SIP Industries
Quality Manufacturer Since 1960

SIP INDUSTRIES SERAMPORE SINCE 1960

SIP *ARC-ZINC*

Presented by

Roger Johnson – SIP Industries

Director of Technical Service
rjohnson@sipindustries.com

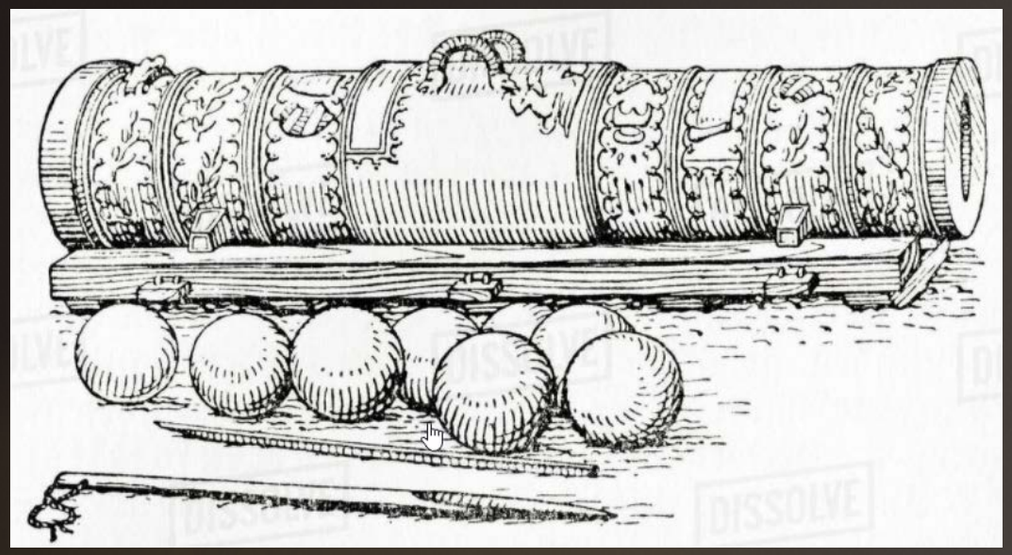
Certified Instructor: NACCER – National Center for Construction Education and Research

Outline

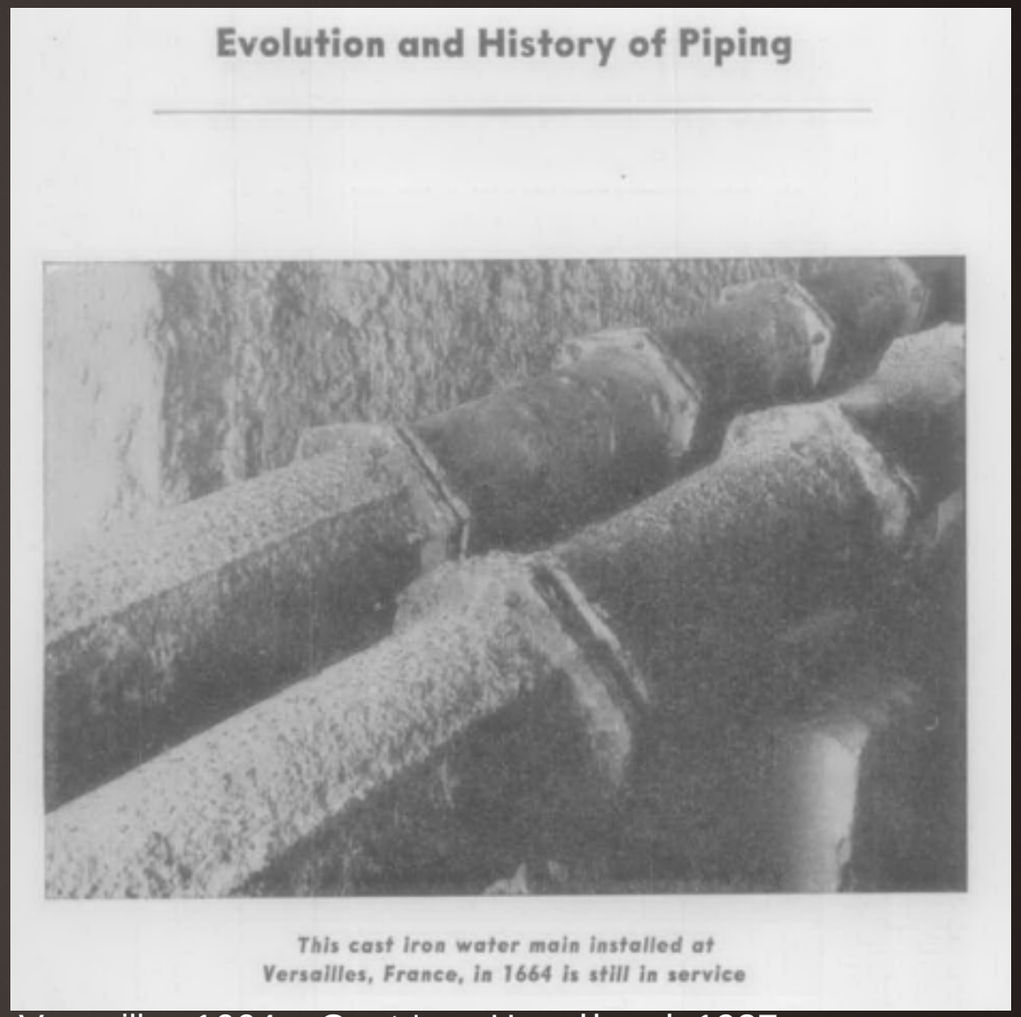
- *Introduction*
- *Industry History*
- *Standards & Testing*
- *Zinc Rich Paint*
- *SIP Arc-Zinc*
- *Comparison*
- *Questions*

