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STEEL: PROVEN 100-YEARS STRONG

Polymer Coated CSP Trenchcoat[®]

Mike McGough, PE NCSPA

Mike Mounts Valfilm

Lynn Riley Valfilm

Todd Gray ACI

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Polymer Coated CSP Not Your Grandfather's CSP



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Polymer Coated Presentation

- Video
- Manufacturing / Coating Process
- Product Fabrication & Availability
- Research / Case Histories
- National Specifications
- DOT Specifications
- Resources



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Learning Session

- Here to learn
- Please ask questions as we go
- Your experiences, what you've heard
- Polymer coating is not the only solution available to corrosive conditions and extended service life





- What CSP profiles can be made from polymer coated coils?
- What is the process that produces the film?
- What is the temperature of the steel when the film is applied?
- How thick is the polymer coating?
- Polymer coated steel can be fabricated just like galvanized or aluminized type 2. T/F
- What is the primary AASHTO installation specification for polymer coated CSP?
- What is the primary ASTM materials specification for polymer coated CSP?

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Poly video



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Polymer Coated Corrugated Steel Pipe Introduction

- Why was TRENCHCOAT Developed/History?
- What is TRENCHCOAT Polymer Coated CSP?
- Why is this information important to you?





- **Next:**

- TRENCHCOAT Polymer Coating– Valfilm Mike Mounts & Lynn Riley
- Lamination to Galvanized Steel Coil Advanced Coil Industries Todd Gray

Forming into Pipe – CSP Fabricators

- Manufacturing
- Case Histories
- Existing Polymer CSP DOT specifications

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TRENCHCOAT Polymer - Valfilm



- Trenchcoat polymer coating is manufactured by Valfilm. Facility is ISO certified.
- Trenchcoat has been installed since 1974 with widespread use on CSP since the mid 1980's. Based upon testing and field studies the NCSPA recommends a service life of 100 years.
- Trenchcoat exceeds specifications ASTM A742 and AASHTO M 246.
- There were some other companies briefly making a type of polymer film but installations are limited. Other epoxy coating were made as well.

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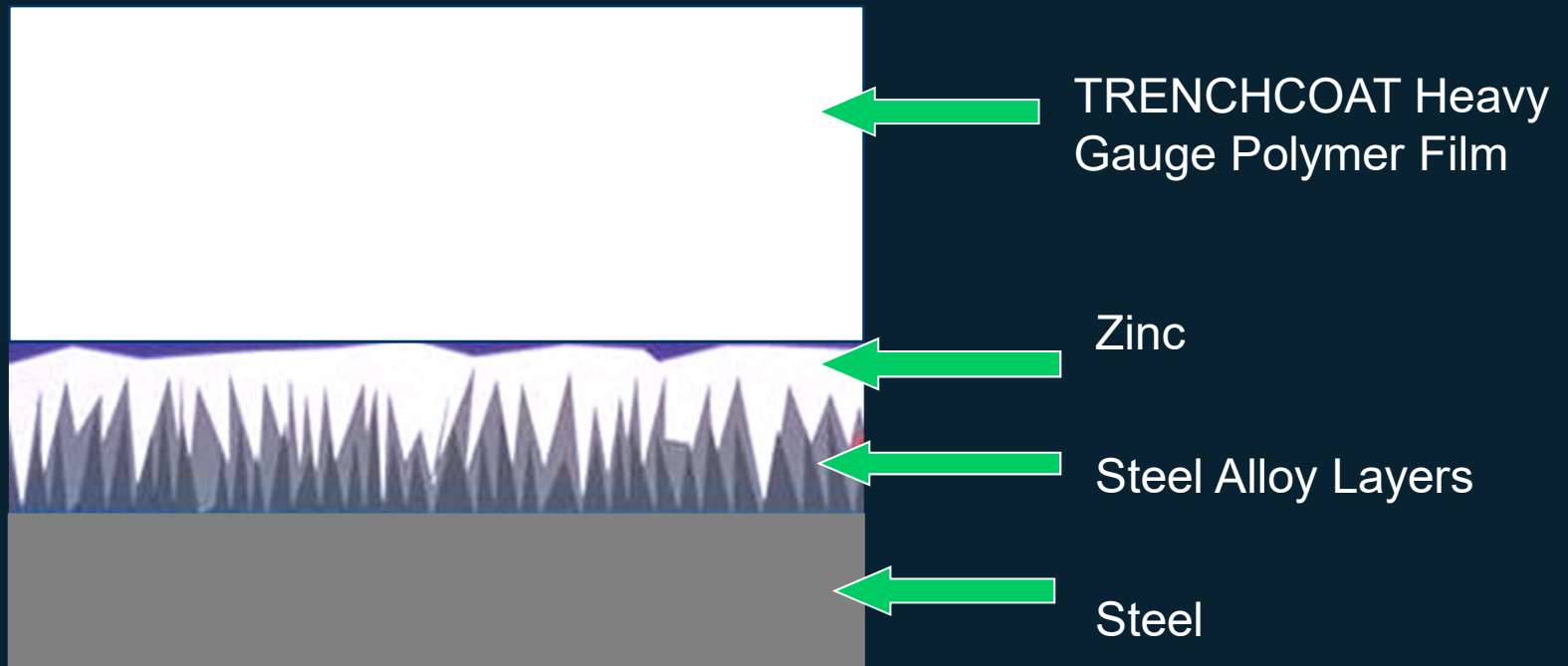


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Polymer Coated Corrugated Steel Pipe

TRENCHCOAT[®] protective film bonds to galvanized steel both
chemically and physically

Polymer consists of an ethylene acrylic protective film



TRENCHCOAT™

Protective Film



Valfilm is entering new markets for steel laminates that protect and perform better in chemical resistance and service life than competitive paint products. These films are manufactured in Findlay, OH and currently are sold under the trademarks of TRENCHCOAT and VALCOAT.

TRENCHCOAT laminated galvanized steel meets and exceeds all specifications of ASTM A742 and AASHTO M-246 and Federal Specification WWP-405-B.

The standard color is black, we can match custom colors or choose from one of our current colors.

The standard thickness is 12 mils, however the films can be ordered in a range of thicknesses from 6 mil to 18 mil.

The film can be embossed with a patterned finish or the standard gloss finish.

™TRENCHCOAT and VALCOAT are registered trademarks of Valfilm USA

Markets

1. Steel decking
2. Agriculture buildings
3. Bridge decking
4. Roofing
5. Steel tanks
6. Alternative to Stainless Steel and/or Aluminum

Valfilm Customers



Valfilm offers technical films for flexible packaging to various markets such as beverage, food, dairy, distribution centers, petrochemical, etc.. The quality of its products keeps on attracting customers in Europe, South America and across North America!

..



