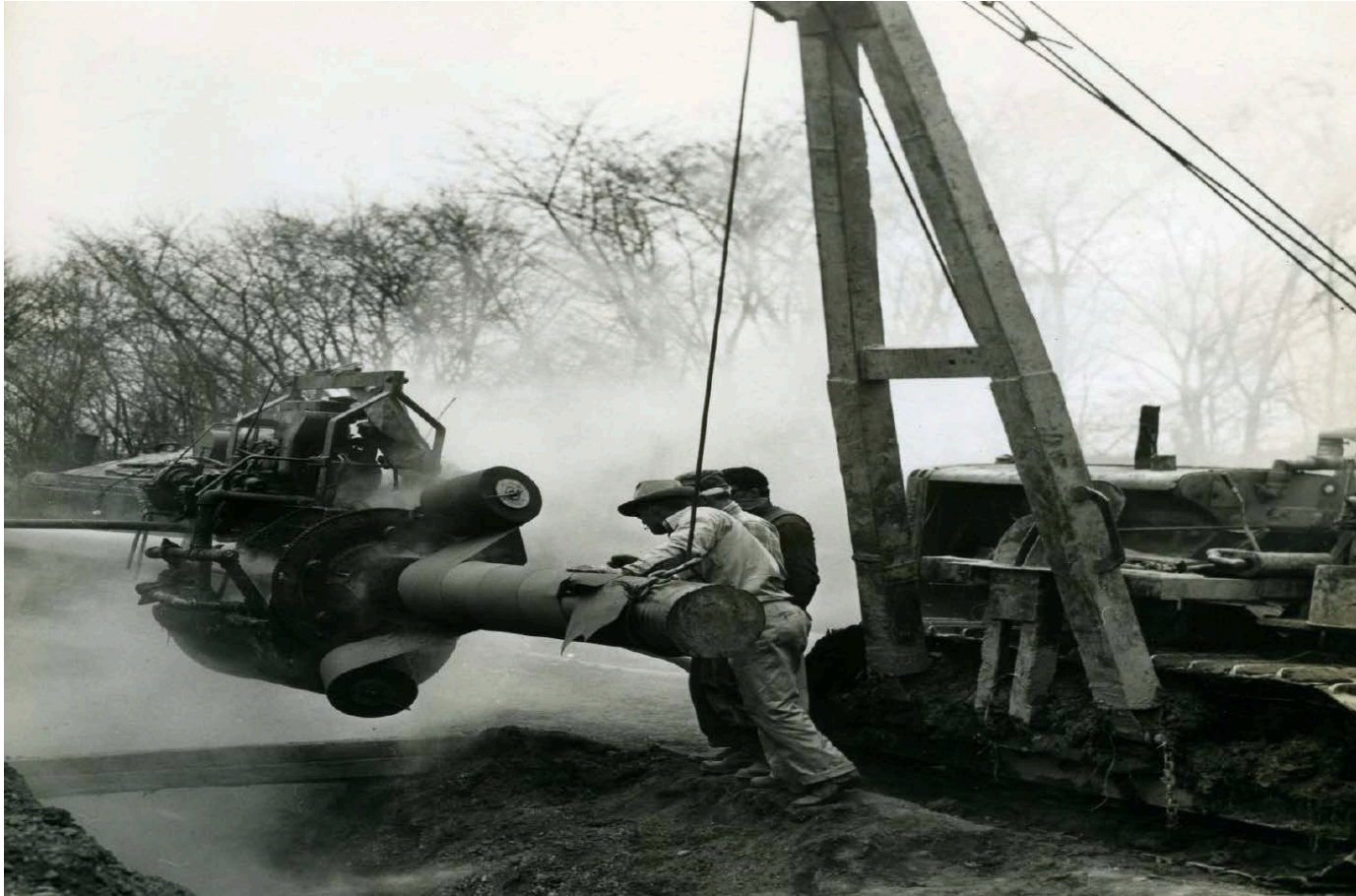


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Applying Coal Tar Over the Ditch



Coating Girth Welds in the Field



Removing Hot Coal Tar from the “Dope Pot”



Field Applied Coatings

- Liquid Epoxies
- Hot applied tapes
 - Coal tar based
 - 60 mils with 50% overlap
- Cold applied polyethylene tapes
 - Applied 30-65 mils with a primer
- UV resistant tape
- Heat shrink sleeves/tubes
- FBE field applied coating for girth welds
- Rock shield



Sandblasted Girth Weld



Installing Shrink Sleeves



Installing Shrink Sleeves



Installing Shrink Sleeves



Completed Shrink Sleeves



Maintenance Application Coatings

- Must be compatible with existing coating.
- Liquid epoxies
- Hot applied coal tar tapes
- Cold applied polymer tapes
- Surface tolerant liquid polymer tapes
- Liquid mastics
- Sealants
- Hot applied waxes
- Cold applied waxes
- Petrolatum



Applying Cold Polymer Tape



Applying Cold Polymer Tape



Maintenance Application Coatings

- Liquid coal tar epoxies
- Two part epoxies
- High temperature tapes
- Flange fillers



Applying Hot Wax in the Field



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Applying Wax Paper



Applying Wax Paper



Applying Petrolatum Tape



Pipe Being Coated with Liquid Epoxy at Girth Welds



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Pipe Being Recoated with Liquid Epoxy Spray Grade



Pipe Being Recoated with Liquid Epoxy Spray Grade



Spray Application Epoxy



Pipe Being Recoated with Liquid Epoxy



Atmospheric Corrosion

- UV degradation
- UV resistant cold applied tape
- Cold applied petrolatum tape
- Various painting systems



Atmospheric Corrosion



Atmospheric Corrosion



Risers

- Some of the most severe corrosion is at the soil interface area at risers
- Two part epoxy with a polyurethane top coat for UV protection
- Wax tapes with protective outer wrap
- Rock shield



Risers



Irregular Bolted Couplings, Valves, Fittings, Etc.

- Liquid mastics
- Wax or petrolatum tapes
- Wet areas maybe covered with petrolatum



Wax Tape for Atmospheric Conditions



Wax Tape Applied to Valves



High Temperature Areas

- Coal Tar Epoxy
- Epoxy primer and high temperature tape
- Two part epoxies



Flanges and Bolts

- Flange filler
- Flood coating with hot applied wax
- Must provide dielectric resistance
- Must be easily removed for re-entry into flanges



Hot Wax being Poured in a Flange



Conclusion

There are many excellent pipeline coatings.

However, not every coating is good for all applications



Conclusion

Correct surface preparation and overall cleanliness of the pipe will create a better environment for coating performance.



Conclusion

Questions?