PROTECTO 401

THE PROVEN CERAMIC EPOXY LINING.

STANDARD FOR LINING DUCTILE IRON PIPE AND FITTINGS FOR SEWER SERVICE

FOR SEWER USE ONLY

QUALIFIED UNDER

ASTM E-96
ASTM G-95
ASTM B-117
ASTM G-14
ASTM D-714
ASTM D-1308
ASTM G-22
ASTM F1476-95a
EPA 1311
EN-598

Protecto401.com **Sixth Edition**

Preface

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 thousands 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 thousands of miles of ductile iron sanitary 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 along with the ability to retard bacteria growth. This concentration of effort has resulted in performance unparalleled by other linings.

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 are performed to insure a sound, chemically resistant protective lining for ductile iron pipe and fittings. 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 intended for use in residential 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.

Not for use as a potable water lining. Please use Induron's Ceramapure PL90 for potable water lining of ductile iron pipe. See page 70 for more info.

Referenced Standard Test Method

ASTM E-96:	Standard Test Method for Water Vapor Transmission of Materials, Procedure A (See pages 35)
ASTM G-95:	Standard Test Method for Resistance to Cathodic Disbondment by the Attached Cell Method (See pages 40)
ASTM B-117:	Standard Test Method of Salt Spray (Fog) Testing (See pages 39)
ASTM G-14:	Standard Test Method for Impact Resistance of Pipe Line Coatings (See pages 30)
ASTM D-714	Standard Test Method for Evaluating Degree of Blistering of Paints (See pages 10)
ASTM D-1308:	Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Finishes (chemical soak test with nine test solutions) (See pages 36-38)
ASTM G-22	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria (See pages 10)
ASTM F1476-95a:	Gasketed Mechanical Joint Vacuum Test (see page 34)
EPA 1311:	Environmental Protection Agency Test Method for Toxicity Characteristics Leaching Procedure (See page 48)
EN 598:	European Standard for Ductile Iron Pipe fittings, accessories and their joints for sewerage applications. Section 7.8 Abrasion Resistance (See pages 25)
SSPC – PA – 2:	Standard Method for Determination of Film Thickness, Steel Structures Painting Council (See page 11)

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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 401TM Ceramic Epoxy. The material shall be an amine cured novalac 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 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.
  - —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 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 reblasted.

Lining

After surface preparation and within 12 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness of Protecto 401TM. 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 401TM 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 401TM 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

Protecto 401TM 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.

ESPECIFICACIÓN ESTÁNDAR PARA EL REVESTIMIENTO DE TUBERÍA DE HIERRO DÚCTIL PARA SERVICIOS DE DRENAJE

I. CONDICIÓN DEL HIERRO DÚCTIL ANTES DE LA PREPARACIÓN DE LA SUPERFICIE

Toda la tubería y las conexiones se entregarán al lugar donde se lleve a cabo la aplicación sin asfalto, revestimiento de cemento, o cualquier otro revestimiento en la superficie interior. Dado que la eliminación de los revestimientos previos podría no ser posible, la intención de este estándar es que el interior de toda la tubería y las conexiones de hierro dúctil no hayan sido recubiertos con alguna sustancia antes de la aplicación del material especificado para revestimiento, y ningún recubrimiento haya sido aplicado a las primeras seis pulgadas del exterior de la tubería.

II. MATERIAL DE REVESTIMIENTO

El Estándar de Calidad es Protecto 401 Ceramic Epoxy (Compuesto adhesivo Cerámico). El material será un compuesto epóxico Novalac curado con una amina conteniendo por lo menos 20 por ciento por volumen de pigmento de cuarzo de cerámica. Cualquier solicitud para su sustitución debe estar acompañada por un historial que demuestre ser exitoso en el revestimiento de tubería y conexiones para el servicio de drenaje, un informe de pruebas verificando las propiedades enunciadas a continuación, y una certificación de los resultados de las pruebas.

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A. Una clasificación de permeabilidad de 0.00 cuando habiendo sido probado de acuerdo al Método A de la ASTM E-96. Procedimiento A con una duración de prueba de 30 días.

B. La siguiente prueba debe ser hecha en cupones de tubería de hierro dúctil revestido en fábrica:

1. ASTM B-117 Salt Spray – prueba de corrosión con aerosol de sal (panel grabado) - Resultados de 0.0 de erosión después de dos años.
2. ASTM G-95 Desprendimiento Catódico a 1.5 voltios en 77° F. Resultados de no más de 0.5 milímetros de desprendimiento después de 30 días.
3. Prueba de inmersión usando ASTM D-714.
   a. 20 por ciento Ácido Sulfúrico—Ningún efecto después de 2 años.
   b. 140° F 25 por ciento Hidróxido de Sodio—Ningún efecto después de 2 años.
   c. 160° F Agua Destilada—Ningún efecto después de 2 años.
   d. 120° F Agua de la Llave (panel grabado)—0.0 de erosión después de 2 años con ningún efecto.
4. ASTM G-22 práctica estándar para determinar la resistencia de los materiales poliméricos sintético a las bacterias. La prueba debe determinar la resistencia al crecimiento de las bacterias Acidithiobacillus y debe realizarse en los 30 grados centígrados durante un período de 7 días en un mínimo de 4 paneles. El crecimiento debe limitarse sólo a trazas de bacterias.

C. Una resistencia a la abrasión que muestre una pérdida de no más de 3 milésimas de pulgada (.075 milímetros) después de un millón de ciclos usando el Estándar Europeo EN 598: 1994 Sección 7.8 Resistencia a la Abrasión.

III. APLICACIÓN

A. Aplicador

El revestimiento se aplicará por una empresa certificada con un historial exitoso de aplicación de recubrimientos en el interior de tubería y conexiones de hierro dúctil. Aplicadores de todos deben analizaron de forma independiente, por lo menos dos veces al año para asegurar el cumplimiento de los requisitos de esta especificación. Esta inspección debe ser coordinada y revisada por el fabricante del material de revestimiento y cualquier desviación de los requisitos de calidad o de aplicación deberá ser corregido por el aplicador. Todas las inspecciones deberán ser por escrito y un registro permanente que se mantiene.

B. Preparación de la Superficie

Antes de la limpieza por granallado o sandblast, toda el área que va a recibir el compuesto Protecto 401TM se inspeccionará por si hay presencia de aceite, grasa, etc. Cualquiera área con grasa, aceite, o cualquier sustancia que pueda ser removida por algún solvente, debe ser limpiada con solvente para remover esas sustancias. Después de que la superficie esté libre de grasa, aceite u otras sustancias, toda el área que va a recibir los compuestos Protecto 401TM es deben ser limpiados abrasivamente usando arena o granalla metálica. Toda la superficie a la que se le va a aplicar el recubrimiento se limpiará con un equipo de sandblast o granallado para que toda la oxidación, los óxidos sueltos, etc., sean quitados de la superficie. Solamente manchas pequeñas y óxido pegado firmemente se puede dejar en la superficie. Cualquier superficie donde reaparezca la oxidación antes del revestimiento debe ser granallada otra vez.

C. Revestimiento

Después de preparar la superficie y dentro de las 12 horas después de preparar la superficie, el interior del tubo recibirá un espesor nominal de 40 milésimas de pulgadas de capa seca de Protecto 401TM. No se debe aplicar cuando la temperatura del sustrato ni del ambiente esté a menos de 40° F (4.5 °C). La superficie también debe estar seca y sin polvo. Si tubería con extremos bridados o conexiones bridadas están incluidos en el proyecto, el revestimiento no se utilizará en la cara de las bridas.

D. Recubrimiento de las cavidades del empaque y del extremo del tubo

Debido a las tolerancias involucradas, el área del empaque y el extremo del tubo hasta 6 pulgadas atrás del final del extremo del tubo debe recibir una capa nominal de 6 milésimas de pulgadas a 10 milésimas máximo, usando Protecto 401TM Joint Compound (Compuesto de adhesión de juntas Protecto 401TM). El Compuesto de adhesión de juntas se aplicará con una brocha para asegurar que todo esté cubierto. Esto debe ser hecho con cuidado para que el Compuesto de adhesión de juntas esté suave sin aumento en exceso en el asiento del empaque o en los extremos del tubo. La capa Protecto 401TM a que se aplicará al asiento del empaque y a los extremos del tubo deberá ponerse después de aplicar el revestimiento.

E. Número de Capas

El número de capas del material de revestimiento será el recomendado por el fabricante del mismo. Sin embargo, en ningún caso debe aplicarse este material por encima del espesor seco por capa recomendada por el fabricante en su publicación de especificaciones técnicas El tiempo máximo o mínimo entre capas será ese tiempo recomendado por el fabricante del material del revestimiento. **Para prevenir la delaminación entre capas, ningún material deberá ser usado para revestimiento el cual no pueda ser recubierto sobre si mismo indefinidamente sin que la superficie se vuelva áspera.**

F. Retocar y Reparar

Protecto 401TM Joint Compound (Compuesto de adhesión de juntas- Protecto 401TM) debe ser usado para retocar o reparar de acuerdo con las recomendaciones del fabricante.

IV. INSPECCIÓN Y CERTIFICACIÓN

A. Inspección

1. El espesor de los revestimientos de toda tubería y conexiones de hierro dúctil serán verificados con un indicador magnético de espesor. La prueba de espesor será hecha usando el método delineado en SSPC PA –2 Film Thickness Rating (Clasificación de Espesor de Capa).
2. El revestimiento interior de todos los tubos y conexiones deberá ser verificado para detectar porosidades con una prueba no destructiva de 2,500 voltios. Cualquier defecto que se encuentre debe ser reparado antes de envío.
3. Cada tubo y conexión deberá ser marcado con la fecha de aplicación del revestimiento junto con una secuencia numérica de las aplicaciones hechas en esa fecha y los registros del trabajo deberán ser mantenidos por el aplicador.

B. Certificación

El fabricante del tubo o de la conexión deberá suministrar un certificado atestiguando el hecho de que el aplicador cumplió con los requisitos de esta especificación, y que el material usado fue el especificado.

V. MANEJO

El tubo y las conexiones recubiertas con Protecto 401TM deben ser manipuladas solamente por el exterior. Ninguna horquilla, cadena, correa, gancho, etc., se colocará dentro del tubo o las conexiones para levantar, posicionar, o colocar.

PROCEDURES

Long-Term Above Ground Storage Of Protecto 401™ Ceramic Epoxy Lined Ductile Iron Pipe and Fittings

There have been many questions concerning the above ground storage of Protecto 401™ Ceramic Epoxy lined ductile iron pipe and fittings. Protecto 401™ Ceramic Epoxy was designed to perform in sewer service. Extended above ground storage requires some precautions. Although our experience indicates that the majority of Protecto 401™ Ceramic Epoxy lined pipe and fittings do not have problems with years of above ground storage, the probability of damage from repeated handling (moved from one job to the next) and damage from high temperatures in extreme climates, escalates with long term above ground storage. Protecto 401 lined ductile iron pipe and fittings must be put in sewer service in as good condition as possible in order to perform up to Protecto 401™ Ceramic Epoxy's 29 year service record of no in-service failure.

Based upon testing and some limited experience in long term above ground storage, it is Induron's opinion that Protecto 401™ Ceramic Epoxy lined ductile iron pipe and fittings should be installed within one year of lining. The date of lining is the first set of numbers in white on the interior of the pipe or fitting.

However, depending upon ambient conditions, location of storage, and other factors, installation times up to 18 months from the time of lining may be approved if requested in writing and accompanied by inspection within two weeks prior to burial by an authorized Induron representative, an approved Protecto 401 applicator,or a representative of the pipe manufacturer.