TRENCHCOAT™

Protective Film



History of TRENCHCOAT

- Dow Chemical developed INTEGRAL™ 625 adhesive film for lamination to steel for corrugated steel pipe applications in 1974
- INTEGRAL 625 was available in thicknesses from 2 to 12 mils
- As the industry trialed different thicknesses, it was determined that a minimum thickness of 10 mils was preferred for corrugated steel pipe
- ASTM A742 was developed based on polymer coating thickness of a minimum of 10 mils on either side of the galvanized steel
- Dow registered the trademark for TRENCHCOAT Protective film in 1994
- TRENCHCOAT is the same formulation as INTEGRAL 625. except it is only available at a thickness of 12 mils, prior to lamination on steel.
- Valfilm purchased the TRENCHCOAT film business from Dow in 2015
- The formulation for INTEGRAL 625 and TRENCHCOAT have not changed since INTEGRAL 625 was first evaluated in this application in 1974

Quality Control and Coating Validation

- ISO 9001:2015 Certified and In-process to GFSI Certification for Food Safety and Quality
- Traceability – Supplier to Customer
- Production Continuous and Lot inspections
- Additional Product Validation Testing – ASTM A742 + others
 - Chemical Resistance
 - UV Resistance
 - Abrasion Resistance
 - Adhesion Performance



ADVANCED COIL INDUSTRIES

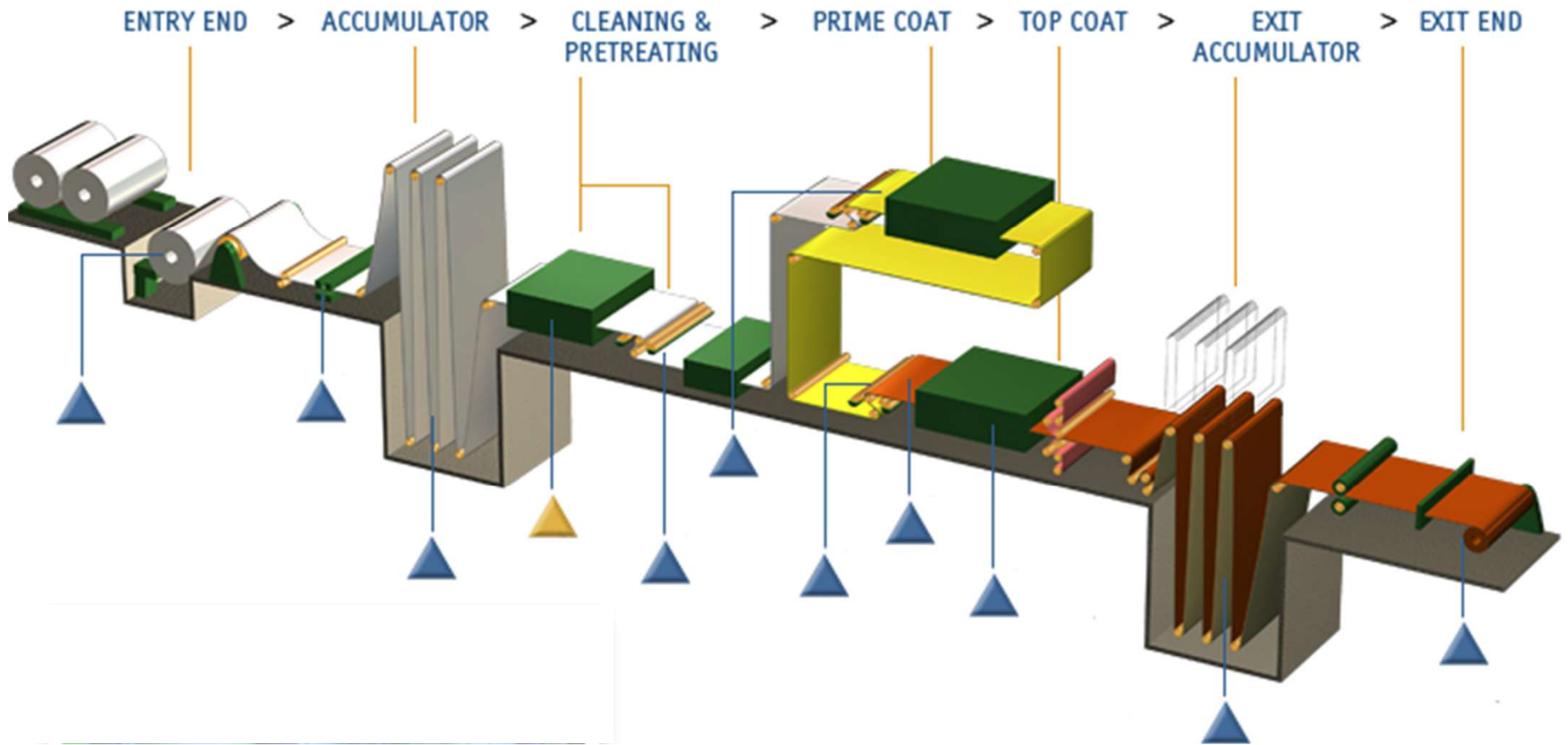
Advanced Coil Industries Inc.

**Quality Control and Quality Assurance
Program Review**

TRENCHCOAT™ Protective Film Coating



ADVANCED COIL INDUSTRIES





ADVANCED COIL INDUSTRIES

Quality Control Procedures

Data and Tracking Requirements

- Verification Process – ACI uses dual verification throughout the QC process. Information is recorded by one employee and a second employee verifies the recorded information with the first employee. This is done continually from receipt through shipment
- Receiving – Upon receipt of coil it is inspected and all weights, dimensions and Mill Coil Tag information is verified. An ACI coil identification number is assigned and both the Mill Coil ID and ACI ID are recorded on the coil and this information is entered into the inventory tracking system along with dimensions and weights.
- Laminating Line-Data Control Sheets – these production records serve as the coil data traveler through the production process. The information is dual verified at five stages of processing as additional information is recorded. Information such as ACI coil number, Lift number, Dimensions, Weight and Lineal Feet are recorded.
- Verification points
 - Forward Operation (Uncoiler)
 - Furnace Operation (Main Operations Control)
 - Laminating Operation (Polymer film tag information added)
 - Back End Operation (Recoiler)
 - Shipping



ADVANCED COIL INDUSTRIES

Quality Control Procedures

Quality Control Process - Production

Stages of Production - QC points of Control

- Straightening and Stitching – provides for flat / straight coil and continuous operation.
- Cleaning – two to three step process
 - Tank One – Mild detergent in heated water – QC Control: operator monitors detergent and temperature levels at two locations.
 - Tank Two – Water rinse only in heated water – QC Control: operator monitors levels of residual detergent.
 - Scotchbrite Operation – Rotary cleaning machine to remove stencil, white rust or Heavy Oil – QC Control: Only in use if needed on coil.
- Chemtreat - chemical treatment added to prevent corrosion and initiate chemical reaction with the polymer coating
 - Chemical treatment per ASTM specification – QC Control: Operator continuously checks electronic reading on measurement equipment and chemical monitoring testing is completed as needed throughout the production run (number of tests per day varies depending on length of each coil and atmosphere conditions)
- Drying – chemtreated coil travels down the line 80 feet in atmosphere to allow drying and setting of treatment