Water Works Industry History

Egyptians – Greeks – Romans – Europe



1650's



Versailles 1664 – Cast Iron Handbook 1927

Cast Iron Pipe Research Association

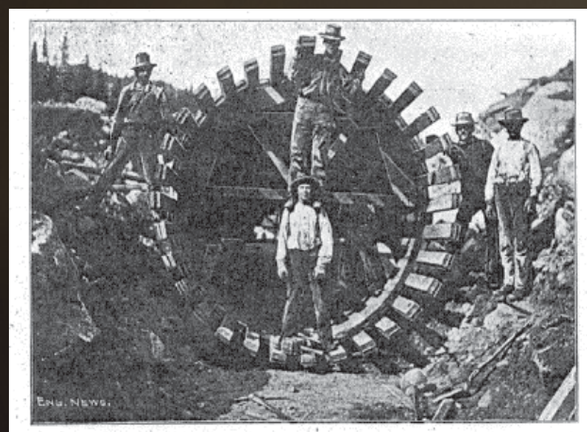


FIG. 1.—VIEW OF 9-FT. REDWOOD PIPE UNDER CONSTRUCTION, NEAR FLORISTON, CAL.

FIG. 2.—RIVETED STEEL ELBOW IN 9-FT. REDWOOD PIPE, NEAR FLORISTON, CAL.

Mr. E. S. Cobb, Engineer; Excelsior Wooden Pipe Co., Contractor.

1903 Floriston, CA –Wood Pipe.

SIP Industries
Quality Manufacturer Since 1960

SIP INDUSTRIES SERAMPORE SINCE 1960

History

- Over the years many manufactures of Cast Iron now Ductile iron fittings have come and gone, just to name a few:

Kittanning Iron & Steel,
Crane Co.,
Mueller Co.,
Sharon Iron Works,
Bethlehem Iron Co.,
Clinton Iron & Steel Co.
Sloss Iron & Steel,
Atlanta Iron & Steel,
Watt Iron Co.,
Reading Iron Co.
American Cast Iron,
US Cast Iron Pipe & Foundry

Martin Iron & Steel Co.,
Sloan,
Union, Darling Mfg.,
Warwick Iron Co.,
Embreville Iron Co., R.
Hecksher & Sons
Northwestern Iron Co.,
Elk Rapids Iron Co.,
McWane Iron,
Griffin Ind.,
Iroquois Iron Co.,
Tonawanda Iron & Steel Co.