If installation within one year of lining is not accomplished, then Induron recomends measures which may be taken for the protection of the Protecto 401™ Ceramic Epoxy lined pipe and fittings for extended storage above ground. The precautions for long term storage are intended to protect the pipe and/or fittings, which are painted black, from the extreme heat generated in harsh climates due to extended exposure to sunlight. This may be accomplished by moving them under cover or covering all exposed sunlit black surfaces with white latex paint or well ventilated light colored tarps. All Protecto 401™ Ceramic Epoxy lined pipe or fittings, whether stored above ground past one year or not, should undergo a thorough visual inspection by the installer to determine that no damage is present prior to installation.

The one year from lining requirement is designed to insure that Protecto 401™ Ceramic Epoxy lined ductile iron pipe and fittings are treated as quality products and that proper rotation of stock is a priority.

This document supersedes all other documents pertaining to this subject.

High Pressure Cleaning

GUIDELINES FOR PRESSURE CLEANING THE INTERNAL DIAMETER OF DUCTILE IRON PIPE

The Ductile Iron Pipe Research Association (and its Member Companies), Federal Signal Corporation (and its subsidiaries Vactor, Elgin, Guzzler, Jetstream & Ravo), and Induron Coatings Inc. participated in a pressure cleaning research program which was conducted by the Missouri University of Science and Technology – High Pressure Waterjet Laboratory.

The test program included asphaltic seal coated cement-mortar lined and Protecto 401™ lined ductile iron pipe which resulted in guidelines for the pressure cleaning of the inside diameters of ductile iron pipe. Through a collaborative effort with the organizations above and the City of Moline, Illinois, field tests were conducted and the guidelines verified as effective and safe for cement-mortar and Protecto 401™ lined ductile iron pipe.

GUIDELINES ARE AS FOLLOWS:

1. The nozzle shall be configured with fan jets only (no round jets).
2. The fan jets should be oriented at a maximum angle of 30 degrees to the pipe wall.
3. The nozzle shall be a minimum of 2-inches standoff from the pipe surface.
4. The nozzle assembly shall be self-rotating and incorporate a rotational control mechanism - target speed of 30 rpm.
5. The water pressure at the nozzles shall be no more than 1,800 psi.
6. The nozzle assembly shall have non-abrasive wheels and/or UHMW (ultra-high molecular weight) polyethylene skids positioned so that at no time does the nozzle assembly contact the lining of the pipe.
7. The nozzle assembly shall continually move when pressure washing with no hesitation in the pipe.
8. All hose couplings, hoses, etc. shall be smooth so as to facilitate movement across the pipe joints without creating damage to the lining.

Pipe diameters of 24-inch and larger may require additional passes for effective cleaning.

VACTOR BLUE TWISTER NOZZLE (OR EQUAL)
AND APPROPRIATE ASSEMBLY

Although research shows no significant damage in testing, the decision to pressure wash, if made by the customer, engineer, or installer, may present some risk of damage to the Protecto 401™ lining.

Any such risk is dependent on water pressure, speed, jet design and angle to the lining, distance of the jet from the lining, type of lining, and other factors. Induron does not warrant or guarantee the result or assume any risk associated with pressure washing.

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 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.

Procedimiento Para Sellar Terminaciones Y Reparar Areas De Campo Dañadas De Tuberia Y Accesorios Revestidos Con Protecto 401

1. Remueva las rebabas causadas por los cortes de terminaciones o daños de manejo y suavice los bordes del revestimiento si están ásperos.
2. Remueva todo residuo de aceite, grasa, asfalto, polvo, sucio, etc.
3. Remueva cualquier revestimiento dañado a causa de operaciones de corte o manejo y limpie cualquier metal expuesto mediante lija o espátula. El uso de lijadora o herramienta eléctrica para limpiar y endurecer también es aceptable. Se recomienda que cualquier revestimiento suelto sea removido mediante cincel, corte o espátula hasta que el revestimiento quede bien adherido, antes de sellar. Asegúrese de poner al menos una pulgada de doble revestimiento en el área que será reparada.
4. Con el área que será sellada y reparada absolutamente limpia y adecuadamente endurecida, aplique una capa de "Protecto Joint Compound" mediante el siguiente procedimiento:
   a) Procedimiento para mezclar – el equipo de reparación para "Protecto 401" contiene dos latas pequeñas de "Protecto Joint Compound". "Protecto Joint Compound" es un epóxico de dos componentes y el contenido del envase pequeño debe ser mezclado con el contenido del envase grande. Si la cantidad a mezclarse es menor que el contenido completo de cada lata, el material puede ser mezclado utilizando la proporción impresa en las etiquetas. Después de que la Parte B sea mezclada con la Parte A, la mezcla debe agitarse fuertemente. Todo el material activado debe ser usado antes de que transcurra una hora a partir del momento en que fue mezclado.
   b) Aplicación del material – Después de que el material haya sido bien mezclado, puede ser aplicado mediante brocha a la superficie preparada. La brocha usualmente funciona mejor debido a que las áreas a ser reparadas son usualmente pequeñas. Las formas para obtener buenas capas están incluidas en la hoja de datos técnicos para "Protecto Joint Compound".
5. Es importante cubrir en su totalidad la recién cortada superficie metálica de la terminación cortada. Para asegurar una proporción adecuada, ponga al menos una pulgada de doble revestimiento con este material de reparación.

DATOS TECNICOS DEL "PROTECTO 401 JOINT COMPOUND"

DESCRIPCION: Es un epóxico resinoso ("novalac") aplicable con brocha, diseñado para poner en proporción las terminaciones, y que repara cuando las tuberías están revestidas con "Protecto 401 Ceramic Epoxy".

LIMITACIONES: Este material debe ser utilizado en grifos y en enchufes de campana sólo después de que la tubería o el accesorio sea revestido con "Protecto 401 Ceramic Epoxy". El "Protecto Joint Compound" puede ser usado sobre el "Protecto 401" o en substrato descubierto. Nota: No aplique "Protecto 401" sobre "Protecto Joint Compound".

PREPARACION DE LA SUPERFICIE: La preparación de la superficie debe llevarse a cabo de acuerdo a las especificaciones del proyecto o según bosquejada en el procedimiento de retoque. No aplique "Protecto Joint Compound" sobre superficies mojadas o congeladas.

GROSOR DE LA CAPA SECA: Como bosquejado en las especificaciones.

DATOS PARA APLICACION: Brocha, rolo o aerosol sin aire.

ADELGAZAMIENTO: Adelgace o limpie con "Methyl Ethyl Ketone"

DATOS FISICOS:

CONTENIDO ORGANICO VOLATIL: menor que 1.40 libras por galón mezclado no adelgazado.

DATOS DE SEGURIDAD: Vea la etiqueta individual del producto para información acerca de seguridad y salud. Las Hojas de Datos de Seguridad de Material Individual están disponibles si son solicitadas.

MAXIMUM OPERATING TEMPERATURE
Protecto 401 Ceramic Epoxy™ Lined Ductile Iron Pipe

The maximum continuous operating temperature for Protecto 401 Ceramic Epoxy™ lined ductile iron pipe is 120°F immersion. Surges up to 150°F may be allowed if the 150°F is not the norm but is infrequent.

THE PROVEN CERAMIC EPOXY LINING.

PROTECTO 401

PERFORMANCE TESTING DATA

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 Spray5% Salt @ 98° F	2.0 years No undercutting at scribe. No other effect when rated using ASTM D-714-87
EN 598-1994Section 7.8 Abrasion Resistance	.002 inch (.05mm) loss After one million cycles

Abrasion Resistance Protecto 401™ Lining In Production Lined Ductile Iron Pipe

EN 598 Section 7.8

The abrasion resistance of Protecto 401™ was tested and measured using the European Standard EN 598: 1994-Ductile iron pipe, fittings, accessories and their joints for sewerage applications-section 7.8 Abrasion Resistance. The test and results are described as follows:

7.8 Abrasion Resistance
The test shall be carried out on a pipe sample 1,000 mm + 10 mm long, closed at both ends after enclosing the test material; preferred sizes are DN 200 and DN 400.

Before test, the pipe section shall be immersed in water at ambient temperature for approximately 24 hours.

The test material shall contain natural siliceous gravel to reach a level of 38 mm ± 2 mm above the invert with enough water to reach the same level. The gravel particle size shall be between 2 mm and 10 mm, with an average size of approximately 6 mm.

The pipe sample shall be fixed horizontally on a testing device capable of inclining the sample successively to an angle of plus 22,5° and minus 22,5° every 3 s to 5 s.

The pipe sample shall be examined after 100,000 cycles; the depth of abrasion shall be the average of 15 measurements taken every 50 mm along 700 mm of the pipe invert, excluding 150 mm at both ends.

The loss of lining thickness shall be no more than described in Section 5.7 Abrasion resistance:

Section 5.7 Abrasion Resistance
When tested in accordance with 7.8, the pipes shall not have an abrasion depth greater than 0.6 mm after 100,000 cycles.

ALLOWABLE LOSS ONE HUNDRED THOUSAND CYCLES	PROTECTO 401™ LOSS ONE MILLION CYCLES
.6 mm (23.6 mils)	.05 mm (2 mils)

Chemical Resistance Testing
Accidental Discharge of Strong Chemicals into Sewer Lines

TEST	PROTECTO 401 RESULTS 40 MIL NOMINAL THICKNESS
1. Strong Acids	**Pass** - 50% Sulfuric, 30% Hydrochloric
2. Strong Base	**Pass** - 50% Sodium Hydroxide
3. Strong Solvents	**Pass** - Gasoline, 111 Trichlorethylene, Methyl Isobutyl Ketone, Propylene Glycol, Toluene, Hi-Sol 15
4. Strong Oxidizer	**Pass** - 50% Hydrogen Peroxide

Deflection Testing
Protecto 401 Ceramic Epoxy™ Lined Ductile Iron Pipe

Sample Preparation:
The sample tested was a 4" wide ductile iron ring cut from factory lined ductile iron pipe.

LINING THICKNESS	TEST	RESULTS
.040 inches	Allows for 5% deflection without lining damage with a 2:1 safety factor.	**No Effect**

Flow Characteristics Of Protecto 401™ Ceramic Epoxy Lined Ductile Iron Pipe

The inside diameter of ductile iron pipe averages 8.25% larger than the inside diameter of most other pipes. The calculations for flow should include the larger inside diameters of ductile iron pipe.

