

PROTECTO 401

**THE PROVEN CERAMIC
EPOXY LINING.**

BACKGROUND

In 1979, Induron Coatings, Inc. began the two-year research and development process that led to the industry-leading product known as Protecto 401™ today.

The first Protecto 401™-lined ductile iron sewer pipe was placed into service in 1981. Since then, literally thousands of miles of ductile iron sewer pipe have been lined with Protecto 401™.

PRODUCT QUALITIES

Specifically designed to protect ductile iron sanitary sewer pipe, Protecto 401™ Ceramic Epoxy Lining provides the reliability of cement mortar lining with the unequalled corrosion protection of novolac epoxy. Its unique qualities have resulted in performance unmatched by any other lining.

PROTECTING YOUR PROJECTS. AND YOUR REPUTATION.

Over the years, Protecto 401™ has been exhaustively tested and evaluated—both by Induron's own Research and Development professionals, and in independent laboratory settings.

To further protect your ductile iron sewer pipe projects, Induron allows no deviations from our strict testing and application specifications without our prior written approval. All third party inspections are conducted using Induron's standard Protecto 401™ Ceramic Epoxy Quality Control Procedures.

APPLICATION AND SPECIFICATION OVERVIEW

Protecto 401™ is applied to the interior of ductile pipe and fittings, utilizing specialized application equipment and stringent specifications. The lining is designed to be applied at a nominal 40-mil thickness. A nondestructive pinhole detection test, and a thickness test, are performed to insure a sound, chemically-resistant protective lining for ductile iron pipe and fittings.

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Nothing protects tough sewer pipe applications more effectively than ductile iron pipe and fittings lined with Induron's Protecto 401™ Ceramic Epoxy. It's been successfully used in hundreds of sanitary sewer applications and proven both in laboratory testing and decades of actual sewer service.

Since 1981, literally thousands of miles of ductile iron sewer pipe have been lined with Protecto 401™. Give your projects and your reputation the protection they deserve. Specify ductile iron pipe and fittings lined with Protecto 401™.

QUALIFIED UNDER:

ASTM E-96 ASTM G-95

ASTM B-117 ASTM G-14

ASTM D-714 ASTM D-

1308 ASTM G-22 ASTM

FI476-95A EPA 1311

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protecto401.com

PROTECTO 401™ Ceramic Epoxy

STANDARD SPECIFICATION FOR LINING DUCTILE IRON PIPE FOR SEWER SERVICE

I. CONDITION OF DUCTILE IRON PRIOR TO SURFACE PREPARATION

All ductile pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that the entire interior of the ductile iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends.

II. LINING MATERIAL

The standard of quality is Protecto 401™ Ceramic Epoxy. The material shall be an amine cured novolac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.

A. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.

B. The following test must be run on coupons from factory lined ductile iron pipe:

- * ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.
- * ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.
- * Immersion testing rated using ASTM D-714-87.
 - 20% Sulfuric acid—No effect after two years.
 - 140°F 25% Sodium Hydroxide—No effect after two years.
 - 160°F Distilled Water—No effect after two years.
 - 120°F Tap Water (scribed panel)—0.0 undercutting after two years with no effect.
- * ASTM G-22 90 Standard practice for determining resistance of Synthetic Polymeric materials to bacteria. The test should determine the resistance to growth of Acidithiobacillus Bacteria and should be conducted at 30 degrees centigrade for a period of 7 days on a minimum of 4 panels. The growth must be limited only to trace amounts of bacteria.

C. An abrasion resistance of no more than 3 mils (.075 mm) loss after one million cycles using European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.

III. APPLICATION

Applicator

The lining shall be applied by a certified firm with a successful history of applying linings to the interior of ductile iron pipe and fittings. All applicators must be independently inspected at least two times per year to insure compliance with the requirements of this specification. This inspection must be coordinated and reviewed by the manufacturer of the lining material and any deviation from the application and/or quality requirements shall be corrected by the applicator. All inspections shall be in writing and a permanent record maintained.

Surface Preparation

Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas with oil, grease, or any substance that can be removed by solvent, shall be solvent cleaned to remove those substances. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering oxide may be left on the surface. Any area where rust reappears before lining must be re-blasted.

Lining

After surface preparation and within 12 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness. No lining shall take place when the substrate or ambient temperature is below 40°F. The surface also must be dry and dust free. If flange pipe or fittings are included in the project, the lining shall not be used on the face of the flange.