McNair & DeCamp Co.,
Allegheny Iron Co.,
Kennedy Ind.,
Elk Rapids Iron Co.,
M&H Ind.,
Eddy Co.,
Ohio Iron & Steel
Chapman Mfg.,
Woodward Iron,
Penn Iron & Coal Co.,
Ashland Coal & Iron Co.,
M. A. Hanna & Co.,

Stockham Ind.,
McNab Co.,
Brier Hill Iron & Coal Co.,
Mabel Co.,
Spearman Iron Co. Andrew
Brothers Co.,
Girard Iron
Longdale Iron Co.,
Dresser,
Elkhart Ind.,
Andrew Brothers Co.
Monogahela Co.,
Sharpsville Co.,
Olympic Foundry
Stewart Iron Co.

American Foundrymen's Association Membership List 1921

- Now we have just Four in our industry;
  - SIP Industries 1960
  - Tyler / Union 1935 & 1911
  - Star Pipe 1981
  - Sigma 1985

History of ARC-ZINC

- A chemist in France named P. J. Melouin presented a paper to the Royal Academy on a process for dipping steel in molten zinc to protect it from corrosion in 1742. Steel dipped in molten zinc became fashionable for making pots, pans, and kettles that would not corrode over years of use.
- Waterwork Industry – Europe, Arc-Zinc pipe late 1950's
- Austria and Germany Zinc pipe became a standard in 1972
- United Kingdom and United States as option from 1980's
- ISO created standards for waterworks industry
  - ISO 8179-1 for Metallic Spray for DI pipe and fittings - 1985
  - ISO 8179-2 for Zinc-Rich Paint for DI pipe and fittings - 1995
- SIP Started Arc-Zinc spraying fittings 2010

SIP Industries
Quality Manufacturer Since 1960

SIP INDUSTRIES SERAMPORE SINCE 1960

Arc Zinc Spray

Two 99.99% Zinc wires are melted at 787 deg F and sprayed on to a Ductile Iron surface in a shop.