The Manning "n" and the Hazen-Williams "C Factor" for Protecto 401™ Ceramic Epoxy lined ductile iron pipe is equal to or better than cement mortar lined ductile pipe which is:

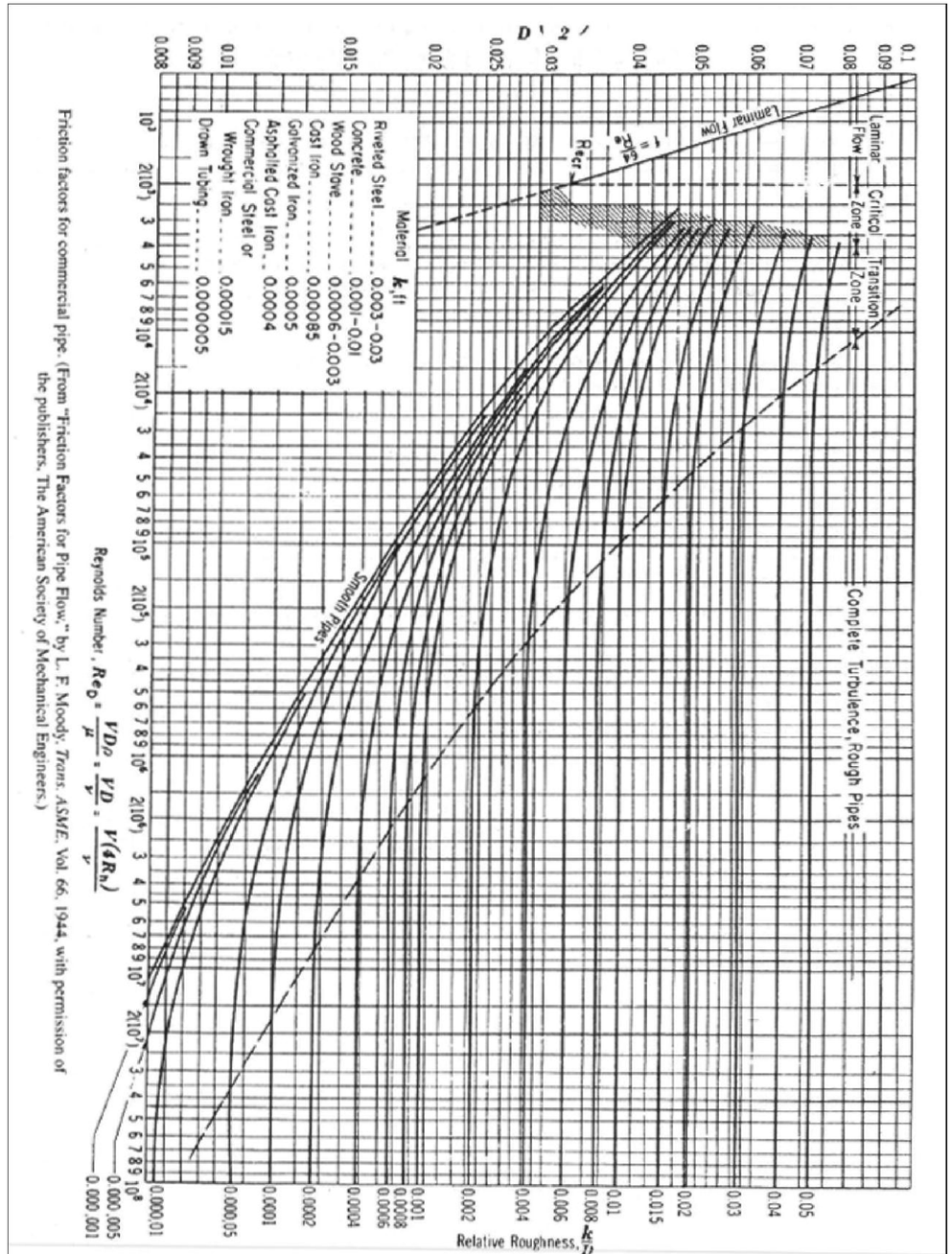
1. Manning "n" (open channel or partially-full sewers) = .011
2. C-Factor (full-flowing pressure pipe) = 140

The inside diameter of ductile iron pipe lined with the standard thickness (0.040 in. nominal) of Protecto 401™ Ceramic Epoxy is listed below:

SIZE (IN.)	OUTSIDE* DIAMETER (IN.)	THICKNESS CLASS 50 INSIDE* DIAMETER (IN.)	THICKNESS CLASS 52 INSIDE* DIAMETER (IN.)
6	6.90	6.32	6.20
8	9.05	8.43	8.31
10	11.10	10.44	10.32
12	13.20	12.50	12.38
14	15.30	14.56	14.44
16	17.40	16.64	16.52
18	19.50	18.72	18.60
20	21.60	20.80	20.68
24	25.80	24.96	24.84
30	32.00	31.14	30.98
36	38.30	37.36	37.16
42	44.50	43.48	43.24
48	50.80	49.70	49.42
54	57.56	56.34	56.02

*NOTE: Tolerances per ANSI/AWWAC151/A21.51

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401



Average k for Protecto 401 = .0212 mm (.00084 inches)

COMPARISON TESTING

Comparison Tests

Protecto 401 vs. Polyurethane

TEST	PROTECTO 401	RESULTS
SALT SPRAY 5% solution ASTM B 117-85	No undercutting at scribe. No damage to panel. 24 months duration	1- 1/2" undercutting at scribe. Damage to panel. 3-3/4 months duration. Test Terminated
TAP WATER IMMERSION 120° F Rated using ASTM D714-87	No undercutting at scribe. No damage to panel. 24 months duration	3/4" scribe undercut 2-1/2 months duration Test Terminated
SODIUM HYDROXIDE IMMERSION 25% solution 140° F Rated using ASTM D714-87	No effect 24 months	Softened film, discoloration and etched surface 2-1/2 months, Test Terminated
CATHODIC DISBONDMENT Attached Cell Method ASTM G-95 30 Days/Average 3 samples	0.17 mm disbondment	10.0 mm disbondment
IMPACT RESISTANCE ASTM G-14 18-month-old linings. Applied to abrasive blasted Ductile Iron Pipe (non-ground pipe)	72 in/lbs	75 in/lbs
EXTERIOR EXPOSURE Continuous exterior exposure to weather and sunlight Birmingham, Alabama	2.5 years Chalking, negligible loss of film - No effect on metal protection.	2.5 years Chalking, negligible loss of film - No effect on metal protection.
HYDROGEN PEROXIDE IMMERSION — 25% Solution 77° F ASTM D-1308	No effect Passed	Large Blisters Failed

NOTE: All materials were tested with an average film thickness of 40 mils on production run ductile iron pipe.

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

Comparison Tests

Protecto 401 vs. Calcium Aluminate Cement

LINING	LINING THICKNESS	TEST	DURATION	RESULTS
SULFURIC ACID TESTING				
Subject: Two materials proposed for lining ductile iron pipe used in sewer service were tested for resistance to sulfuric acid.				
Sample Preparation: The samples tested were ductile iron coupons cut from factory lined ductile iron pipe. Each sample was backed and edged to prevent contamination from unprotected metal.				
Protecto 401 Ceramic Epoxy	.040 inches	Immersion in 20% Sulfuric Acid	24 months	No effect
Calcium Aluminate Cement Lining	.192 inches	Immersion in 5% Sulfuric Acid	1.2 months	Erosion of .08 inches 42% loss of lining thickness
Calcium Aluminate Cement Lining of Sulfuric Acid	.311 inches	Immersion in a 2 pH Solution 27% loss of	12 months	Erosion of .089 inches lining thickness
SLIDING ABRASION TESTING				
Protecto 401 Ceramic Epoxy		EN 598 Section 7.8	100,000 cycles	0.0 loss
Calcium Aluminate		EN 598 Section 7.8	100,000 cycles	8.6 mils loss
DEFLECTION TESTING				
Subject: Two materials proposed for lining ductile iron pipe used in sewer service were tested for resistance to deflection from earth loading using slow-loading with with a Baldwin test machine.				
Sample Preparation: The samples tested were 4" wide ductile iron rings cut from factory lined ductile iron pipe.				
Protecto 401 Ceramic Epoxy	.040 inches	5% Pipe Deflection		No effect
Calcium Aluminate Cement Lining	.188 inches	1% PipeDeflection		Failure with hairline cracks at the top and the bottom of pipe

Comparison Tests

Protecto 401 vs. Polyethylene

TEST	PROTECTO 401	RESULTS
160°F DISTILLED WATER IMMERSION scribed panels Rated using ASTM D-714-8	24 months, slight red rust in scribe, no undercutting.	1-1/2 months, delamination of film, test terminated.
120°F TAP WATER IMMERSION scribed panels Rated Using ASTM D-714-87	24 months, slight red rustin scribe, no undercutting.	6 months, film curlsback l/2" from scribe, test terminated.
140°F 25% SODIUM HYDROXIDE IMMERSION Rated Using ASTM D-714-87	24 months, no effect.	1-1/2 months, delamination of film, test terminated.unscribed
SALT SPRAY ASTM B-117 scribed panels	24 months, red rust in scribe, no undercutting.	1-1/2 months, l-1/2" under-cutting at scribe. Testterminated

Note: All materials were tested with an average film thickness of 40 mils on production-run ductile iron.

Protecto 401 vs. Polyamide Coal Tar Epoxy

TEST	PROTECTO 401	RESULTS
PERMEABILITY Procedure "A"of ASTM E-96-6642 Day Test Duration	0.00 perms	.22 perms

Note: The lower the permeability rating, the less water borne chemicals can penetrate the lining.

TEST	PROTECTO 401	RESULTS
IMMERSION in 20% sulfuric acid	No blisters or delamination of lining after 24 months.	Blisters over all of the tested area of lining after 3 months. Test terminated.
SALT SPRAY 5% solution ASTM B 117-85 Scribed	24 months No undercutting at scribe. No damage to panel.	After 4.7 months no undercutting at scribe. No damage to panel.

Note: All materials were tested with an average film thickness of 40 mils.

Comparison Tests

Protecto 401 Ceramic Epoxy vs. Resin Rich 100% Solids Epoxy

	PROTECTO 401 CERAMIC EPOXY	RESIN RICH EPOXY
Epoxy Resin	100% Novalac Epoxy[1]	50% Novalac Epoxy[1] 50% Non-Novalac Epoxy[1]
Film Build	60 mils minimum in one coat[3]	12 mils maximum per coat
Recoatability	Recoatable indefinitely with itself[3]	Not recoatable after 24 hours @70°F, Less recoat time at higher temperature
Ductile Iron Pipe Lined History/Usage	25 years/40 million linear feet	Unknown

Independent Testing:

	PROTECTO 401 CERAMIC EPOXY	RESIN RICH EPOXY
Impact Resistance ASTM D-2794-93	72 in./lbs.[4,]	60 in./lbs.
Abrasion Resistance ASTM D-4060-90 H-18 wheel 1,000 gram load for 1,000 cycles	.39 Average weight loss[4,6]	.58 Average weight loss[6]
Permeability ASTM E-96-66	0.00 [4,7]	No independent data
UNDERCUTTING RESISTANCE ALTERNATE WET / DRY IMMERSION (5% NaCl, flowing aerated, 120°F, wet 1 hour followed by dry 1 hour – 12 cycles/day 1 YEAR DURATION	Passed – no undercutting or blisters	FAILED – Undercutting along cut edges began after 3 weeks, After 1 year – severe undercutting
Standard Test Method for Effect of Household Chemicals ASTM D-1308	Passed[4,7]	No independent data
Resistance to Cathodic Disbondment by the Attached Cell Method – 45 Days ASTM G-95	0.5 mm[4,7]	No independent data
Salt Fog Testing ASTM B-117	0.0 undercutting[4,7]	No independent test data

[1]Material safety data sheet published by the manufacturer.
[3]Quality control records for Protecto 401 Ceramic Epoxy™
[4]All test data on Protecto 401 Ceramic Epoxy™ as reported was produced by testing production-run ductile iron pipe.
[6]Test commissioned by pipe manufacturer.
[7]Test commissioned by manufacturer of Protecto 401 Ceramic Epoxy™

