

PROTECTO 401 CERAMIC EPOXY

CALL TOLL FREE 1-888-SPEC401 or [Email](#)

Standard For Lining Ductile Iron Pipe and Fittings For Sewer Service

QUALIFIED UNDER

ASTM E-96	ASTM G-14
ASTM G-95	ASTM D-714
ASTM B-117	ASTM D-1308

[Standard Test Methods](#)

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Protecto 401 lined ductile iron pipe and fittings provide the maximum protection and the strength necessary to do the job in tough sewer pipe applications. Protecto 401 has successfully been used in hundreds of sanitary sewer applications and has been proven with both laboratory testing and years of actual sewer service on all sizes of ductile iron pipe and fittings. The development of Protecto 401 was begun in 1979. The first ductile iron sewer pipe was lined and placed in service in 1981. Since then hundreds of miles of ductile iron sewer pipe have been lined with Protecto 401 with no lining failure.

Because Protecto 401 Ceramic Epoxy Lining was designed and is used as protection for ductile iron sanitary sewer pipe, it provides the reliability of cement mortar lining with the excellent corrosion protection of novalac epoxy. This concentration of effort has resulted in performance unparalleled by other linings.

Protecto 401 has been tested extensively. The [Table of Contents](#) contains results of these tests and other data associated with lining for ductile

iron sewer pipe. *Because the specifications for application and testing of Protecto 401 Ceramic Epoxy have been developed for ductile iron pipe using test data and performance history, no deviations from the specification shall be permitted without prior written approval of the lining manufacturer. If required, third party inspection of Protecto 401 Ceramic Epoxy lined ductile iron pipe shall be done only after written notice to the applicator of Protecto 401 Ceramic Epoxy. Any third party inspection shall be accomplished using standard Protecto 401 Ceramic Epoxy Quality Control Procedures.*

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

Protecto 401 is intended for use in domestic sanitary sewage lines. Chemical injection for odor control may damage pipe, gaskets, and/or protective linings and should be undertaken with extreme caution. Requests for industrial sewer applications of Protecto 401 lined ductile pipe and fittings should be made to a pipe marketing representative for individual recommendations.



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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-714-87
160°F Distilled Water Immersion	2.0 years No undercutting at scribe. No effect when rated using ASTM D-714-87
140°F 25% Sodium Hydroxide Immersion	2.0 years No effect when rated using ASTM D-714-87
20% Sulfuric Acid Immersion	2.0 years No effect when rated using ASTM D-714-87
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-714-87
EN 598-1994 Section 7.8 Abrasion Resistance	.002 inch (.05mm) loss After one million cycles
Note: All Immersion tests are currently ongoing.	

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TEST METHOD: ASTM G-95: Standard Test Method for Resistance to Cathodic Disbondment by the Attached Cell Method.

COATING SYSTEM: PROTECTO 401 CERAMIC EPOXY Lining: Plant applied Protecto 401 Ceramic Epoxy lined ductile iron pipe (DIP) cut into 6 inch x 6 inch coupons.

PROCEDURE: Following ASTM G-95, a five inch tall by four inch diameter section of PVC pipe, ground to the approximate curvature of the internal surface of the pipe coupon, was attached via RTC silicone caulk. A 0.25 inch holiday was drilled through the coating to metal in the center of each coupon. A 0.25 inch hole was drilled through one corner of each coupon and fitted with a bolt to provide attachment of the negative lead from the impressed current cathodic protection power supply. Triplicate coupons were subjected to simulated cathodic protection by impressing a 1.5 volt potential between the metal and an electrode within the CD cell for a period of thirty days. The electrolyte used was 3% sodium chloride in tap water.

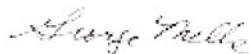
An additional set of coupons were subjected to the same test regime with the exception that they were maintained at 60°C on a sand bath. The hot (60°C) cells were covered with plastic wrap to minimize evaporative losses. Evolved hydrogen was able to escape through the plastic and did not present a problem.

The values given are in mm of disbondment increase in diameter from original RADIUS of holiday.