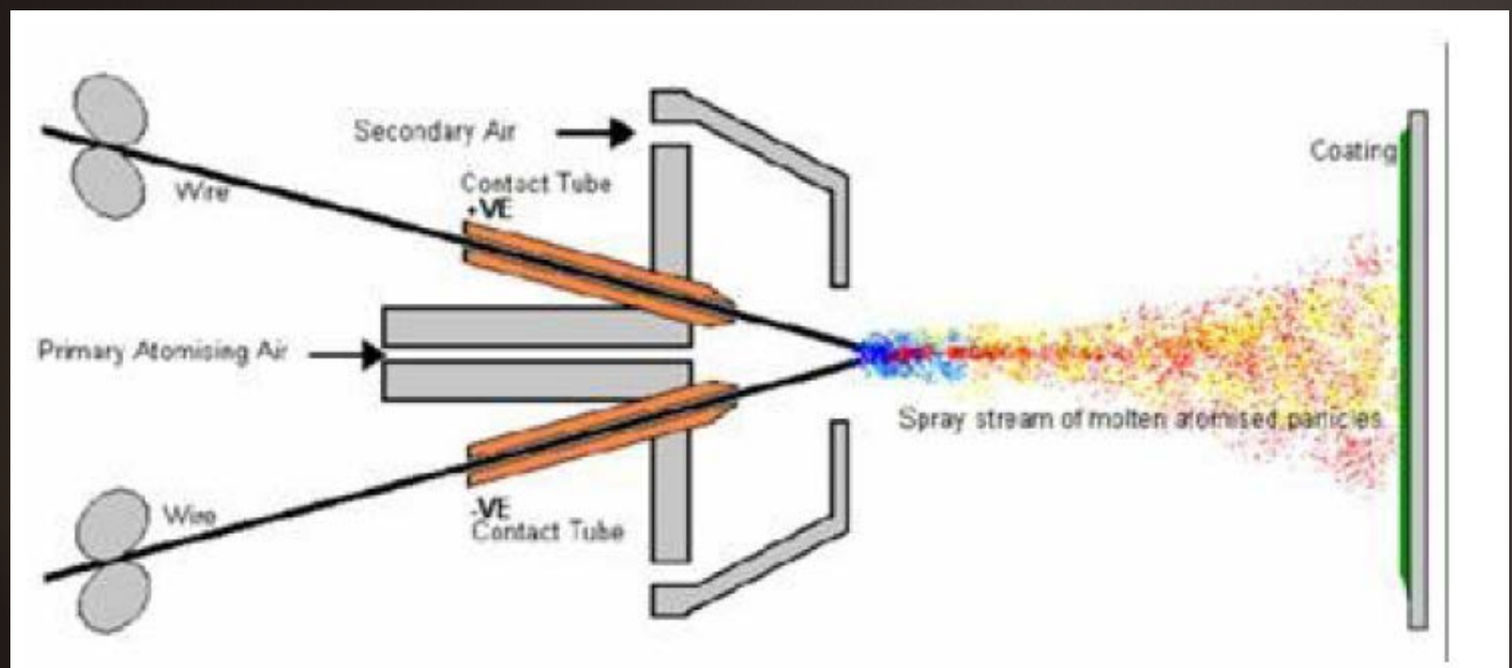


Figure 11. The metallized arc spray process. (Kalivas, 2003)

Standards & Testing

ISO 8179-1 – Metallic Zinc for DI Pipe and Fittings

4 Materials

The coating materials shall be

— pure metallic zinc with a purity of 99,99 %,

— zinc and aluminium alloy with or without other metals, or

— other zinc alloys

followed by a finishing layer that can be bituminous paint or synthetic resin compatible with zinc-based layer.

5.4 Zinc-based coating mass

The mean mass of zinc-based coating measured in accordance with 7.1 shall be as follows:

— not less than 200 g/m² with a local minimum of 180 g/m²;

— in low corrosive areas, by agreement between the purchaser and the supplier, 130 g/m² of zinc with a local minimum of 110 g/m²;

— in case of very corrosive soils, the manufacturer and the purchaser may decide to use additional coating mass.

Standards & Testing

ISO 8179-2 – Zinc Rich Paint for DI Pipe and Fittings

4 Materials

The coating materials shall be zinc-rich paint with organic or/and inorganic binder and zinc content of at least a mass fraction of 85 % in the dry film followed by a finishing layer that can be bituminous paint or synthetic resin compatible with zinc-rich paint coating.

5.4 Zinc-rich paint coating mass

The mean mass of zinc-rich paint coating measured in accordance with 7.1 shall be as follows:

— not less than 235 g/m² with a local minimum of 210 g/m²;

— in low corrosive areas, by agreement between the purchaser and the supplier, 150 g/m² with a local minimum of 130 g/m².

Zinc-Rich Paint

Most common: Tnemec 90-98 Ethyl Silicate Inorganic Zinc-Rich

APPLICATION

COVERAGE RATES

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	2.5 (65)	4.0 (100)	417 (38.7)
Minimum	2.0 (50)	3.0 (75)	521 (48.4)
Maximum	3.5 (90)	5.5 (140)	298 (27.7)

Allow for overspray and surface irregularities. Film thickness is based upon closest 0.5 mil (5 microns). Application of coating below miniumum or above maximum recommended dry film thicknesses may adversely affect coating performance.

MIXING

Always use the entire contents of A and B components. Use an air-driven power mixer and keep material under constant agitation while mixing. Slowly sift powder (Part B) into liquid (Part A). **-Do Not Reverse This Procedure-** Adjust mixer speed to break up lumps and mix until the two components are thoroughly blended. Strain through a 35 to 50 mesh (300 to 600 microns) screen before using. Keep under agitation to prevent settling. Do not use mixed material beyond pot life limits.

THINNING

Use No. 15 Thinner below 80°F (27°C); No. 18 Thinner above 80°F (27°C). For air spray, thin up to 9% or 3/4 pint (380 mL) per gallon. For airless spray, thin up to 5% or 1/4 pint (190 mL) per gallon.