Comparison Tests

Protecto 401 vs Epoxy Manhole Lining

TEST	PROTECTO 401 RESULTS	EPOXY MANHOLE LINING
PERMEANCE ASTM E-96 Water Vapor Transmission	0.00 Test for permeation of water, liquids and gases	No Independent Test Data
ASTM B-117 Salt Fog Unprotected edges of Lined Ductile Iron Pipe	Passed – no undercutting Test for disbondment at cut spigots or damaged areas	No Independent Test Data
HOT SALT WATER IMMERSION Cycling 1 hour wet 1 hour dry for 1 year @ 120 DEGREES F. - 5% Nacl solution Unedged – Lined Ductile Iron Pipe	Passed – no undercutting or blistering Test for disbondment at cut spigots or damaged areas	No Independent Test Data
Gasketed Mechanical Joint Lined Ductile Iron Pipe Vacuum Test	Passed – no lining delamination Test for vacuum pulled by inverted siphons and force mains when not pumping	No Independent Test Data
ASTM CATHODIC DISBONDMENT	3 Samples tested- 0.17mm (.026") Average disbondment Test for adhesion, permeability, and cathodic disbondment	2 samples tested- 22.86 mm (.9") Average disbondment
FDA WATER EXTRACTABILITY TEST	Passed Test for non-hazardous effect on ground water	No Independent Test Data
EPA METHOD 1311 TOXICITY CHARACTERISTICS	Passed Test for non-hazardous effect on ground water	No Independent Test Data
EFFECT OF CHEMICALS ON LINING 10% Sulfuric Acid 25% Sodium Hydroxide 10% Sodium Hydroxide 5% Sodium Hydroxide Gasoline Toluene D.I. Water Hot Water (76° C)	Passed Test for resistance to accidental discharges	No Independent Test Data
ASTM G-22-90 Standard Practice for determining resistance to Acidithiobacillus Bacteria	Passed Resistance to growth of bacteria which produces sulfuric acid from hydrogen sulfide in sewer lines	No Independent Test Data
IMPACT TEST FOR PIPE ASTM G-14	72 inch lbs. Test for resistance to damage in sewer lines	No Independent Test Data

Comparison Tests

Protecto 401 vs Epoxy Manhole Lining

TEST	PROTECTO 401 RESULTS	EPOXY MANHOLE LINING
SEVERE WASTE WATER ANALYSIS (S.W.A.T.) 28 Days	10,950 days Actual sewer use in partially full sewer force main & gravity sewers on ductile iron substrate - No Failures	28 days reduction in log-z Electrical impedance .05 Loss Tested on Steel
Abrasion BS EN598 Rocking Abrasion, 1,000,000 cycles Ductile Iron Pipe	2 mils Loss	5.5 mils Loss
Adhesion Ductile Iron Pipe	1000 psi Failure in cohesion @ 300 psi (Film remains on surface)	1131 psi Failure to surface (Delamination)
Cathodic Disbondment	0.17mm (.026") Average Disbondment - 3 test on Ductile Iron Pipe	22.86 mm (.9 inch) Average Disbondment - 2 test on Ductile Iron Pipe (Reported on Steel 0.00)
Chemical Resistance Immersion Ductile Iron Pipe	2 years 20% Sulfuric Acid 25% Sodium hydroxide	6 months duration PH-3 (0.065 sulfuric acid) PH-13 (0.4% sodium hydroxide
Shore DHardness	71 (Ductile Iron)	78 (Steel)
D.I. Water Immersion	2 years (17,520 hrs) No Effect (Ductile Iron Pipe)	4000 hours No effect (Steel)
Salt Fog ASTM B-117 Unscribed	7 years (61,320 hrs) No effect Ductile Iron Pipe	5,000 hrs (Steel) No effect
Salt Fog ASTM B-117 Scribed to Substrate	2 years (17,520 hrs) No effect on unscribed surface No undercutting at scribe Ductile Iron Pipe	No report
Water absorption ASTM C 413-01 (2006)	No water absorption	No water absorption
Water Vapor Transmission ASTM E-96 / E96 M-05	0.00	0.09
120° Hot Water Immersion Ductile Iron Pipe	2 years No Effect	No report
Impact Resistance ASTM G-14 Ductile Iron Pipe	72 in/lbs	No report
Chemical Resistance ASTM D-1308 Ductile Iron Pipe	Passed	No report

THE PROVEN CERAMIC EPOXY LINING.
PROTECTO 401

THIRD PARTY TESTING

Gasketed Mechanical Joint Vacuum Proof Test
ASTM F1476-95A

Professional Service Industries, Inc.
ORDER NO: 47048035
DATE: March 6, 2000

On March 6, 2000, a 30" diameter by 4' long, plain end by plain end ductile iron pipe, lined with Protecto 401™ Ceramic Epoxy, was subjected to a vacuum proof test. The test conducted was in accordance to the Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Application, ASTM F 1476-95a, a Class 3 design, gasketed mechanical coupling, i.e., a flexible and unrestrained coupling.

For the vacuum test, each end of the 30" pipe was capped off with a TYTON® Joint Cap Fitting. After connecting the test assembly to the vacuum pump, the pump was turned on, a vacuum of 25 inches of mercury was drawn, and the assembly was sealed with a 3/4" DynaQuip® ball valve.

The vacuum was held for an uninterrupted time period of 7 minutes without loss of vacuum. The vacuum gage used for measurement during this test was a Model No. 1980, Ametek gage with a range of 0-30" Hg, graduated in 1/10th inches of mercury. The gage was certified to be in conformance with the requirements of ASTM F 1476, i.e., +/- 1% or better throughout the gage's range.

After the vacuum test, the pipe was uncapped and the lining was examined. No disbondment or damage to the lining was detected.

This test was performed in the presence of a representative of Professional Service Industries. We certify that the results of this test are correct and accurately reported herein as observed by our representative.

PROFESSIONAL SERVICE INDUSTRIES, INC.

Wesley Parkhurst Jr.

Permeance
ASTM E-96

COATINGS RESEARCH GROUP, INC.
2340 Hamilton Avenue, Cleveland, Ohio 44114 U.S.A.
216-781-9122 * * * FAX 216-781-9239

TO: Bill Setser
FROM: Phil Slifko
SUBJECT: Perm Rating of Indurall Sample PROTECTO 401™

Procedure A of ASTM 96-66, described in Project 10-002 p 14-30 (February 1979), was used to determine the permeance of the submitted paint sample. Over a period of thirty days in our humidity cabinet, relative humidity (outside the cup) and temperature averaged 48.6% and 78.0° F (25.6°C), respectively. Glidden's Insul-aid was used as the control in this test. The permeance of the Protecto 401™ (Q8-2401 [component A] blended with D8- 2401 [component B]) along with the control are shown in the following Table:

TABLE: Perm Rating of Test Coatings

COATING	PROTECTO 401™	GLIDDEN INSUL-AID
DRY FILM THICKNESS (MILS)	53.00	2.36
PERMS	0.00	0.63

*All samples were run in duplicate and averaged for permeance.

Sincerely,

Phil Slifko

Effect of Household Chemicals – ASTM D-1308

GEORGE MILLS & ASSOCIATES INTERNATIONAL, INC.

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TEST REPORT PROTECT 401™ CERAMIC EPOXY

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

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

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

ASTM B-117: Standard Test Method of Salt Spray (Fog) Testing.

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

Effect of Household Chemicals – ASTM D-1308

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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.

CERTIFIED:

George Mills

Dr. George Mills

Effect of Household Chemicals – ASTM D-1308

GEORGE MILLS & ASSOCIATES INTERNATIONAL, INC.

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TEST METHOD: ASTM D-1308:

Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Finishes. (Chemical Soak Test modified for evaluation with various concentrations of hydrogen peroxide immersion solutions. Solutions were changed regularly to maintain concentration of H_2O_2.)

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), room temperature partial submersion in a series of concentrations of hydrogen peroxide H_2O_2. The test results are tabulated below.

CHEMICAL SYSTEM	RESULTS
1% H_2O_2	135/136 Pass: Coating unaffected; no undercutting or loss of adhesion; Some corrosion to back of coupon and from un-protected hole drilled in top of coupon.
5% H_2O_2	126/131 Pass: Coating unaffected, no uncercutting or loss of adhesion; Some corrosion to back of coupon and from un-protected hole drilled in top of coupon.
10% H_2O_2	123/125 Pass: Coating unaffected; Some corrosion to back of coupon and from un-protected hole drilled in top of coupon. Corrosion to metal at un-protected areas of coupon.
25% H_2O_2	121/122 Pass: Coating unaffected; Some corrosion to back of coupon and from un-protected hole drilled in top of coupon. Corrosion to metal at un-protected areas of coupon
50% H_2O_2	Pass: Coating unaffected. Some corrosion to back of coupon and from un-protected hole drilled in top of coupon. Corrosion to metal at un-protected areas of coupon

CERTIFIED:

Dr. George Mills

Salt Spray ASTM B-117

GEORGE MILLS & ASSOCIATES INTERNATIONAL, INC.

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TEST METHOD: ASTM 117:

Standard Test Method of Salt Spray (Fog) Testing.

COATING SYSTEM:
PROTECTO 401™ CERAMIC EPOXY Lining: Plant applied epoxy lined ductile iron pipe (DIP) cut into 4 inch x 6 inch coupons.

PROCEDURE:
Using the ASTM B 117 salt fog apparatus and procedures with the exception that the film was not scribed so as to allow observation of underfilm corrosion creep along cut edges of coupon. Duration of the test was 1080 hours (45 days).

PANEL NUMBER	AVERAGE MM COROSION UNDERCUT ABOUT PERIPHERY OF COUPON
147	0 mm
148	0 mm
149	0 mm

There was no corrosion undercutting of the coating although heavy corrosion product developed along the unprotected edges. Coating could not be forced to delaminate by vigorous probing.

CERTIFIED:

Dr. George Mills

Cathodic Disbondment ASTM G-95

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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 60øC 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
154 (Room Temp.)	0 mm
157 (Room Temp.)	0 mm
156 (Room Temp.)	0.5 mm

PANEL NUMBER	INCREASE IN RADIUS
*155 hot (60°C)	xx
* 158 hot (60°C)	xx
159 hot (60°C)	2 mm

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

CERTIFIED:

Dr. George Mills

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

ASTM G-14 Impact Test Report Protecto 401™ Ceramic Epoxy

GEORGE MILLS & ASSOCIATES INTERNATIONAL, INC.

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IMPACT TEST REPORT
PROTECTO 401™ CERAMIC EPOXY

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.

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:

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.

CERTIFIED:

Dr. George Mills

Protecto 401's Ability To Protect Ductile Iron From Acid Attack

Induron has included independent test data concerning the growth of Acidithiobacillus Bacteria on the Protecto 401™ Ceramic Epoxy lining of ductile iron pipe and fittings. The growth of this bacteria contributes to the erosion of ferrous metals and concrete in sewer service, since this bacteria produces sulfuric acid as a waste product when it consumes hydrogen sulfide.

It is our opinion, based upon ASTM G 22 90 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria, that Protecto 401™ Ceramic Epoxy is not only an excellent barrier coat with zero permeability and resistance to high percentages of both bases and acids, but also a non-ablative (non-sacrificing) bactericide—which dramatically reduces the growth of thiobacillus bacteria, the main culprit in damage to sewer lines.

Because Protecto 401™ Ceramic Epoxy is constructed to produce a lining that has a higher ph throughout the lining and acidithiobacillus have to have an acid environment to flourish then Protecto 401™ Ceramic Epoxy acts as a bactericide without any loss of film integrity. The proof is in the testing. (see attached) The bare metal grows acidithiobacillus, when subjected to the warm moist climate and inoculated with the bacteria, at an alarming rate.

Protecto 401™ Ceramic Epoxy (which is referred to as the Black Epoxy Coupons in the test data), limits growth to only traces.

This added advantage—plus the unique construction of Protecto 401™ Ceramic Epoxy—is the reason for the longevity of Protecto 401™ Ceramic Epoxy in sewer service on ductile iron pipe and fittings.