ADVANCED COIL INDUSTRIES

Quality Control Procedures

Quality Control Process - Production

Stages of Production - QC points of Control

- Furnace (Oven) Operation – steel is heated in a 400 (F) degree indirect heat natural gas fired oven to achieve optimal temperature to laminate the polymer coating.
 - Three zone oven is heated to approximately 600 degrees Fahrenheit (depending on atmospheric conditions).
 - Soak time for steel is achieved by passing the steel through the 35 foot long oven to achieve 380 to 400 degrees Fahrenheit surface temperature – QC Control: Oven temperature and Steel surface temperature are coordinated via a dual wave length industrial infrared pyrometer within the operations control of the oven. The operator records temperatures on the production records.
 - Surface temperature testing is done both electronically and manually. The manual testing is done with special markers designed to melt at 380 degrees – QC control: no marking should be visible from the marker and entrance temperatures to the laminator should not vary from furnace exit temperatures significantly.
- Lamination – the heated steel is immediately transferred from the oven to the laminator
 - The laminator consists of 4 feed rollers (two at a time are utilized top and bottom) where the polymer film is fed automatically to the steel and passed through compression rollers.
 - Excess polymer is trimmed from the edges of the steel for an edge to edge coating. This is an ACI specific production process as the ASHTO specification does not call for edge to edge coating specifically but allows a one-quarter inch coating gap.
 - Splices in material are marked with “flags” on the material and overlap is maintained per the AASHTO specification.



ADVANCED COIL INDUSTRIES

Quality Control Procedures

Quality Control Process - Production

Stages of Production - QC points of Control

- **Quench and Stenciling** – the steel passes through a cold water quench tank to bring the surface temperature of the now coated steel down for recoiling
 - The temperature of the quench tank should not exceed 160 degrees Fahrenheit in order to properly bring the steel down to a temperature that allows recoiling of the steel. QC control: the main control operator monitors the temperature of the quench tank with a digital readout adding cold water as needed to maintain the proper temperature.
 - The polymer is fully adhered and does not require the quench for its properties to be achieved. This process is mainly for handling purposes.
 - Stenciling is applied after quenching marking the date of production, customer name, company name, coil ID and the TRENCHCOAT™ logo.
- **Recoiling** – the steel is recoiled under tension to ensure a straight and even recoiling without significant side to side travel.
 - At this point in the process the samples are taken from each coil.
 - All traveler information is written on the coil by the recoiler operator and this information is verified by the coil removal operator.
 - The coil is placed into inventory and its location is noted on the traveler which is now complete and turned in for recording of final information.
 - QC control: end of QC control, start of Quality Assurance.



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Quality Control Procedures

Quality Assurance Process

Quality Assurance

- Recording of QC process Data – all data from the Laminating Line-Data Control Sheets is entered into the inventory and billing systems. Both systems are double checked for accuracy by two employees.
- Testing – six testing samples are sheared from the master sample removed from the coil. All samples from the previous days production are tested the following work day as to maintain control of each sample. Samples are logged by coil ID, date and run position as well as who tested them.
- Testing Procedure – testing is performed by a lab technician per ACI QA instructions. The following procedures are required of each test.
 - Three 4 inch by coil width test bars are sheared from the master sample. Each is labeled with the coil information from the master coil. Three additional 2 inch by 8 inch samples are sheared from the master sample and labeled just as the larger samples are.
 - The samples are numbered one through three for each group and logged in the Testing Log Form (Test Lab) per ACI QA instructions.
 - Two samples (one and two from each group) will be tested while the third will remain untested should an issue arise that may require independent verification.
 - Samples are retained for a period of seven years. The physical storage location of each sample is recorded in the Testing Log Form for access should it be required at a future date.
 - Any non-conformity with any test will be reviewed with the Operations Manager, The VP of Manufacturing or the President. Any material that is deemed to be non-conforming as confirmed by one aforementioned personnel is to be segregated and will not be allowed to leave the facility unless independent testing disproves the internal results.



ADVANCED COIL INDUSTRIES

Quality Control Procedures

Quality Assurance Process

Tests Performed per AASHTO, ASTM requirements or ACI requirements

- Thickness test – AASHTO requirement is 10-10 mil minimum
 - This test is carried out using an electronic thickness gauge. QA control: the thickness of the two samples is recorded at the top, middle and bottom on both sides of the larger test samples. This is a PASS / FAIL test. Reference ASTM D1005 or ASTM D7091.
- Impact test - one of three tests for adhesion
 - The large sample group is tested for adhesion by impact testing meeting a minimum impact of 34 in – lb. This impact is achieved with a horizontal impact testing device. Per the specification there will be no breaks in the polymer. The sample is run through the device and then tested for electric conductivity to determine if any penetration in the polymer coating has occurred (Holiday Test). This a PASS / FAIL test. Reference ASTM D2794.
- Mandrel Bend test (Ambient temperature) – test for adhesion
 - The small sample group is tested for adhesion by bending the samples over a mandrel with a hydraulic press. There should be spalling, cracking or disbonding of the coating on the outside of the bend after this test. This is a PASS / FAIL test. Reference ASTM 742
- Mandrel Bend test variant (Freeze/ Thaw) – not a requirement per ASTM unless for not approved material
 - At the request of the customer, ACI will perform the Mandrel Bend test on a sample chilled to 0 degrees Fahrenheit as well as heated to 122 degrees Fahrenheit. The test procedures and requirements are the same as above. This is a PASS / FAIL test. Reference ASTM 742.
- Holiday test - test for adhesion
 - The requirement is that an average of 2 or less holidays per square foot required. Per ASTM G62 Method A



Coated Galvanized
Steel Coil

06.22.2011 10:39



Coated Galvanized
Steel Coil

06.22.2011 10:41

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Why was Polymer Coated CSP Developed?

TRENCHCOAT Protective Film was developed by the Dow Chemical Company in 1974 to extend the service life of galvanized corrugated steel pipe (CSP).

With the development of TRENCHCOAT Polymer Coating, CSP could now be installed in corrosive environments outside the range of plain galvanized CSP.

Polymer Coated CSP combines the strength of steel with the corrosion protection of polymer.



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Why is Polymer Coated CSP Important to You? Added value compared to Rigid Pipe.