POT LIFE

16 hours at 60°F (16°C) 12 hours at 77°F (25°C) 7 hours at 100°F (38°C)

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss MBC	E	704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	30-40 psi (2.1-2.8 bar)	15-25 psi (1) (1.0-1.7 bar)

(1) For 25 ft (7.6 m) length of material hose. Low temperatures or longer hoses will require additional pressure. Use pressure pot equipped with an agitator and keep pressure pot at same level or higher than the spray gun.
If work is stopped for 10 to 15 minutes, do not allow material to remain in hose. Shut off pot pressure at the fluid regulator and open pressure relief valve. Loosen spray gun cap ring three turns, hold cloth over air cap and pull trigger to force the material in the hose back into the pot. Keep material under agitation during shut-down, but do not repressurize pot until ready to resume work.

Standards & Testing

LADWP Specifications

LA DWP Los Angeles Department of Water & Power

The Los Angeles Department of Water and Power (LADWP) employs an electronic Request Solicit Procure (eRSP) online purchasing system for both the posting of Invitation for Bids (IFBs) and receiving Bid documents electronically. Currently, the eRSP system is not available. Therefore, all documents and instructions for bidders related to this procurement will be issued and posted on www.labavn.org. Please note the IFB documents will not be updated to reflect the changes below regarding the eRSP system.

IFB 132057

DIVISION F2 **DETAILED REQUIREMENTS**

j. Fitting Coating: The fittings shall be coated with metallic zinc wire in accordance with ISO 8179-1 with a zinc content of at least 99.99% by mass with asphalt paint or synthetic resin topcoat compatible with zinc.

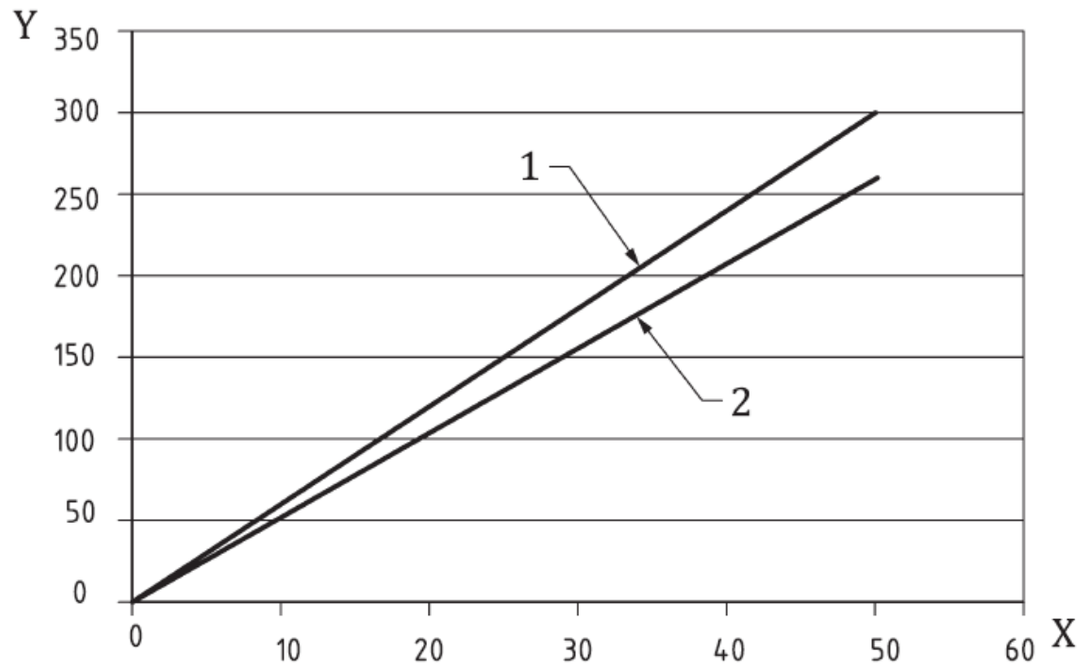
(1) Zinc Coating Mass: The mean mass of the metallic coating shall be a minimum of 300 grams per square meter using metallic zinc wire when measured in accordance with the section titled "Test Method for Determining Zinc Mass" of this specification. The mass of the zinc coating shall be verified at the beginning of each shift, at changes to application equipment settings, and at sufficiently frequent intervals to verify conformance to the mass requirements. Results shall be documented and kept on file for a period of one year.