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

Microbe Inotech Laboratories, Inc.
Summary Report of Analysis
[MILB –5554A]

John Anspach
Induron Coatings
3333 Richard Arrington, Jr. Blvd North
Birmingham, AL 35234
Phone: 205-521-9626
Fax: 205-324-6942

July 3, 2008

Description and Chain of Custody Record Information:

- Thursday, May 29, 2008 – 4:20PM: Received by Fed Ex, four (4) types of metal coupons (20 Black epoxy coupons, 20 Red epoxy coupons, 20 Tan epoxy coupons, and 20 blank coupons, total of 80 coupons) for a biodegradability study using *Acidithiobacillus ferrooxidans*.
- MILB Report & Invoice Number: 5554A (down payment) and 5554B (remaining balance).
- Proposal Option #3

Sample Processing:

- ASTM G22 90 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria.
- **Test Setup:** A metal coupon was placed on top of sterile water agar. The coupon was then inoculated with 1 mL of *Acidithiobacillus ferrooxidans* in growth media. This process was repeated 12 times for each coupon type. The replicates were then placed at 30°C for growth.
- **Controls:** Four (4) coupons were placed on sterile water agar and were not inoculated. These replicates were placed at 30°C. Four (4) additional squares of ribbon were placed on sterile water agar and were inoculated with sterile *Acidithiobacillus ferrooxidans* media. These replicates were placed at 30°C
- **Observations for Growth:** Observations for growth were made at 7 days from inoculation. The following ratings were used for the observations:

Observed Growth on Specimens	Rating
None	0
Traces of growth (less then 10%)	1
Light growth (10-30%)	2
Medium growth (30-60%)	3
Heavy growth (60%-complete coverage)	4

the MiL, Inc. 7259 Lansdowne Avenue Suite 200 St. Louis MO 63119-3421
Phone: (800) 688-9144 Fax: (314) 344-3031

Results

Data: Aerobic Growth Results		
	Replicate	7 Day
Coupon coated in Black Epoxy	1	1
	2	1
	3	1
	4	1
	5	1
	6	1
	7	1
	8	1
	9	1
	10	1
	11	1
	12	1
Average Aerobic		**1**
Media Control	1	0
	2	0
	3	0
	4	0
Average Media Control		**0**
Negative Control	1	0
	2	0
	3	0
	4	0
Average Negative Control		**0**

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THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

Data: Aerobic Growth Results		
	Replicate	7 Day
Coupon without epoxy coat	1	4
	2	4
	3	4
	4	4
	5	4
	6	4
	7	4
	8	4
	9	4
	10	4
	11	4
	12	4
	13	4
	14	4
	15	4
	16	4
Average Aerobic		**4**
Media Control	1	3
	2	2
Average Media Control		**2.5**
Negative Control	1	0
	2	0
Average Negative Control		**0**

Thank you from the staff on project:

James J. O'Donnell III
Laboratory Manager

Sara J. Blamey
Senior Microbiologist II

the MiL, Inc. 7259 Lansdowne Avenue Suite 200 St. Louis MO 63119-3421
Phone: (800) 688-9144 Fax: (314) 344-3031

Toxicity Characteristics Of Cured Film Of Protecto 401™

Cured Films of Protecto 401™ have been independently tested using the Environmental Protection Agency Method 1311 Toxicity Characteristic Leaching Procedure. This procedure is a determination of leachable characteristics of the sample for

Arsenic	Chloroform	1,4-Dichlorobenzene
Barium	1,2-Dichloroethane	2,4-Dinitrotoluene
Cadmium	1,1-Dichloroethane	Hexachlorobenzene
Chromium	Methyl ethyl ketone	Hexachlorobutadiene
Lead	Tetrachloroethylene	Hexachloroethane
Mercury	Trichloroethylene	Nitrobenzene
Selenium	Vinyl Chloride	Pentachlorophenol
Silver	Toluene	Pyridine
Benzene	o-Cresol	2,4,5-Trichlorophenol
Carbon tetrachloride	m & p Cresol	2,4,6-Trichlorophenol
Chlorobenzene	Cresol (o+m+p)	

the following chemicals.

Fully cured films of Protecto 401™ do not leach any of these chemicals in an amount which exceeds that allowed by EPA Test Method 1311.

Based on the above testing and a literature search, Protecto 401™, when used to protect sewer lines against corrosion, does not present a health hazard to humans or any risks to the environment.

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

GUARDIAN SYSTEMS, INC.

1108 Ashville Road
P.O. Box 190
Leeds, Alabama 35094

Telephone 205/699-6647
Wats 866/729-7211
Fax 205/699-3882

Mr. John Anspach
Induron Coatings, Inc.
P.O. Box 2371
Birmingham, Alabama 35201

Subject: Code of Federal Regulations

Dear Mr. Anspach,

Guardian Systems, Inc. performed a Water Extractability Test on Protecto 401 Ceramic Epoxy coating provided by Induron Coatings, Inc. The coating was applied to glass plates and cured for one week. The test was run per exposure conditions 4(v) simulating room temperature filling and storage. The plates were placed in D.I. water for twenty-four hours at 120°F. The water was evaporated and the residue weighed to the nearest 0.1 milligram.

The calculated result of 7.0mg/L was less than 50mg/L (ppm), which is the reference point for doing extended analysis to determine chloroform-soluble extractives. The water extractable results of 0.30mg/sqin is well below the reference of 18mg/in^2 for a coating intended for repeat use.

Attached are copies of the Code of Federal Regulations Volume 21 Part 175.300 to use as reference material.

If you have further questions, please contact me at (205) 699-6647.

Sincerely,

Jerry Horncastle
Laboratory Manager

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

REPRESENTATIVE LISTINGS OF COMPLETED PROTECTO 401 PROJECTS

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Sweeny Wastewater Treatment Plant Sweeny TX	440' 4" CL.51 650' 6" CL.50 894' 8" CL.50 342' 10" CL.50 558' 12" CL.50 90' 14" CL.50 126' 16" CL.50	O'Malley Engineers Inc. P.O. Box 1976 Brentham TX 77866	City of Sweeny 102 W. Ashley Sweeny TX 77480
Ft. Caroline Rd. @ University Club Rd. Jacksonville FL	9460' 8" Cl.55	City of Jacksonville Eng. Dept. 219 Newnan St. Jacksonville FL 32202	City of Jacksonville 219 Newnan St. Jacksonville FL 32202
Oslo Road Water Main Vero Beach FL	90' 8" CL.52	Indian River County Bd. Of Commissioners 1840 25th Street Vero Beach FL 32960	Tri-Sure Corporation P.O. Box 653 Auburndale FL 33823
C-205 Merrill Barber Bridge Relocation Project Vero Beach FL	2000' 12" CL.350 18' 12" CL.50 300' 6" CL.50 220' 4" CL.51	City of Vero Beach Engineering Dept. P.O. Box 1389 Vero Beach FL 32961	Treasure Coast Contracting 165 14th Ave. Vero Beach FL 32961
Stratford Wastewater Impr. Red bud Trail & Stratford Dr. Austin TX	1775' 6" PC350 120' 8" PC350 3045' 10" PC350	Baker Aicklen Assoc. 9111 Jollyville Rd Suite #107 Austin TX 78759	City of Austin Dept. of Public Works 505 Barton Springs Rd. Austin TX
Cotton Wood Shores Austin TX	150' 6" CL350	City of Austin TX	City of Austin TX 505 Barton Springs Rd. Austin TX
Riverside Dr. Coral Springs FL (Broward County)	1050' 10" CL.50 480' 6" CL.53	Williams Hatfield & Stoner 1901 S. Congress Ave. Suite 150 Boynton Beach FL 33426	Broward Co. Bd of Comm. 115 S. Andrews Ave. Ft. Lauderdale FL 33301
DOT Project No.26250-3523 SW 34th St. Improvements Gainesville FL (Alachua County)	2640' 8" CL.50	Tampa Bay Engineers 18167 US 19th N. Clearwater FL	FL Dept. of Transportation 3456 SW 42nd Ave. Suite A Gainesville FL 32508
13th Ave. N. Sanitary Sewer Jefferson County AL	779' 24" CL.52 792' 16" CL.52 90' 16" CL.52	Gary L. Owen & Assoc. 420 Lorna Square Birmingham AL 35216	Jefferson County Environmental Services 716 21st St. N. Room 204E Birmingham AL 35263
City Southeast Water Lift Station #48 Lubbock TX	270' 24" CL.53 18' 30" CL.53 507' 36" CL.53 18' 12" CL.52	City of Lubbock Lubbock TX	City of Lubbock TX P.O. Box 8000 Lubbock TX 79457
Taylor Correctional Institute Perry on US 98 Tallahassee FL	160' 4" CL.53 140' 6" CL.53 90' CL.53	Connelly of Wick Drue Avery P.O. Box 5143 Jacksonville FL 32240-1343	State of FL/Dept of Corrections Bureau of Facilities Services 2701 Blair Stone Rd Tallahassee FL
Bridge Crossing LaGrange FL	72' 8" CL.50	Befco Engineering Inc. 220 N. Worthington St. LaGrange FL	City of LaGrange

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Riverside Drive Coral Springs FL (Broward County)	1050' 10" CL.50 480' 6" CL.53	Williams Hatfield & Stoner 1901 S. Congress Ave Suite 150 Boynton Beach FL 33426	Broward Co. Bd of Comm. 115 S. Andrews Ave. Ft. Lauderdale FL 33301
Austell GA	178 pcs Asst. Pipe		
Brookfield Village Douglasville GA	1550' 6: CL.50	Douglasville Douglas Co. Water & Sewer Authority P.O. Box 1157 Douglasville GA 30133	Douglasville Douglas Co. Water & Sewer Authority P.O. Box 1157 Douglasville GA 30133
Sunshine Recycle Largo FL	504' 10" CL.50 40' 6" CL.50		
Flavor Pict Road Coral Lakes III Palm Beach County FL	2140' 6" CL.50	Shalloway Floy Raymond & Newell Inc. 1201 Belvedere Rd. West Palm Beach FL 33405 407-655-1151	Oriole Homes 1690 S. Congress Ave. Delray Beach FL 33445 407-274-2000
Tallahassee FL	Assorted Fittings 42 pcs		
Boynton Beach Utility Lift Station Boynton Beach fl	1400' 8" CL.50 w/Protecto EL	CCL Engineering 2200 Park Center Blvd. N. Suite-100 Pompano Beach FL 33064	Tradewinds Design & Const. 902 Clintmoore Rd. Suite – 124 Boca Raton FL 33487
Lemont Construction Jefferson County AL	600' 4"		
Ocala Palms Water & Sewer Improvements Ocala FL	10730' 10" CL.50	Miles Anderson Consulting Engineers 1515 E. Silver Springs Blvd. Box 8 Suite W-165 Ocala FL 34470	Venture Association 8888 SW State Road 200 Ocala FL 32676
Atlanta GA	77 pcs Assorted Pipe		
Scott & Martin Port Orange FL	216' 12" 72' 8" 108' 12" 72' 8"		
Sanitary Sewer Extensions Lanett AL	735' 10" CL.50 400' 8" CL.50	Goodwyn Mills & Cawood P.O. Box 3605 Montgomery AL 36109	City of Lanett P.O. Box 290 Lanett AL
Hemphill Construction Co. P.O. Drawer 879 Florence MS 39073	200' 48" Pipe		
Wastewater Pump Station #458 Modifications Ft. Lauderdale FL	Assorted Cut Pipe	Hazen & Sawyer 4000 Hollywood Blvd. Suite 750 North Lawyer Hollywood FL 33021	Broward Co. Bd of Comm. 115 S. Andrews Ave. Ft. Lauderdale FL 33301
Anderson Mill #21 Austin TX	144' 8" CL.350	City of Austin TX	City of Austin TX
RHJ Delray Beach FL	1100' 4" CL.51		
Groveland WWT Plant	4" Fittings & 6" Fittings		Vogel Brother Bldg. Co. P.O. Box 5200 Lakeland FL
Jergins Kettering OH	1800' 16" CL53		