- Long term strength of steel
- Corrosion protection of polymer
- High pipe stiffness relative to plastic pipe
- Available in Round and Pipe Arch
- Long lengths available.
- High Beam Strength
- High % of Recycle Content up to 95%
- Wide range of diameters up to 144"
- Various End Treatments/End Sections
- Small OD/ID ratio vs RCP
- Installed cost savings



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Polymer Coated CSP corrosion and abrasion resistant

- Excellent Adhesion
- Chemical resistance to
 - Acids
 - Alkalis
 - Salts
- High resistance to abrasion.
- All documented through extensive long term field and laboratory testing.



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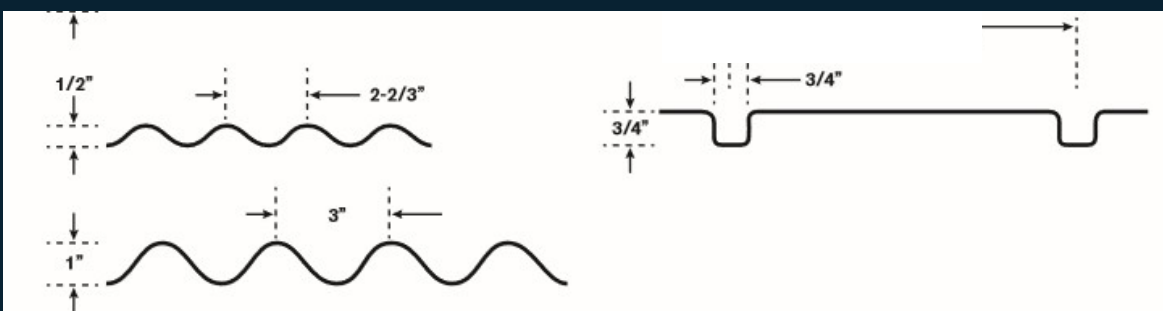


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Product Availability



- Dia. 12" – 144"
- All corrugations
- 10 gage* – 16 gage



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Applications Storm Sewer, Culvert, Reline Irrigation & Stormwater Detention



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Annular, Helical and Smooth Spiral Rib



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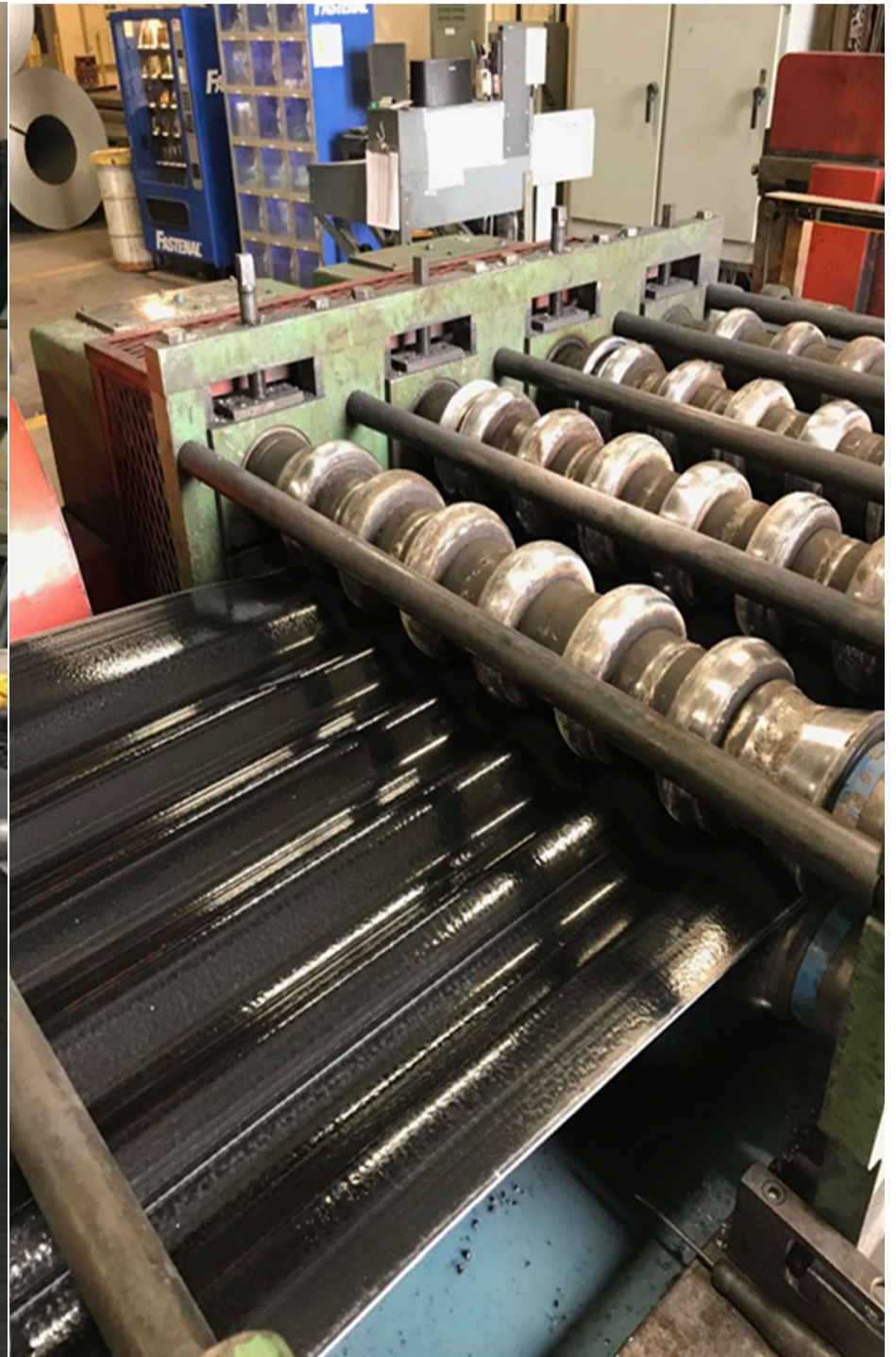
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Round Pipe & Pipe Arch Solid & Perforated Pipe





Corrugation Rollers







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Manufacturing/Coating Process

Helical Pipe





Finished 48" diameter

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Manufacturing/Coating Process

Riveted (Annular) Pipe





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Plant Handling



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Plant Storage



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Manufacturing/Coating Process

Loading and Transportation
Use of timbers and nylon slings to protect coating



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Manufacturing/Coating Process

Field Handling – Nylon Slings or Lifting Lugs Recommended





Coating Repair

ASTM A762 is the standard which covers the fabrication of the pipe. Includes some language regarding the repair of the polymer coating. In section 10.1 it states the following:

Pipe which has been damaged, either during fabrication or in shipping, may be rejected unless repairs are made which are satisfactory to the purchaser.

New language for ASTM A 762 "Scratches > 0.125" wide. Total area > 2.8 in²/ft²"

11.5 Areas of damaged polymer coating shall be repaired with a polymer coating similar and compatible with respect to durability, adhesion, and appearance of the original polymer coating.

11.5.1 Polymer coating damaged during shipping or installation may be repaired using materials as described in 11.5 or by the application of a coating material conforming to Specification A849.



