Pipeline Coatings

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Fundamentals Session
Jeff Didas – Matcor, Inc. – Mechanicsville, VA
Remember This!

- Coatings are the #1 defense against corrosion.
- This is true for underground, transition and above ground service.
Coating Types

• Underground – buried or immersion service
• Transition area coatings
• Atmospheric coatings
• Internal coatings & linings
Underground Pipeline Coatings

• Mill or Plant Applied
• Field Applied
• Line Coatings
• Repair Coatings
• Coating Discussion
• Coating Cost
• Coating Quality
Mill or Plant Applied

- Most economical method to apply coatings
- Highest level of quality and quality control
- Plant/Mill conditions allow use of higher performing coatings
- Normally, high quality storage, handling and shipping
- Normally allows for some coated pipe storage
Field Applied

- Costly method either over the ditch or in the ditch
- Hard to manage quality control due to environmental conditions
- Normally lower performing coatings
- Newer field coatings do allow higher productivity
Line Coatings

• Coal Tar Enamel
• Asphalt Enamel
• Extruded Polyethylene
• Fusion Bonded Epoxy
• Somastic
• Pritec
• Liquid Epoxy
• 3 Layer
Repair Coatings

• Tapes
• Wax
• Shrink Sleeves
• Two - Part Epoxy
• Mastic
• Misc.
Coatings Discussion

• Most important component of a pipeline
• High quality holiday free coating requires almost no cathodic protection current
• Coatings need to be specified
• Coatings need to be tested
• Every coating has a use, but most coatings are used improperly – follow procedures
Coating Cost

- Cost of material
- Cost of application
- Cost to repair
- Handling
- Expected life
- Dielectric strength
Coating Quality

• Quality determines price
• Quality is normally dependent upon surface preparation & application methods
• Quality is assured with competent inspection
• Quality is determined by good procedures and good specifications
Transition Area Coatings

• Used where piping transitions from buried service to atmospheric service
• Used to protect from mechanical damage – freeze/thaw cycle, weed whackers, gravel, etc.
• Used to protect buried service coatings from Ultraviolet light when used above ground
Atmospheric Coatings

• Various types, quality and expected life
• Primary purpose is corrosion prevention, secondary purpose is appearance
• Problem areas, flanges, nuts, bolts, hold down clamps, high temperature service, beneath insulation, through walls/foundations, etc.
WHAT IS CORROSION?
CORROSION IS THE DESTRUCTION OF A SUBSTANCE, USUALLY A METAL, OR ITS PROPERTIES BECAUSE OF A REACTION WITH ITS ENVIRONMENT.
Energy In → IRON ORE → STEEL → Energy Out

Pipes

Structures
IRON ORE

STEEL

Coatings
Cathodic Protection
Inhibitors
Material Selection
- Uncouling
- Leveling
- Ultrasonic inspection of uncoiled strip
- Side trimming
- Roll and cage forming
- Pre-forming
- Electric resistance welding and inside and outside flash trimming
- First ultrasonic inspection
- Post annealing
- Water cooling
- Sizing
- Drying
- Hydrostatic testing
- End facing
- Straightening
- Flying cut-off
- Customer's inspection
- Second ultrasonic inspection
- Visual and dimensional inspection
- Weighing and measuring
- Marking (and coating if specified)
- Shipping
COATING DEFINITION

WATER
ACID
CO₂
H₂S
SUNSHINE
CAUSTIC

BARRIER COATING

STEEL

A coating is a barrier to protect steel from the environment.
Perfect Coating

- **Ease of Application** - It can be applied with a mop on any surface or from above ground.
- **Cost Effective** - Cost $1.00/Gallon or less!
- **Environmentally Safe and Friendly** – OK to Drink it.
- **Performance** - Lasts forever.
In Reality a Perfect Coating

• Requires a quality standard
• Requires a quality specification
• Requires a quality coating mill
• Requires a quality material or materials
• Requires a quality inspector or inspectors
General Requirements of a Pipeline Coating

- Ease of Application
- Good Adhesion to Pipe
- Good Resistance to Impact
- Flexibility
- Resistance to Flow
- Water Resistance
- Electrical Resistance
- Chemical and Physical Stability
- Resistance to Soil Bacteria
- Resistance to Marine Organisms
- Resistance to Cathodic Disbondment
- Resistance to Soil Stress
Pipeline Corrosion Coatings

- Weight Coating
  - Concrete
- Triple Layer (3 layer)
- Double Layer (2 layer)
- Single Layer

Pipe
Single Layer Pipeline Coating

- FBE - Fusion Bonded Epoxy Powder
- Liquid:
  - Epoxy Base -
    - Coal Tar
    - Epoxy
  - Urethane Base -
    - Coal Tar Urethane
    - Urethane
- Wax Tapes
Double (2) Layer Pipeline Coating