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
AL Water Works P.O. Box 8056 Montgomery AL 36110	3185' 8" Pipe & 10" Pipe		City of Montgomery AL
Kamminga & Roodvoets P.O. Box 310396 Pinellas Park Tampa FL	568' 24" Pipe		
Thomasville/Velda Dairy Rd. Sewer Extension Tallahassee FL	1973' 14" RJ CL.51	City of Tallahassee Water & Sewer Dept. 300 S. Adams Street Tallahassee FL 32302	City of Tallahassee Water & Sewer Dept. 300 S. Adams Street Tallahassee FL 32302
Orlando FL	216' 12" CL.52 144' 12" CL.52		
Stratford Wastewater Impr. Red Bud Trail & Stratford Dr. Austin TX	1775' 6" PC350 120' 8" PC350 3045' 10" PC350	Baker Aicklen Assoc Inc. 9111 Jollyville Road Suite 107 Austin TX 78759	City of Austin Dept of Public Works 505 Barton Spring Rd Austin TX
W.G. Johnson Gainesville FL	486' 24" CL.51 216' 8" CL.51		
C205 Merrill Barber Bridge Relocation Project Vero Beach FL	2000' 12" CL.350 18' 12" CL.50 300' 6" CL.50 220' 4" CL.51	City of Vero Beach Engineering Dept. P.O. Box 1389 Vero Beach FL 32961	City of Vero Beach P.O. Box 1389 Vero Beach FL 32961
Tucker Construction Montgomery AL	306' 18" CL.50		
Kaufman WWTP Kaufman TX 75142	40' 4" CL.53 40' 6" CL.53 260' 8" CL.53	Allen Plumer & Assoc. Attn: Mark Perkins 210 6th Street Suite 400 Ft. Worth TX	City of Kaufman Attn: Jo Ann Talbot City Hall 209 S. Washington Kaufman TX 75142
Pompano Beach FL	180' 10"		
Smith's Food King Melrose & Hacienda Vista CA	39 pcs CL.300	Wilson Engineering 703 Palomar Rd Suite 300 Carlsbad CA 92009	Smith Food & Drugs 1550 S. Redwood Rd Salt Lake City UT 84104
City of Victoria Victoria TX	400' 4" CL.51	City of Victoria	City of Victoria
Calhoun Georgia	2380' 36"	Hensley Schmidt Atlanta GA	
Fox Construction McKinney TX	594' 20" Pipe		
Delray Beach	83 pcs Assorted Pipe		
Denco Ft. Myers FL	1512' 8" CL.51		
Tucker Utilites Ann Street Sewer Job Montgomery AL	18' 18" CL.50 54' 20" CL.50		City of Montgomery AL
Speegle Construction Cocoa Beach FL	Assorted Pipe & Fittings		
16" Force Main Miami FL Broward County	720' 16" CL.52 414' 16" CL.52 36' 12" CL.52	Hazen & Sawyer 4000 Hollywood Blvd. Hollywood FL 33021	City of Miami 6700 Miramar Pkwy. Miramar FL 33023
Douglas Electric Hinesville GA	126' 18" CL.50 80' 6" CL.50 108' 10" CL.50 198' 12" CL.50		

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Washington Sewer Plant Washington NC 27889	Pipe and Fittings 3300' 16" 1777' 24"		Loving Co. Drawer 919 Goldsboro NC 27533
Weems Road Interceptor Swr Tallahassee FL	1850' 30" CL.51	City of Tallahassee 300 S. Adams Street Tallahassee FL 32301	City of Tallahassee 300 S. Adams Street Tallahassee FL 32301
Construction Contractor Ocala FL	10728' 10" CL.50		
Rattan Creek Lift Station Parmer Lane Force Main Austin TX	3130' 14" PC250	Martinez & Wright 1106 Clayton Lane Suite 400W Austin TX 78723	c/o Engineer (Murfee Engr) 1101 Capitol of TX Hwys. Bldg. D#110 Austin TX
City of Lubbock TX Lubbock TX	144' 16" CL.56	City of Lubbock	City of Lubbock
Apple Valley S/D-Sewer Richmond Co. GA	252' 18" CL.50	WR Toole Engineers Inc. 349 Greene Street Augusta GA 30901	Richmond Co. Bd of Comm. 530 Green Street Augusta GA 30901
Smith & Company Palm Beach Co. FL	1700' 12" CL.50		
Lewters Lift Station Lubbock TX	10" 54" CL.50	City of Lubbock Water Utilities Engineers 1625 13th Street Lubbock TX 79457	City of Lubbock 1625 13th Street Lubbock TX 79457
City of West Palm Beach Project No. 94-280 Utilities Maintenance Div. 1045 Charlotte Ave West Palm Beach FL	90' 14" CL.52 108' 12" CL.52 108' 10" CL.52 100' 8" CL.52	City of West Palm Beach Eng. Div. 1045 Charlotte Ave. West Palm Beach FL 33401	City of West Palm Beach 1045 Charlotte Ave. West Palm Beach FL 33401
Chaparral Road Lift Station Allen TX	160' 12" CL.51	Cummins & Pewit Inc. Allen TX 214-680-0602	Cummins & Pewit Inc. Allen TX 214-680-0602
Wastewater Plant Sand Springs OK	40' 6" CL.350 320' 10" CL.350 54' 14" CL.250 300' 24" CL.250 36' 30" CL.50	Srini Sundaramoorthy FHC Inc. 5416 S. Yale Suite 400 Tulsa OK 74063	City of San Springs 100 E. Broadway P.O. Box 338 Sand Springs OK
Golden Eagle Estates NW 97th Ave & 126th Street Hialeah Gardens FL (Dade Co.)	2250' 12" CL.50	Avino & Assoc 305-227-1813 2460 SW 137th Ave. #250 Miami FL 33175	Golden Eagle Estates NW 97th Ave & 126th Street Hialeah Gardens FL 33012
De Telice 30 Bunhard Road North Harion CT 06473	Assorted Pipe 5832 SF		
Lakeland Project Austin TX	36' 10" CL.350	City of Austin TX	City of Austin TX
Satellite Office Complex Tallahassee FL	1994' 12" CL.51 18' 18" CL.51 20' 4" CL.51	Camp Dresser & McKee Inc. 325 John Knox Road Suite 102 Tallahassee FL 33406	State of Florida Dept. of Mgt. Services Div. 2737 Centerview Dr. Ste.300 Tallahassee FL 32399
Rowland Inc. 6855 102 Ave. N Pinellas Park FL 34666	6700' 36" Pipe		

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Jog Road Palm Beach County FL	2700' 12" CL.50	Palm Beach Co. Engineers 160 Australian Ave Suite 503 West Palm Beach FL 33406	Palm Beach Co. Comm. 50 S. Military Trial Suite 110 West Palm Beach FL 33415
Water & Wastewater System Improvements New Port Richey FL	18' 18" PC350 18' 16" PC350 36' 18" PC350 162' 18" River Crossing 162' 16" River Crossing 162' 12" River Crossing	C & D Engineering 1520 Land Lakes Blvd Suite F Land O'Lakes FL 33549	City of New Port Richey 5919 Main Street New Port Richey FL 34652
SR 80 Water & Sewer Impr. Freemont Street to Prospective Avenue Ft. Myers FL	1500 8" CL.51 1000 6" CL.50	Pitman Hartenstein & Assoc. 4755 Summerlin Road Suite B Ft. Myers FL 33919	City of Ft. Myers 2200 Second Street Ft. Myers FL 33902
Tri Sure Vero Beach FL	90' 8" CL.52		
Ludrug Sub. Rehab Austin TX	234' 8" CL.50	City of Austin Baker Aicklen Assoc. Inc.	City of Austin Dept. of Public Works 505 Boston Springs Rd Suite 760 Austin TX
Oslo Rd. Water Main Vero Beach FL	90' 8" CL.52	Indian River City Bd of Comm. 1840 25th Street Vero Beach FL 32960 407-567-8000	Indian River City Bd of Comm. 1840 25th Street Vero Beach FL 32960
Cooley Creek WWTP Alexander City AL	1490' 16" PC300 1400' 14" PC300	CH2M Hill 2567 Fairplane Drive Montgomery AL 36116	City of Alexander City P.O. Box 552 Alexander City AL 35010
Cooley Creek WWTP Alexander City AL	1850' 16" PC300 306' 14" PC300	CH2M Hill 2567 Fairplane Drive Montgomery AL 36116	City of Alexander City P.O. Box 552 Alexander City AL 35010
Taylor Correctional Inst. Perry FL	880' 6" CL.51 344' 8" CL.51 54' 8" CL.51	Connley & Wicker 1711 S. 5th Street Jacksonville Beach FL 32250	State of Florida
Scott Contractor Memphis TN	28 pcs Assorted Pipe		
Hwy.21 Sanitary Sewer Crossing Monroeville AL	475' 12" CL.50	Goodwyn Mills & Cawood P.O. Box 3605 Montgomery AL 36109	City of Monroeville P.O. Box 147 Monroeville AL 36461
Vogel Building Lakeland FL	55 pcs Assorted Cut Pipe		
Pelham AL Heather Ridge & KDA Sanitary Sewer Impr.	36' 24" CL.51 4126' 18" CL.51 1821' 14" CL.50 496' 12" CL.50 1680' 6" CL.50	Municipal Consultants 400 Century Park S. Suite 126 Vestavia AL 35226	City of Pelham P.O. Box 1419 Pelham AL
Nashville TN	250 pcs Assorted Pipe		
Ann Street Sewer Interceptor Montgomery AL	443' 36" CL.50 4318' 30" CL.50 3637' 30" CL.51 117' 30" CL.52 1140' 24" CL.50 112' 20" CL.53 1372' 18" CL.50	CH2M Hill 2567 Fairlane Drive Montgomery AL 36116	City of Montgomery Water & Sewer Bd. P.O. Box 1631 Montgomery AL 36102