Coating of Bell Sockets and Spigot Ends

Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum using Protecto 401™ Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

Number of Coats

The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. To prevent delamination between coats, no material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.

Touch-Up and Repair

Protecto 401™ Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

IV. INSPECTION AND CERTIFICATION

Inspection

All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC PA-2 Film Thickness Rating.

The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2,500 volt test. Any defects found shall be repaired prior to shipment.

Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

Certification

The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

V. HANDLING

Lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling.

Care should be taken not to let the pipe strike sharp objects while swinging or being off loaded. Ductile iron pipe should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers.

**SIMULATED SEWER ENVIRONMENT ACCELERATED
 TESTING OF PROTECTO 401™ LINING IN
 PRODUCTION RUN DUCTILE IRON PIPE**

TEST	RESULTS
120° F Water Immersion	2.0 years No undercutting at scribe. No effect when rated using ASTM D-714
160° F Distilled Water Immersion	2.0 years No undercutting at scribe. No effect when rated using ASTM D-714
140° F 25% Sodium Hydroxide Immersion	2.0 years No effect when rated using ASTM D-714
20% Sulfuric Acid Immersion	2.0 years No effect when rated using ASTM D-714
ASTM B-117-85 Salt Spray 5% Salt @ 98° F	2.0 years No undercutting at scribe. No other effect when rated using ASTM D-714
EN 598 Section 7.8 (Modified) Abrasion Resistance	.002 inch (.05mm) loss After one million cycles

Note: All Immersion tests are currently ongoing.

SEALING CUT ENDS AND REPAIRING FIELD DAMAGED AREAS OF PROTECTO 401™ LINED PIPE AND FITTINGS.

1. Remove burrs caused by field cutting of ends or handling damage and smooth out the edge of the lining if rough.
2. Remove all traces of oil, grease, asphalt, dust, dirt, etc.
3. Remove any damaged lining caused by field cutting operations or handling and clean any exposed metal by sanding or scraping. Sandblasting or power tool cleaning roughening is also acceptable. It is recommended that any loose lining be removed by chiseling, cutting, or scraping into well-adhered lined area before patching. Be sure to overlap at least 1" of lining in the area to be repaired.
4. With the area to be sealed or repaired absolutely clean and suitably roughened, apply a coat of Protecto 401™ Joint Compound using the following procedure:
 - a) **Mixing Procedure**—The repair kit for Protecto 401™ contains two small cans of Protecto 401™ Touch-Up Material . Protecto 401™ Touch-Up is a two component epoxy and the contents of the small container shall be mixed with the contents of the large container. If less than the full contents of each can is to be mixed, the material may be mixed using the mixing ratio printed on the labels. After Part B is added to Part A, the mixture shall be thoroughly agitated. All activated material must be used within one hour of mixing.
 - b) **Application of Material**—After the material has been thoroughly mixed, it can be applied to the prepared surface by brush. Brushing is usually best due to the fact that the areas to be repaired are usually small. Practices conducive to a good coating are contained in the technical data sheet for Protecto 401™ Touch-Up.
5. It is important to coat the entire freshly cut exposed metal surface of the cut pipe end. To ensure proper sealing, overlap at least one inch of the lining with this repair material.

PROTECTO 401™ TOUCH-UP TECHNICAL DATA

DESCRIPTION: A brushable novalac epoxy designed for sealing cut ends and repairs when pipes are lined with Protecto 401™ Ceramic Epoxy.

LIMITATIONS: This material should be used on spigots and in bell sockets only after the pipe or fitting is lined with Protecto 401™ Ceramic Epoxy. Protecto 401™ Touch-Up can be used over Protecto 401™ or on bare substrate.

NOTE: *Do not apply Protecto 401™ over Protecto 401™ Touch-Up.*

SURFACE PREPARATION: The surface preparation shall be equal to the specifications for the project or as outlined in the touch-up procedure.

NOTE: *Do not apply Protecto 401™ Touch-Up over wet or frozen surfaces.*

DRY FILM THICKNESS: As outlined in specifications.

APPLICATION DATA:

APPLICATION: Brush, roll, or airless spray.

THINNING: Thin or clean up with Methyl Ethyl Ketone.

PHYSICAL DATA:

VOLATILE ORGANIC CONTENTS: <1.40 lbs. per gallon mixed unthinned.

SAFETY DATA: See individual product label for safety and health data information. Individual Material Safety data Sheets are available upon request.