National Specifications for Polymer Coated CSP

AASHTO

Manufacturing – M245

Material – M246

Design – Section 12

Installation – Section 26

ASTM

Manufacturing – A762

Material – A742

Design – A796

Installation – A798

AREMA

Part 4 – Culverts



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Long Term Performance / Durability





Long-Term Field Investigation of Polymer Coated Corrugated Steel Pipe - 2012

Steel Market Development Institute

2012

LONG-TERM FIELD INVESTIGATION OF POLYMER COATED CORRUGATED STEEL PIPE

Written by: Elzly Technology Corporation

Prepared for: NATIONAL CORRUGATED STEEL PIPE ASSOCIATION, March 2012

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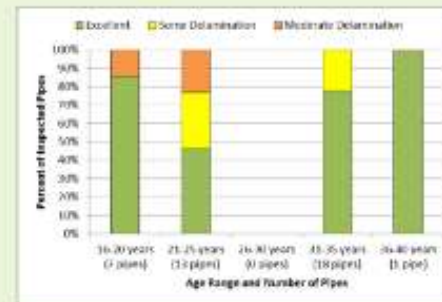


Figure 4. Polymer coating condition as a function of pipe age.

CONCLUSIONS

1. The data continues to support guidance for a polymer coating "add-on" life of 80 years. Polymer coatings were observed to significantly extend the life of corrugated steel pipe.
2. The polymer coating continues to protect the galvanized steel pipe in severe environmental and abrasion conditions beyond the design conditions. This suggests a robust product design approach that is inherently conservative.
3. In all of the pipes, less than 5% of the polymer had coating delamination. This keeps the film intact and protecting the pipe from corrosion. Locations of polymer degradation which were observed are at locations of external damage such as cut edges or handling damage. None of these instances indicated a systemic involvement of the coating on the entire length of the pipe.

FIELD INSPECTIONS

Most of the previous (2011) field inspections were performed by the Chief Engineer of the National Corrugated Steel Pipe Association with the assistance of local DOT and manufacturer representatives. Elzly participated in the first inspection (Sharp County, Arkansas) to ensure that the inspection process was consistent with historical inspections. Elzly performed most of the historical field inspections of the polymer coated CSP installations and was able to provide:

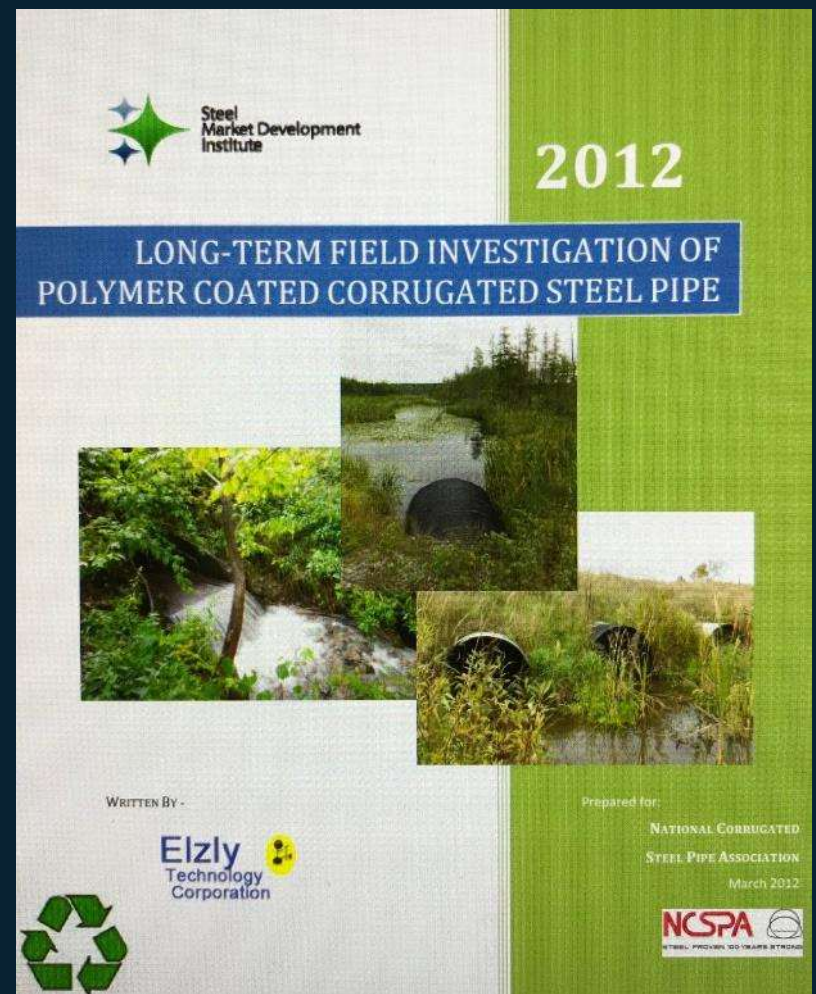
Polymer CSP Service Life NCSPA Recommendations Based on 2012 Field Studies

Data supports a add-on service life
 80 years to plain galvanized pipe.

A 50-year add-on service life would
 Be a conservative approach.

CONCLUSIONS

1. The data continues to support guidance for a polymer coating "add-on" life of 80 years. Polymer coatings were observed to significantly extend the life of corrugated steel pipe.
2. The polymer coating continues to protect the galvanized steel pipe in severe environmental and abrasion conditions beyond the design conditions. This suggests a robust product design approach that is inherently conservative.
3. In all of the pipes, less than 5% of the polymer had coating delamination. This keeps the film intact and protecting the pipe from corrosion. Locations of polymer degradation which were observed are at locations of external damage such as cut edges or handling damage. None of these instances indicated a systemic breakdown of the coating on the entire length of the pipe.





Florida Department of Transportation-Office of Materials Service Life Estimation of Stay-in-Place Forms with Trenchcoat[®]

The service life was determined by examining the individual components of the stay-in-place form; polymer layer, galvanized layer and the steel substrate.

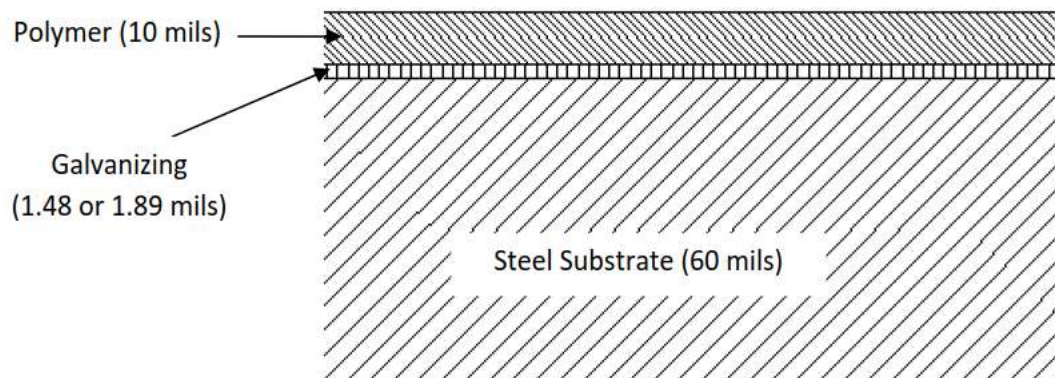


Figure 1. Representation of Stay-in-place form

Conclusion

Based on the evaluations of the different layers of protection provided by the Trenchcoat[®] coating system, the stay-in-place forms with Trenchcoat[®] polymer coating should provide at least 124 years of service before a failure of the forms is observed.