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
SCE Inc. 3805 Springhill Rd Tallahassee FL	9764' Assorted Pipe		City of Tallahassee FL
Tallahassee FL	15000' Assorted Pipe	HNTB Engineering 5900 Lake Elenor Drive Suite 600 Orlando FL 32809-4639	City of Tallahassee FL
Tampa FL	814 pcs 8" Pipe 34096 sf		
Jacksonville Utilities Jacksonville FL	594' 16" Pipe	Jacksonville Utilities Jacksonville FL	Jacksonville Utilities Jacksonville FL
McMahan Const. Ormond Beach FL	180' 6" Pipe 240' 6" Pipe 360' 10" Pipe 72' 10" Pipe 54' 8" Pipe		
Calhoun GA	11784' pcs 48" Pipe	Hensley Schmidt Atlanta GA	
W. Jackson West Palm Beach FL	216' 8" Pipe 1380' 6" Pipe 160' 4" Pipe		City of West Palm Beach FL
Reynolds Inc. 121 Roberts Street Fairburn GA 30213	11000' 42" Pipe		
Tidewater Contruction Norfolk VA	5 pcs Assorted Pipe		
Weed Contracting Jenkins Creek Sewer Montgomery AL	3503' 30" CL.52 570' 30" CL.51 7300' 30" CL.50	CH2M Hill Montgomery AL	Montgomery Sewer & Water Works
Davis Meter Tampa FL	486' 8" Pipe 460' 6" Pipe 1725 sf		
W. Jackson Palm Beach County FL	1760' 6" CL.50		Palm Beach County FL
Eagle Valley Inc. 3401 N. Raceway Rd Indianapolis IN 46234	36' 4" Pipe 1242' 6" Pipe		
City of Tallahassee Tallahassee FL	504' 14" CL.51		City of Tallahassee Tallahassee FL
Indian River Industrial P.O. Box 23009 Jacksonville FL	1000' 6"-16" Pipe		
Pompano Beach FL	3280' (410 pcs) 8" Pipe 4 pcs 6" Pipe		Pompano Beach FL
B & M Water & Sewer Supply Marietta GA	444' 18" Pipe		
Mercedes Sanitary Sewer Tuscaloosa AL	9100' 30" Pipe 10145' 24" Pipe 14940' 20" Pipe 73570' 16" Pipe	McGiffert & Associates Tuscaloosa AL	City of Tuscaloosa AL
Westvaco Paper Charleston SC	8000' 48" Pipe		Westvaco Paper
Gainesville FL	3000' 8" – 12" Pipe		City of Gainesville
McMalar Construction Ormond Beach FL	4148' 8" CL.50		

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Cooley Creek WWTP Alexander City AL	1490' 16" PC300 1400' 14" PC300	CH2M Hill 2567 Fairlane Dr. Montgomery AL 36116	City of Alexander City P.O. Box 552 Alexander City AL 35020
Brasfield & Gorrie Safety Harbor FL	650' 30" Pipe		
Wastewater Plant Sand Springs OK	40' 6" CL.350 320' 12" CL.350 300' 24" CL.250	Srini Sundaramoorthy FHC Inc. 5416 S. Yale Suite 400 Tulsa OK 74063	City of Sand Springs 100 E Broadway P.O. Box 338 Sand Springs OK
Boca Falls Boca Raton FL	1134' 8" PC350 3260' 6" PC350 220' 4" CL.51	Lawson Noble & Assoc. 420 Columbia Dr. West Palm Beach FL 33409	Centex/Engle Joint Venture 2541 Metro Centre Blvd. West Palm Beach FL 22407
Tidewater Construction Norfolk VA	777' 42" Pipe		
Golden Eagle Estates NW 97th Ave. & 126 St. Hialeah Gardens FL (Dade County)	2250' 12" CL.50	Avino & Assoc. 2460 SW 137th Ave Suite 250 Miami FL 33175	Golden Eagle Estates 3822 West 12th Ave. Hialeah FL 33012
Cardinal Contracting St. Petersburg FL	105 pcs Assorted cut pipe and fittings		
Tillery Square Subdivision Austin TX	702' 8" PC350	City of Austin TX	City of Austin TX
B & H Sales Waco TX	80 pcs Assorted Pipe		
13th Ave N. Sanitary Sewer Jefferson County AL	779' 24" CL.52 792' 16" CL.52 90' 16" CL.52	Gary L. Owen & Assoc. 420 Lorna Square Birmingham AL 35216	Jefferson County Environmental Service 716 21st Street N. Room 240E Birmingham AL 35263
R.A. Scott Port Orange FL	4392' 10" CL.50		
Birmingham AL	7992' 36" & 54" Pipe	Doughtry & Assoc. Birmingham AL	Birmingham Water & Sewer Board
Kimmims Pinellas Park FL	432' 20" CL.52		
West Palm Beach FL	1650' 20" Pipe	John J. Kirlen West Palm Beach FL	City of West Palm Beach FL
Light House Point FL	2780' 30" Pipe	Coastal Utilities Broward County FL	
Light House Point FL	1500' 30" Pipe	Coastal Utilities Broward County FL	
Kissimee FL	1650' 20" Pipe	Martin K. Eby Kissimee FL	Kissimee FL
Kissimee FL	54518 sf Assorted Pipe	Triad Assoc. Contractors Greensboro NC	Kissimee FL
San Juan Puerto Rico	1200' 10" Pipe	Water Works Suppliers GPO Box 366203 San Juan PR 00936	San Juan Puerto Rico
Beaumont TX	10800' 30" Pipe	Alco Inc. P.O. Box 3684 Beaumont TX 77704	Beaumont TX
Jefferson County AL	6300' 8" & 12" Pipe	Hailey Rast Trussville AL	Jefferson County AL

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Baton Rouge LA	3500' 4"6" & 8" Pipe	Pittman Construction Baton Rouge LA	Baton Rouge LA
Clearwater FL	Assorted Pipe & Fittings	Hail Contracting P.O. Box 20200 St. Petersburg FL	
Huntsville AL	5323' 48" Pipe	Bryant Electric Co P.O. Box 1430 High Point NC 27261	City of Huntsville AL
Bay Maintenance Austin TX	4146' 8" Pipe		
Southern Region WWTP Phase II Boyton Beach FL	3632' Assorted Pipe	Hazen & Sawyer 2101 NW Corporate Blvd Boco Raton FL	Palm Beach City Bd of Commissioners
Vogel Brothers Lakeland FL	26 pcs 12" Pipe		
Broward County	Assorted Pipe 250 pcs	John J. Kirlin Pompano Beach FL	Broward County Bd of Commission 115 S. Andrews Ave Ft. Lauderdale FL 33301
Venezuela	22000' 24" & 30" Pipe	Trouvay & Cauvin Inc. Westgate Center 19408 Park Row Suite 350 Houston TX	Venezuela
Polk City Project	3000' 16" & 20" Pipe	Triyillo Construction 248 Spirit Lake Rd West Winter Haven FL	
Miami-Dade County Florida	1500' 8" Pipe	Persant Miami FL	Miami-Dade Water & Sewer Authority
Polk City Project	400' 54" Pipe	Pittman Construction Baton Rouge LA	
Lavonia GA	6719' Assorted Pipe & Fittings	Sheriff Construction P.O. Box 1 Gastonollee GA 30538	
Orlando FL	2700' 16" Pipe	Prince Contracting Rt.1 Box 404 Palmelio FL 33561	
Kuwait Sewerage Renovation PhaseV Part B – Jahra (1) SE/5/128	700mm pipe 5200 mm pipe	Gulf Consul/Joint Venture With Watson Hanksley	Ministry Public Works Kuwait
Miami-Dade County Flagler Street Pump Station	560' 60" Pipe	Urban Construction	Miami-Dade Water & Sewer Authority
Miami Southwest Sewer Force Main	3200' 48" Pipe		Miami-Dade Water & Sewer Authority
Miami Beach FL	500' 16" Pipe	City of Miami Beach Public Works	City of Miami Beach FL
Roseville CA	42220' 8" Pipe		City of Roseville CA
Danis Shoal Construction Clearwater FL	314 pcs Assorted Pipe & Fittings		
Azalea West Industrial Park Sewer Valdosta GA	1800' 18" & 16" Pipe	Jordan Jones & Goulding 2000 Clearview Ave Atlanta GA 30340	Valdosta-Lowndes Co. Industrial Authority

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Columbus MS	30,480' 20", 18" & 16" Pipe		City of Columbus MS
Hughes Supply Wilmington NC	3240' 12",10" & 8" Pipe	City of Wilmington	City of Wilmington NC
Fayetteville NC	1700' 12", 8", & 6" Pipe	City of Fayetteville	City of Fayetteville NC
Dubuque IA	2500' 20" Pipe		City of Dubuque IA
Bullard Ave Sewer Goodyear AZ	2900' 20" Pipe	Keogh 15650 N Blackley Hwy Suite 245 Phoenix AZ 85023	Sun Cor Development
Atchison KS	3720' 24 Pipe		City of Atchison KS
College of Veterinary Medicine – Auburn University Auburn AL	2200' 12" Pipe	Poly Engineering P.O. Box 837 Dothan AL 36301	Auburn University Auburn AL
Clear Creek Sewer	2580' 16",12" & 18" Pipe	McClelland Consulting Eng. 1810 N College Ave Fayetteville, AR 72702 501-443-2377	City of Springdale AR
Lobo Street Lift Station Cedar Park TX	4460' 24" & 20" Pipe	Turner Collie & Braden 400 West 15th St. Suite 500 Austin TX 78701	City of Cedar Park TX
Mandan ND	20 pcs 16" Pipe		City of Mandan ND
Sunrise FL	312 pcs 12" Pipe		City of Sunrise FL
City of Douglas AZ	2283' 16" Pipe	City of Douglas	Douglas AZ
South Wastewater Treatment Plant Miami OK	180' 30",24",14" & 12" Pipe	FHC, Inc. 5416 South Yale Tulsa OK 74135	City of Miami OK Public Utility Board 129 5th NW Miami OK 74355
Greensboro NC	10000' 30" Pipe		City of Greensboro NC
Marion SC Wastewater Improvements	1279' 16" Pipe	BP Barber & Associates N. Charleston SC	City of Marion SC
Cedar & 52nd Street Sewer Savannah GA	720' 24" Pipe	Hussey, Gay, Bell & Deyoung Savannah GA	City of Savannah GA P.O. Box 1027 Savannah GA 31402
Richmond VA	2440' 30" Pipe		City of Richmond VA
Austin TX	12258' 16",12" & 10" Pipe	Murfee Eng.	City of Austin TX
Metro Red Line Vermont Veverly Station Los Angeles CA	1812' 8" & 6" Pipe	LA County Sanitation District	LA County Metropolitan Transit Authority
Soos Creek Kent WA	800' 12" & 8" Pipe	Hedgest Roth Eng. 14450 NE 29th Suite 101 Bellevue WA 98007	Soos Creek Water & Sewer District P.O. Box 58039 Renton WA 98058-1039
Hiawatha KS	480' 8" Pipe		City of Hiawatha KS
Battle Creek MI	14640' 30" Pipe	City of Battle Creek MI	City of Battle Creek MI
Memphis TN	5600' 18",14" & 10" Pipe		City of Memphis TN
Spring Valley OH	360' 10" Pipe	Shook Inc	City of Spring Valley OH
Branson MO Sterling Excavating	4896' 18" Pipe		City of Branson MO
Goose Creek SC	5780' 24" & 16" Pipe	Tideland Utilities	City of Goose Creek SC
Vista CA	2540' 8" Pipe		City of Vista CA