SIP Industries
Quality Manufacturer Since 1960

SIP INDUSTRIES SERAMPORE SINCE 1960

Standards & Testing

ISO 8179-2 – Zinc Rich Paint for DI Pipe and Fittings



Key

1 zinc-rich paint
2 metallic zinc
X coating thickness (µm)
Y zinc-rich paint coating mass (g/m^2)

Figure A.1 — Example of correlation between zinc-rich paint coating mass and coating thickness, defined by the manufacturer

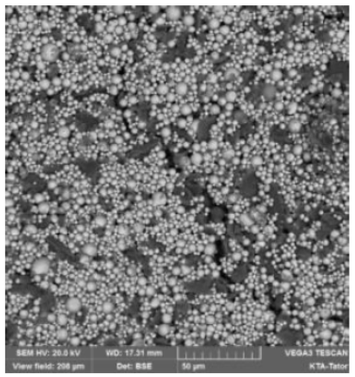
SIP Industries
Quality Manufacturer Since 1960

SIP INDUSTRIES SERAMPORE SINCE 1960

Excerpt from:

Article by Rick Huntley

‘Hot Dip Galvanizing vs Zinc Rich Primers – which Protects Better? ‘



A zinc rich primer is a liquid-applied coating that has microscopic spheres of solid zinc metal held together with a resin. There are several options for the type of resin that may be used. Most organic zinc rich primers incorporate an epoxy resin, although polyurethane and vinyl resins can be used. Various silicate-based inorganic zinc rich primer resins are also available. This article focuses on solvent-based ethyl silicate zinc rich primer, which is the most commonly used of the inorganic zinc rich primers. SSPC Paint Specification No. 20, Zinc-Rich Coating Type I – Inorganic and Type II – Organic addresses test procedures to evaluate the protective properties of these coatings.

Surface preparation and application of an inorganic zinc rich primer is similar to that of other protective coatings. The minimum surface preparation for application an inorganic zinc-rich primer is SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning; although SSPC-SP 10/NACE No. 2, Near-white Metal Blast Cleaning is recommended for more severe environments. Generally, it is recommended that an angular abrasive be used to produce a greater peak density. Application of inorganic zinc rich primer is somewhat more challenging than typical protective coatings. The liquid inorganic zinc rich primer is heavily filled with dense metallic zinc pigment (up to 90% zinc in the dry film). The pigment is usually supplied as a dry powder and sifted into the liquid component(s) while being agitated with a mechanical mixing blade. However, once the zinc pigment is blended into the liquid component, it tends to settle once mixing ceases; therefore, continuous agitation of the coating is recommended during the application process.

Zinc-rich primers have a relatively low resin-to-pigment ratio; therefore, they tend to dry spray if the application technique is poor, or if there is air movement (wind). Additionally, inorganic zinc rich primers have a propensity to mud crack if the applied thickness is too great. Typically, the inorganic zinc primers are applied in the range of 2-4 mils (50-100 µm) and will often mud crack at thicknesses as low as six mils. Because of these and other challenges, application of inorganic zinc-rich primers is usually accomplished in a shop where air movement can be controlled, and the surfaces to be coated are more accessible to help control the applied thickness. Rarely are they field-applied.

Mud Cracking

Galvanizing for Painting – It’s not Overly Complicated” discusses the importance of proper surface preparation prior to painting galvanizing, and Jay Helsel, in his KTA University article published in April 2018 titled, *“Preparing and Painting Galvanizing”* discusses the common coating systems used over galvanizing.

There are many topcoats that can be applied to zinc-rich primers; epoxy and polyurethane are the most common. A mist coat is often required when topcoating inorganic zinc-rich primers to release the air in the voids between the microscopic zinc spheres and seal the surface; otherwise outgassing will occur and pinholes will frequently form in the applied topcoat.

Rick Huntley is a Chemical Engineer, and the Technical Manager of Consulting Services and a Senior Coatings Consultant for KTA-Tator, Inc. Rick has over 30 years of experience in corrosion prevention, coating system recommendations, coating failure investigations and litigation support.