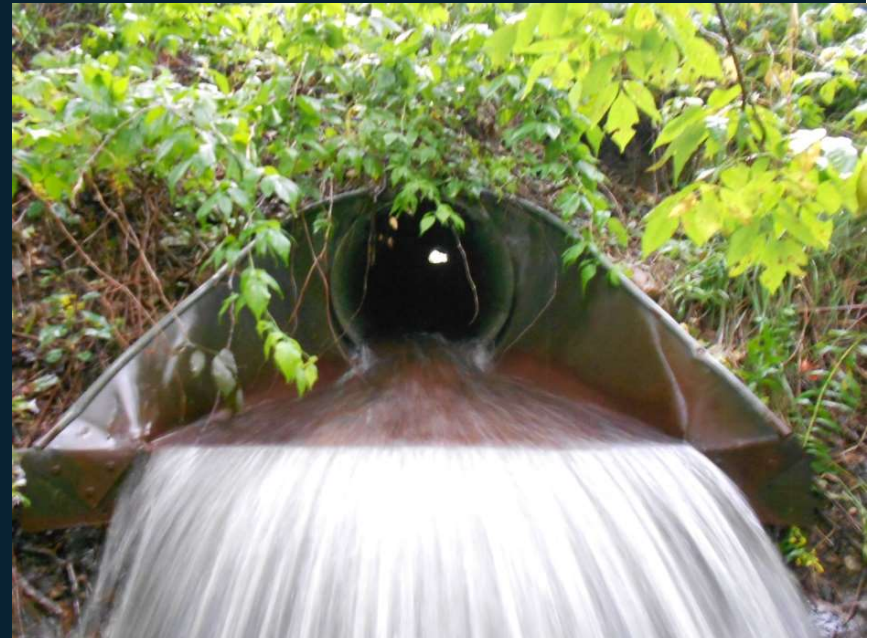
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New York Summary

- 14 locations
- Round (18" – 48") – 3 x 1 and 2 2/3 x 1/2
- Multiple locations – Albany, Dormansville, Rt. 30 near Speculator and Long Lake
- 22 - 23 years old
- Just after Hurricane Irene





New York State DOT Highway Design Manual – Chapter 8 – Highway Drainage

Table 8-7 Anticipated Service Life, in years, for Steel (with and without additional coating)^{1,2}

Gauge	Metallic Coated (Galvanized)		Metallic Coated (Aluminum Coated - Type 2) ³ & Metallic Coated (Galvanized) w/ Paved Invert ³ or Fully Paved ³		Metallic Coated (Galvanized) w/ Polymer Coating ⁴		Metallic Coated (Galvanized) w/ Polymer Coating and Paved Invert ⁵		Metallic Coated (Galvanized) w/Paved Invert ⁶ (Structural Steel Plate)	
	§707-02/§707-09		§707-02		§707-02		§707-02		§707-09	
	Zone I	Zone II	Zone I	Zone II	Zone I	Zone II	Zone I	Zone II	Zone I	Zone II
18	26	13	51	38	51	38	66	53	Gauge not manufactured	
16	32	16	57	41	57	41	72	56		
14	40	20	65	45	65	45	80	60		
12	54	27	79	52	79	52	94	67		
10	69	34	94	59					89	62
8	84	42	109	67					104	69
7	94	47	Coating option not specified for these gauges						119	77
5	109	54								
3	124	62								
1	140	70								

Table 8-5 Design Lives

LOCATION	DESIGN LIFE (Years)
Driveways	20
Significant Locations ¹	70
Other Locations	50



Gage should be as per AASHTO LRFD

- Don't "over-gage" for added design life.
- Trenchcoat provides the added design life.
- 48" dia 16 gage "FS" is super high.

Corrugated Steel Pipe Backfill Heights

Round Pipe		2-2/3" x 1/2" Corrugations				
Pipe Size (inches)	Minimum cover (inches)	Steel Thickness (Gage)				
		16	14	12	10	8
		Galvanized Thickness (inches)				
		0.064	0.079	0.109	0.138	0.168
Corrugated Steel Pipe Backfill Heights (feet)						
12	12	219	273	-	-	-
15	12	183	228	255	-	-
18	12	146	182	191	-	-
24	12	109	137	191	-	-
30	12	87	108	153	-	-
36	12	73	91	127	164	-
42	12	62	78	109	141	172
48	12	55	68	96	123	150
54	12	-	61	85	109	134
60	12	-	-	76	98	120
66	12	-	-	-	89	109
72	12	-	-	-	82	100
78	12	-	-	-	-	89
84	12	-	-	-	-	77

The Table is based on the following criteria (ASTM/AASHTO embankment)

1. Pipe Type = Helical or Annular (riveted or spotweld)
2. Design Method = LRFD
3. Fill Density = 120pcf (prism above pipe)
4. Minimum Fill height taken as Span/8 but not less than 12"
5. Minimum cover for unpaved roadways is from the top of gravel surfacing.
6. Minimum cover for paved roadways is:
 - a) To the top of the base for asphalt surfaces
 - b) To the top of the pavement for concrete surfaces



New York State DOT Highway Design Manual – Chapter 8 – Highway Drainage

Table 8-6 Metal Loss Rates for Steel By Geographic Location

Zone I (2 mils/yr)		Zone II (4 mils/yr)
Region 1	except	Albany, Greene, and Schenectady Co.
Region 2	except	Montgomery Co.
Region 3	except	Cortland, Tompkins Co.
Region 4	—	—
Region 5	except	Cattaraugus Co.
—	—	Region 6
Region 7	—	—
—	—	Region 8
—	—	Region 9
—	—	Region 10
—	—	Region 11



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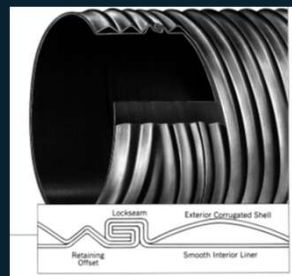


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Polymer Coated Double Wall New Jersey DOT – Lodi, NJ Sewer Improvements



- 4,000 LF 132" Diameter
- 1,000 LF 120" Diameter
- Constrained Site
- Integrated Manholes