Panel Number:	Increase in RADIUS:	Panel Number:	Increase in RADIUS:
154 (Room Temp.)	0 mm	* 155 hot (60°C)	xx
157 (Room Temp.)	0 mm	* 158 hot (60°C)	xx
156 (Room Temp.)	0.5 mm	159 hot (60°C)	2 mm

* Over heated; suffered thermal damage after leaking dry over week end.

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DATE: March 14, 1994

TEST METHOD: ASTM D-1308: Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Finishes. (Chemical Soak Test with Nine Test Solutions)

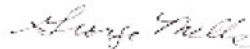
COATING SYSTEM: PROTECTO 401 CERAMIC EPOXY Lining: Plant applied Protecto 401 lined ductile iron pipe (DIP) cut into 3 inch x 4 inch coupons.

TEST DURATION and CONDITIONS: 1080 hours (45 days), Room temperature, panels submerged 50% to provide liquid and vapor phase testing.

Coupons, cut from plant applied Protecto 401 Ceramic Epoxy lined pipe, were subjected to specific 1080 hour (45 day), 70°C partial submersion in a series of strong chemicals. The test solutions and results are tabulated below.

CHEMICAL SYSTEM	RESULTS
3% Sulfuric Acid	Pass: Coating unaffected; Corrosion to opposite side of metal coupon.
10% Sulfuric Acid	Pass: Coating unaffected; Corrosion to opposite side of metal coupon.
5% Sodium Hydroxide	Pass: Coating unaffected.
20% Sodium Hydroxide	Pass: Coating unaffected.
25% Sodium Hydroxide	Pass: Coating unaffected.
10% Hydrochloric Acid	Pass: Coating unaffected; Heavy corrosion loss to opposite side of coupon.
Gasoline	Pass: Coating unaffected; Some discoloration of gasoline.
Toluene	Pass: Coating unaffected; Some discoloration of toluene.
DI Water	Pass: Coating unaffected.
Hot Water (45 day @ 76°C)	Pass: Coating unaffected.

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Dr. George Mills

Date: 12 July 1994

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PROTECTO 401 CERAMIC EPOXY

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Procedures for sealing cut ends and repairing field damaged areas of PROTECTO 401 lined pipe and fittings.

PROTECTO 401 JOINT COMPOUND 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 Joint Compound can be used over Protecto 401 or on bare substrate. **Note: Do not apply Protecto 401 over Protecto Joint Compound.**

SURFACE PREPARATION: The surface preparation shall be equal to the specifications for the project or as outlined in the touch-up procedure. Do not apply Protecto Joint Compound 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 gal. mixed unthinned

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

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Procedures for 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 Joint Compound using the following procedure:
 - a. **Mixing Procedure** - The repair kit for Protecto 401 contains two small cans of Protecto Joint Compound. Protecto Joint Compound 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 Joint Compound.
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.

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TEST REPORT PROTECTO 401 CERAMIC EPOXY

March 2, 1995

GM&A has completed a test program on Protecto 401 Ceramic Epoxy lined pipe coupons. The results of the completed tests are reported herein. They include the following test procedures:

ASTM G-14: Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).

Coating System: PROTECTO 401 CERAMIC EPOXY (Internal) Lining, Plant applied to the internal surface of ductile iron with a reported age in excess of eighteen months.

The conditions of the test include the following: 48 hour minimum temperature and humidity equilibration within the lab at 73°F (23°C). Coupons were approximately 3 x 6 inch with coating applied at a DFT of 33 to 48 mils (825 to 1175 microns). The weight of the falling impactor was 4 pounds. Continuity was determined with a low voltage, wet sponge holiday detector per ASTM G-62. Four panels were evaluated for the test using a Gardner Model #5510 Impact Tester.

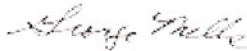
Panel No:	1	2	3	4
Total number of impacts:	6	6	8	8
Film Thickness (mils):	37-39	39-44	33-36	45-48
	----- *			

The impact results using a four (4) pound weight were as follows:

Height of Drop, inches:	16	17	18	19	20
Number of Impacts:	5	5	14	2	2
Number of Pass:	5	5	9	0	0
Number of Fail:	0	0	5	2	2

RESULTS: The average impact strength of the coating as tested was determined to be 72 inch pounds.

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Date: 2 March 1995

Dr. George Mills

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