He can be reached at rhuntley@kta.com

Mud Cracking

This is what mud cracking looks like

- It can create hot spots for corrosion
- Critical to keep under 4 mills

Comparison

Arc-Zinc vs Zinc Rich Primer

ARC-ZINC	Zinc Rich Primer
ISO 8170-01 Standard	ISO 8170-02 Standard
99% pure Zinc applied at minimum 2 mills (yields 300 to 400 g/m² pure zinc)	85% pure Zinc applied at 2 to 3.5 mills max (yields 130 to 235 g/m² zinc paint)
Coverage of 300 g/m² to 400 g/m² pure zinc	Coverage of 130 g/m² to 235 g/m² of zinc paint
Overspray not a factor	Over and Under spray has detrimental affects
No Mud Cracking	Will Mud Crack at 6 mills, detrimental affects
Seal coat creates an oxide layer	Seal coat can cause Mud Cracking, detrimental affect
Physical inspection of thickness and uniformity	Settling of Zinc in paint can cause uneven coating, no way to inspect
Matches Pipe Manufactures	Different than the adjacent pipe Zinc Process
Any topcoat can be applied	Topcoats need be approved by Zinc Rich Paint Manufacture
Applied and cured regardless of Weather/Humidity	Curing and application Weather/Humidity dependent
No Pot life	Application must be constantly agitated and limited Pot life
Greater surface adhesion (Nickel Scratch Test)	Lower surface adhesion (Nickel Scratch Test)

Comparison

Arc-Zinc vs FBE (Fusion Bonded Epoxy)

Arc Zinc ISO 8170-01

- Metallic Zinc 300 grams/m2
- Applies and cures in minutes
- Seal coated asphaltic
- Self healing when chipped or dinged
- Weathering element won't affect it
- Identified with stripe and stencil
- Different chemicals oxidize zinc at different rates

FBE / AWWA C116

- Dry Film Thickness 12 mills
- Must be heated and baked in oven
- Can chip and ding
- Corrosion can propagate
- Can oxidize when left in sun
- Identifiable Red Oxide Color
- Many chemical resistances

SIP Industries
Quality Manufacturer Since 1960

SIP INDUSTRIES SERAMPORE SINCE 1960

Internal SIP Testing – Aug 2021

Arc Zinc FBE/Arc Zinc Seal coat/Bare Arc Zink/FBE/Bare Job site ring and covers

- Arc Zinc 32” Manhole Ring Test St Johns Florida – Installed Dec 2021
- Arc Zinc 32” Manhole Ring and Cover Phoenix, AZ Installed Aug 2023
- Arc Zinc 32” Manhole Ring and Cover Aqua Works - Brownsville, TX Installed Jan 2024

SIP Industries
Quality Manufacturer Since 1960

SIP INDUSTRIES
SERAMPORE
SINCE 1960

Internal SIP Testing

Hole drilled – March 2023
Arc Zinc FBE/Arc Zinc Seal coat/Bare Arc Zink/FBE/Bare

SIP Industries
Quality Manufacturer Since 1960

SIP INDUSTRIES SERAMPORE SINCE 1960

St. Johns FL - SIP Testing

Installed Dec of 2021 St Johns Florida

Ring was place at intake vault at WWTP
High sulfur content

Ring was removed and inspected Dec of 2022 and put back, chain failed and had to be Replaced, last inspection still no corrosion

- Arc Zinc 24" Ring Test St Johns Florida

SIP

SIP Industries

Quality Manufacturer Since 1960

60 YEARS OF SERVICE

SIP INDUSTRIES
SERAMPORE
SINCE 1960

SIP Industries
Quality Manufacturer Since 1960

SIP INDUSTRIES SERAMPORE SINCE 1960

SIP ARC-ZINC

Features & Benefits:

- Applied by SIP for over 10 years!!
- 300 g/m2 of pure metallic zinc
- Complies with ISO 8179-1
- Uniform cathodic protection
- Ability to “self-heal”
- Bells painted silver with “ARC - ZINC” stenciled on the fitting body
- No special handling or installation procedures required

Questions ?

- Thank you !!