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Highway 84 Cass County MN Installed 1977 14 Different Culvert Pipes





North Dakota DOT Highway 23 Improvements

- ND DOT – Hwy 23 Improvements – 18” – 60” Polymer Coated Spiral Rib Pipe
- Spiral Rib used for storm drain with a manning’s “n” of 0.012
- Polymer coating gives the pipe required service life in the site soil conditions



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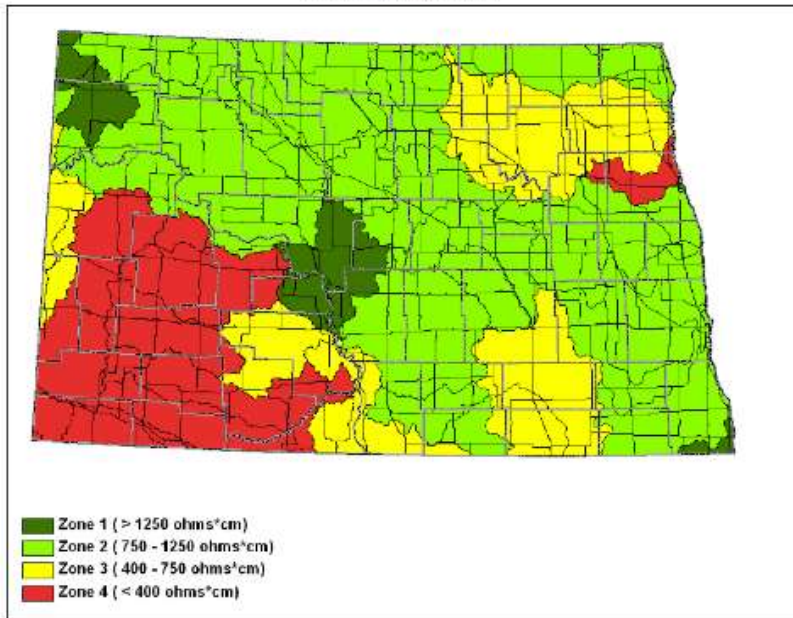
Medora, ND



- Installed in 1988.
- Zone 4 North Dakota DOT Corrosion Map. “RED Zone” <math><400 \text{ Ohms}^* \text{cm}</math> the highest corrosion zone in ND.
- No signs of corrosion,
- Mud splatter on the side walls and mud layered on the inverts.

Corrosion Zone Map & Tables

North Dakota Corrosion Zones (Map 1)
 (Based on Soil Resistivity)



Corrosion Table: 4a

- Mainline Drainage -
 (Design Service Life - 75 Years)

Pipe Material	Gauge	Corrosion Zone			
		Zone 1	Zone 2	Zone 3	Zone 4
Concrete Pipe (Section 830.01)		Y	Y	Y	Y
Metal Pipe (Section 830.02)					
Zinc Coated Corrugated Steel	16 ga.				
	14 ga.				
	12 ga.				
	10 ga.	Y			
	8 ga.	Y	Y		
Aluminum Coated Corrugated Steel (Type 2)	16 ga.				
	14 ga.				
	12 ga.	Y			
	10 ga.	Y	Y		
	8 ga.	Y	Y	Y	
Polymeric Coated Steel (over Zinc or Aluminum Coated Steel)	16 ga.	Y	Y	Y	Y
	14 ga.	Y	Y	Y	Y
	12 ga.	Y	Y	Y	Y
	10 ga.	Y	Y	Y	Y
	8 ga.	Y	Y	Y	Y
Structural Steel Plate Pipe (Zinc Coated)	16 ga.				
	14 ga.				
	12 ga.				
	10 ga.	Y			
	8 ga.	Y	Y		
Aluminum Alloy Structural Plate Pipe	16 ga.	Y	Y		
	14 ga.	Y	Y		
	12 ga.	Y	Y		
	10 ga.	Y	Y		
	8 ga.	Y	Y		

Data Source: United States Environmental Protection Agency's (EPA) Environmental Monitoring Assessment Program.

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NDDOT

North Dakota
Department of Transportation



- Added protection from abrasion, salts, alkalis and hot soils
- 100 Years Life, PH 5-9 and >1000 resistivity
- ND DOT Approval for Storm Sewer (shown), and Culvert

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STEEL: PROVEN 100-YEARS STRONG



Illinois Department
of Transportation



Precoated Galvanized (Polymer Coated) meets minimum 75 year service life for culvert & storm sewer.

All small diameter CSP under 48” diameter should be Precoated or Aluminized Steel.

(h) Precoated Galvanized Corrugated Steel Pipe	1006.01
(i) Precoated Galvanized Corrugated Steel Pipe Arch	1006.01

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STEEL. PROVEN 100-YEARS STRONG

Tax School Road, Marshall County IL – Installed 1975 13 Difference Culvert Pipes



NCSPA



STEEL. PROVEN 100-YEARS STRONG

144" Polymer Double Wall Illinois DOT I-74, Moline, Illinois



Illinois Department
of Transportation



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STEEL. PROVEN 100-YEARS STRONG



- Added protection from abrasion, salts, alkalis and hot soils
- 100 Years Life, PH 5-9 and >1000 resistivity
- Utah DOT Approval for Storm Sewer, Culvert, Detention and reline applications

NCSIPA



STEEL. PROVEN 100-YEARS STRONG

Underground Detention – Draper, Utah 96" Polymer CMP (in UDOT right of way)



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STEEL. PROVEN 100-YEARS STRONG

Polymer Coated Double Wall Indiana DOT – Indianapolis, IN



- 10,000 LF 96" Diameter Storm
Fill heights 20' – 45'
Ground Water



NCSIPA



STEEL. PROVEN 100-YEARS STRONG

Polymer Coated Pipe Arch MDT East Billings, MT



NCSIPA



STEEL. PROVEN 100-YEARS STRONG

36" Polymer Coated Pipe – Installed 1978 Yellowstone CC Billings, MT



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STEEL. PROVEN 100-YEARS STRONG

MT Rail Link – Toston, Montana Installed in 1990s - Abrasion Resistant

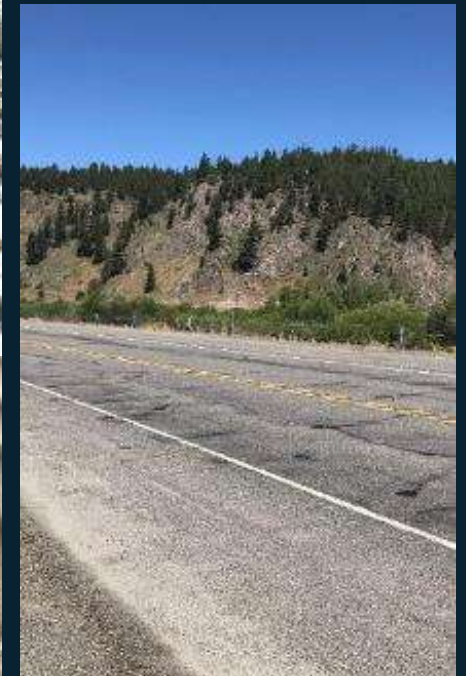


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STEEL. PROVEN 100-YEARS STRONG