- FBE & Polyolefin (PE or PP)
- Butyl & Polypropylene (PE)
- FBE & FBE (Abrasion Resistance)
- FBE & Liquid Coatings (Abrasion Resistance)
- Cold Applied Polyolefin Tapes
Triple (3) Layer Pipeline Coating

- 3rd Coat
- 2nd Coat
- 1st Coat

Triple (3) Layer

- FBE & Copolymer Adhesive & Polyolefin (PE or PP)
- Liquid & Copolymer Adhesive (PE or PP)
SURFACE PREPARATION
SURFACE PREPARATION

PURPOSE OF SURFACE PREPARATION

- To clean surface of materials which could cause the coating system to fail prematurely.
- To provide a surface that can be easily wetted for good coating adhesion.
- To provide an anchor profile.
- Paints adhere to the surface by mechanical bond.
TOO LOW

1-2 MILS

GREATER THAN 2 MILS

ANCHOR PATTERNS
Anchor Pattern Formation

Before

After
FUSION BONDED
COATINGS
APPLICATION PROCEDURE

1. CLEAN
2. HEAT
3. APPLY
4. CURE
5. INSPECT
6. REPAIR
DUVAL COATING SYSTEM

1. **Preheat**
2. **Blast Clean**
3. **Blast Clean**
4. **Inspection**
5. **Grinding**
6. **Powder Application**
7. **Heating Station**
8. **Acomet Application**
9. **HI Pressure Water Cleaning**
10. **Phosphate Cleaning**
11. **Polyolefin Extruder**
12. **Quencher**
13. **Electrical Inspection**
14. **To Stockpile**
DUAL POWDER
"GOLD"
FBE AND A
PLASTICISED FBE TOP COAT
Coal Tar Enamels

- Preheat
- Blast Clean
- Primer
- Primer Drying Rack
- Fiber Glass
- Enamel Application
- Kraft Paper
- Outer Wrap
- Electrical Inspection
- Quencher
- To Stockpile
Figure 1 Shows a Schematic Diagram of a Typical 3-Layer Pipe Coating

1. EPOXY PRIMER
2. INTERMEDIATE ADHESIVE LAYER
3. POLYOLEFIN TOPCOAT
Schematic Diagram of 3-Layer Pipe Coating

1. Abrasive Clean to Sa 2 1/2
2. Induction Heat to 200°C
3. Epoxy Primer Spray
4. Adhesive Extrusion
5. Polyolefin Extrusion
6. Water Quench

Pressure Roller
Application of EUROKOTE Epoxy Powder Primer Layer
Extrusion of Adhesive and Low Density Polyethylene Over the Epoxy Primer Layer
Line Pipe Coating Process
INTRODUCTION

This slideshow steps you through the process of Mill-Applied external thin film (FBE) coating. The guideline for this process is set forth in NACE Specification RP0394-94.
The pipe enters the mill and is ready for the abrasive blasting procedure.
The pipe enters the pre-heat oven where its temperature is raised to approximately 130 degrees. It then enters the abrasive blasting booth.
The pipe exits the blasting booth with a near-white surface finish and the required anchor profile.
At this stage, the blasted pipe surface is checked for raised slivers, scabs, laminations, or bristles which are removed by file or abrasive sanders. A coupler is then inserted into the end of each joint of
The coupler is used to connect and seal two joints of pipe together, so one pushes the other through the rest of the process.
Two pipe joints joined with coupler.
The pipe then enters an acid bath to remove surface contaminants.
After the acid bath and rinse, the pipe enters a series of ovens that raise the temperature of the pipe to approximately 475 degrees before application of the coating.
Pipe entering last oven before coating.
The joint between pipes is covered, so that the ends of each joint are left free of coating. This is done to allow welding in the field.
The pipe exits the coating booth where jets have applied a coating to the hot pipe with an average coating thickness of 15 mils.
The tape around the joint is now removed and pipe continues to the quenching chamber.
In the next step of this process, the pipe enters a quenching chamber and is water cooled to around 250 degrees.
Pipe coming out of quenching chamber.
Stencil being added to pipe stating the company name, API information and size and wall thickness of pipe.
Company Inspector verifying that the coating thickness is acceptable.
Ropes are put around pipe to keep joints of pipe separated and to prevent coating damage.
A 2,000 volt, nonpulsating, low ripple DC dry-type holiday detector is then used to detect any holidays that may exist in the coating.
Repair of a pinhole size holiday in the coating. Patching with these touch up sticks is only allowed in the mill while the pipe is still hot. Preheating the pipe properly is the limiting factor for field application.
Holiday repair using touch-up sticks.
Each pipe is measured and given a number.
The pipe is then carried into the yard. The forklift has protective padding on the jaws.
The pipe is stacked with padded boards between them to prevent damage to the coating.
The joints of pipe are unloaded on to the padded boards and the ropes separate the joints and protect them from damage when striking other pipes.
The End!

• Questions?