Montana DOT – Hwy 12 MP 13.7
Elliston, Montana
66" X 51" PA Installed in 1988 (30 years)
Heavy Bedload Present



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STEEL. PROVEN 100-YEARS STRONG

Polymer Coated CSP, Onawa, IA US Army Corps of Engineers Levee



**Project required
10 psi factory joint test**



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STEEL. PROVEN 100-YEARS STRONG

96" Polymer Coated Double Wall BNSF Reline – Afton, Iowa

BNSF
RAILWAY



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Polymer Coated Double Wall CTH 16 Pewaukee, WI Wisconsin DOT



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STEEL. PROVEN 100-YEARS STRONG

Superior Storm Sewer, Superior, WI 114" Polymer Double Wall CMP



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STEEL. PROVEN 100-YEARS STRONG

Polymer Coated CMP 48" & 42" Detention Marshfield, WI Library



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STEEL. PROVEN 100-YEARS STRONG

Minneapolis, MN Hiawatha Golf Course



Installed in 1988.
Steel Spiral Rib Storm Sewer
42" Pipe Arch



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STEEL. PROVEN 100-YEARS STRONG

11th and Walnut St. Denver, Colorado Polymer Coated CMP 42" Detention/Retention



NCSA



STEEL. PROVEN 100-YEARS STRONG

Why is Polymer Coated CSP Important to You? Added value compared to Rigid Pipe.

- Strength of steel
- High pipe stiffness
- High Beam Strength
- Long Lengths available
- Flexibility in diameters
- Small OD/ID ratio
- Cost Savings
- Corrosion Protection of Polymer
- Available in Round and Pipe Arch
- High % of Recycle Content up to 95%
- BOF ~ 25-30% & EAF ~ 95%
- Various End Treatments/End Sections
- Multiple Fabrication Options
- Best Overall Value!





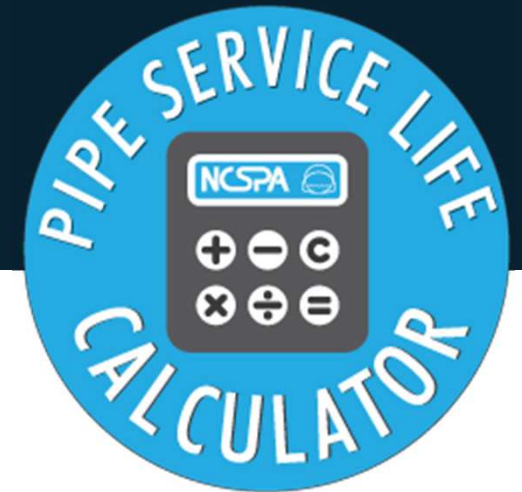
- What CSP profiles can be made from polymer coated coils?
- What is the process that produces the film?
- What is the temperature of the steel when the film is applied?
- How thick is the polymer coating?
- Polymer coated steel can be fabricated just like galvanized or aluminized type 2. T/F
- What is the primary AASHTO installation specification for polymer coated CSP?
- What is the primary ASTM materials specification for polymer coated CSP?

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STEEL. PROVEN 100-YEARS STRONG

Service Life Calculator



[Calculators, Charts and Tools](#) > Service Life Calculator

Calculators, Charts and Tools

Service:	<input type="text" value="75"/>	(years)
Resistivity:	<input type="text" value="3000"/>	(ohm-cm)
pH:	<input type="text" value="6.5"/>	
Abrasion:	<input type="text" value="Level 2: Low Abrasion"/>	<input type="button" value="More Info"/>
Soft water with CaCO ₃ < 50 ppm ?:	<input type="text" value="No"/>	
	<input type="button" value="Next"/>	

Material	Life (Years)
Galvanized	
0.109 (12 gage)	87
0.138 (10 gage)	100
0.168 (8 gage)	100
Aluminized Type 2 (ALT2)	
0.052 (18 gage)	75
0.064 (16 gage)	75
0.079 (14 gage)	100
0.109 (12 gage)	100
0.138 (10 gage)	100
Polymer Coated	
0.052 (18 gage)	100
0.064 (16 gage)	100
0.079 (14 gage)	100
Service life can be extended with a supplemental coating and/or paving as follows:	
Add-on Service Life	
Abrasion Level 1 or 2	(years)
Asphalt Coated	10
Asphalt Coated and Paved	30
General Note:	
1. User must also check structural requirements for gage selected.	
2. For further information see	

NO
STEEL. F



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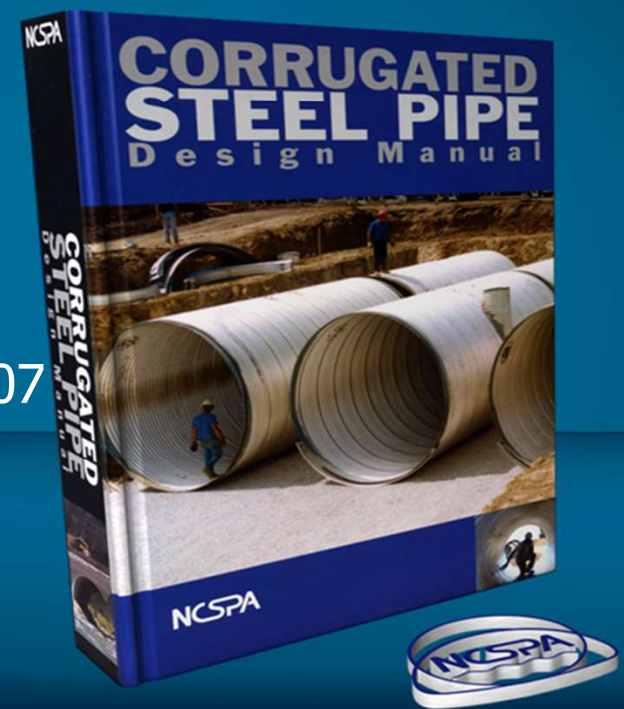


Polymer Coated Storm Sewer Improvements

 Lodi, NJ, USA



- Visit www.transportation.org
 - AASHTO Materials Specifications M36, M245, M246
 - LRFD Bridge Design (Section 12) and Construction (Section 26) Specifications
- Visit www.astm.org
 - ASTM Specifications A760, A762, A798 and A807
- Visit www.NCSPA.org to see steel in action.
 - NCSPA Corrugated Steel Pipe Design Manual
 - NCSPA Installation Guide



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THANK YOU!!!
Questions???



www.NCSPA.org