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Ephrata PA	86 Assorted pcs 30" Pipe		City of Ephrata WWTP
Albany GA	1728' 24" Pipe		Albany State College City of Albany GA 1900 North Monroe Albany GA
Terramar Offsite H2O Peoria AZ	960' 16" Pipe	City of Peoria	City of Peoria AZ
Tracy CA	250' 12" Pipe		City of Tracy CA
Phoenix AZ	8100' 24" Pipe	Martin K. Ebby	City of Phoenix AZ
Jackson NJ	7240' 16" Pipe		City of Jackson NJ
Tacoma WA 86th Ave. Sanitary Sewer Interceptor	2900' 18", 8" Pipe	Pierce County	Pierce County Utilities Tacoma WA
Germantown MD	3420'36" Pipe		City of Germantown MD
Gulfport MS	600' 24" Pipe		City of Gulfport MS
Oman	312' 6" Pipe	Abb Susa Inc.	Oman
O'Fallon IL WWTP	1780' 12", 10" Pipe		City of O'Fallon IL
New Orleans LA	9000' 54" Pipe	Brown Cunningham & Gannuch New Orleans LA	Jefferson Parrish LA
San Juan PR	7260' 10",14" & 16" Pipe		San Juan PR
Vinita OK	450' 20" & 36" Pipe	Phillips & Bacon Tulsa OK	City of Vinita OK
Houston TX Davis-McAllen Pipe & Supply	3140' 42",36", 30",24",8" & 6" Pipe		Houston TX
Wilmington NC	8320' 36", 12" & 8" Pipe	City of Wilmington	City of Wilmington NC
West Des Moines IA U.S. Filter	470' 36" & 12" Pipe		
Millersville PA	25920' 36" Pipe	Myers Inc.	
Las Cruces NM	2500' 36",30", 20" Pipe		City of Las Cruces NM
Smyrna TN	18420' 24",18",16" &12" Pipe	Stan Nelson & Assoc. Birmingham AL	City of Smyrna TN
Warminster PA	640' 42" Pipe	Warminster Municipal Authority	Warminster Municipal Authority Warminster PA
Houston TX EP Brady Inc.	3700' 20" Pipe		City of Houston TX
Woodburn OR	2000' 12" Pipe	Fowler Company	City of Woodburn OR
Corpus Christi TX	256' 16" & 36" Pipe	Govind Eng. & Assoc. Corpus Christi TX	City of Corpus Christi TX
Williamsburg VA	1080' 20" Pipe		Hampton Roads Sanitation District
Fontana CA	600' 36" Pipe	Thompson Inc.	
Phenix City AL Cochalegee Creek Treatment Plant	7500' 30" Pipe		Phenix City AL
Temple TX Fryers Creek Trunk & Force Main	1512' 8" Pipe	Freese and Nichols Inc.	City of Temple TX
Charlotte NC	512' 8" Pipe		City of Charlotte NC
Enid OK	1180' 12",20", & 36" Pipe		City of Enid OK

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Jonesboro AR	980' 10" & 12" Pipe		City of Jonesboro AR
Baton Rouge LA	1220' 6" & 8" Pipe		City of Baton Rouge LA
Lexington SC	42000' 20",24",30" Pipe		City of Lexington SC
Mobile AL Snow Road Sewer	1006' 8" & 10" Pipe	BCM-Smith Environmental P.O. Box 1784 Mobile AL 36601	Mobile Water & Sewer Board Mobile AL
Broward County FL	11720' 4" to 30" Pipe		Broward County FL Sewage & Water
Sunrise FL	6240' 6" – 48" Pipe		City of Sunrise FL
Fayetteville NC	4360' 16" Pipe		City of Fayetteville NC
Ocala FL	7619' 20" Pipe	City of Ocala Eng. Dept 405 S Oceola Ave Ocala FL 34471	Ocala FL
Venezeula	25000' 10",24" & 36" Pipe	Trouvay & Cauvin Inc. Houston TX	Venezeula
Beaumont TX	11837' 30" Pipe		City of Beaumont TX
Broward County FL Carver Ranches & Utopia	2200' 8",12", & 16" Pipe	Craven Thompson & Assoc Bob Cole Proj. Eng. 3563 NW 53rd Street Ft. Lauderdale FL 33309	Broward County Bd. Of Commissioners 115 S Andrews Ave Government Ctr. Room 212 Ft. Lauderdale FL 33301
Lafayette LA	3000' 30" Pipe		City of Lafayette LA
Huntsville AL	25000' 6" to 30" Pipe		City of Huntsville
Miami-Dade County FL	5500' 16" & 24" Pipe	Miami Dade Water & Sewer Authority	Miami Dade Water & Sewer Authority Miami FL
Pineville LA Sunny Hill Sewer	468' 8" & 10" Pipe	Pan American Eng.	City of Pineville LA
Ozark AL Sanitary Sewer Rehab Ph.II Deese Rd-Meadowlanke Dr.	1000' 8" Pipe	Polyengineering Inc. 1935 Headland Ave Dothan AL 36303	City of Ozark Utilities Bd. 421 North Union Ave Ozark AL 36360
Berkeley SC Sewer Extension Pump Station #44	625' 18" Pipe	Berkeley Co. Water & Sanitation Authority 2111 Red Bank Rd Goose Creek Sc 29445	Berkeley Co. Water & Sanitation Authority 2111 Red Bank Rd Goose Creek SC 29445
Marion SC Div.II Wastewater System Improvements	1279' 16" Pipe	B P Barber 5300 Int'l Blvd Suite 100 N. Charleston SC 29418	City of Marion SC 107 S Main St. Marion SC 29571
Dothan AL Golf Creek Sewerage Interceptor	1900' 12" Pipe	Barge Wagonner Sumner & Cannon 2047 W Main St. Dothan AL 36301	City of Dothan Box 2128 City Hall Dothan AL 36301
Woodlands TX Alden Bridge Sewer Ext.	2052' 24" Pipe	Pate Eng. Houston TX	Montgomery Co. M.U.D.
Puyallup WA Corrington	634' 16" Pipe	Pierce County	Pierce County Gravelly Lake Office 9116 Gravelly Lake Dr SW Tacoma WA 98499-3190
La Quinta CA Mid Valley Water Rec Plan	125' 18" Pipe	Coachella Valley Water Dist.	Coachella Valley Water Dist.
Kuwait Fifth Ring Motor Way West Section	828m 1000mm Pipe		Ministry Public Works Kuwait

Representative Listings of Completed Protecto 401 Projects

PROJECT NAME AND LOCATION	MATERIAL SIZE AND QUANTITY	ENGINEER	OWNER
Miami Fl	36160' 12" – 48" Pipe	Miami Dade Water & Sewer Authority	Miami Dade Water & Sewer Authority
Aberdeen MS South Lagoon Effluent Pump Station	820' 24" TJ Pipe	Neal Schaffer, Inc. Charles Hundall Eng. 820 2nd Ave N Columbus MS 601-328-4547	City of Aberdeen MS
Irving TX	927' 8" TJ CL.51	City of Irving TX	City of Irving TX
Pryor OK Hwy 20 Relocation	545' 8" TJ CL.51 144' 12" TJ CL.51 1082' 10" TJ CL.50 174' 18" TJ CL.51	Settle Engineers	City of Pryor OK
Seminole County University of Central FL Board of Regents WWTP Expansion WW Interconnect	8732' 20" TJ CL.250	Glace & Radcliffe Maitland FL	Florida Board of Regents Tallahassee FL
Palm Coast FL	414' 12" TJ CL.50 54' 16" TJ CL.50	Gee & Jenson 9452 Phillips Hwy Jacksonville FL	Dunes Community Development District
Houston TX	2898' 8" TJ CL.52	City of Houston	City of Houston
Killeen TX Southwest Interceptor	272' 30" TJ CL.50	Wallace Group	City of Killeen
Cedar Park TX Wastewater Collection	3040' 8" TJ CL.350	Carter & Burgess Austin TX	City of Cedar Park TX
Miami FL San Pedro	1129' 8" TJ CL.52	B A Carmona 7400 SW 50th Terrace Miami FL 33155	Soriano Investments 3837 SW 8th Street Coral Gables FL 33134
Charleston SC Daniel Island Interchange I-65W & S	417' 24" TJ CL.250 317' 16" TJ CL.250 290' 8" TJ Cl.50	South Carolina State Ports Authority P.O. Box 22287 Charleston SC 29413 843-856-7049	Charleston Commission of Public Works 103 St. Phillips St. Charleston SC 29403 843-727-6894

Protecto 401 Lined Ductile Iron Pipe Representative List of Destinations

Alabama
Abbeville
Alexander City
Auburn
Bessemer
Birmingham
Brookwood
Dothan
Enterprise
Florence
Headland
Huntsville
Lanett
Mobile
Montgomery
Monroeville
Ozark
Pelham
Phenix City
Tuscaloosa

Arizona
Avondale
Claypool
Douglas
Flagstaff
Fountain Hills
Gilbert
Glendale
Goodyear
Johnson
Mesa
Peoria
Phoenix
Scottsdale
Siloam Springs
Tempe
Tolleson

Arkansas
Batesville
Bentonville
Fayetteville
Jonesboro
Little Rock
Lowell
Magnolia
N Little Rock
Pinebluff
Rogers
Springdale
Tontitown
West Memphis

California
Alameda
Carson
Coachella
Corona
Fontana
Glendale
Laguna Beach
La Mirada
Los Angeles Cty.
Sacramento
Tracy
Union City
Vista

Colorado
Colorado Springs
Denver

Connecticut
New Haven

Delaware
New Castle

Egypt

Georgia
Albany
Atlanta
Augusta
Austell
Bolingbroke
Buford
Canton
Carrollton
Conyers
Cordele
Cornelia
Douglasville
Folkston
Gainesville
Lawrenceville
Lavonia
Locust Grove
Marietta
Newnan
Rome
Savannah
Valdosta

Florida
Brevard County
Dade Cty.
Auburndale
Aventura
Boca Raton
Boynton Beach
Bradenton
Brooksville
Cape Canaveral
Casselberry
Clearwater
Coconut Creek
Coral Springs
Davenport
Davie
Daytona Beach
Debary
Eustis
Ft. Lauderdale
Gainesville
Hallandale
Hollywood
Homestead
Jacksonville
Kendall
Key West
Kissimmee
Lakeland
Land O' Lakes
Leesburg
Manatee County
Melbourne
Miami - Dade City
Miramar
Naples
North Miami
North Naples
Oak Hill
Oakland Park
Ocala
Orlando
Oviedo
Palm Beach
Palm Coast
Panama City
Pembroke Pines
Plantation
Polk County
Pompano
Pompano Beach
Port Charlotte
Riviera Beach
Royal Palm Beach
Sanford
Sarasota
Seminole County
St. Lucie
St. Petersburg
Sunrise
Tallahassee
Tamarac
Tampa
Titusville
Vero Beach
Wellington
West Palm Beach
Winter Haven

Hawaii
Maui

Illinois
Chicago
Dwight
O'Fallon
Park Ridge
Perkin

Indiana
Bloomington
Fishers
Clarksville
Indianapolis
Merrillville
Muncie

Iowa
Bettendorf
Des Moines
Dubuque

Kansas
Atchison
Hiawatha
Johnson County
Lawrence
McPherson
Merriam
Overland Park
Prairie Village
Wichita

Kentucky
Brooksville
Covington
Dry Ridge Falmouth
Lewisport
Lexington
Owensboro
Paintsville

Kuwait

Louisiana
Baton Rouge
Hahnville
Lafayette
Linville
Monroe
Mandeville
New Orleans
Pineville

Maryland
Baltimore
Cumberland
Forestville
Fredrick
Germantown
Kent
Mt. Airy
Riverdale
Rockville

Massachusetts
Ayer
Danvers
South Barre

Michigan
Ann Arbor
Auburn Hills
Battle Creek
Commerce
Fenton
Fruitport
Grand Rapids
Holt
Ionia
Jenison
Lansing
Nashville

Protecto 401 Lined Ductile Iron Pipe Representative List of Destinations

Warren

Minnesota
Mankato
Minneapolis
St. Michael

Mississippi
Aberdeen
Bay St. Louis
Clinton
Columbus
Gulfport
Jackson
Pascagoula
Ridgeland
Yazoo City

Missouri
Branson
Grandview
Hollister
Kansas City
Knob
Noster
Lees
Summit
Republic
St. Ann
St. Louis

Nebraska
Omaha

New Hampshire
Manchester

New Jersey
Atlantic City
Egg Harbor City
Florham Park
Jackson
Little Ferry
Phillipsburg
Vineland
Watchung
Woodbridge

New Mexico
Las Cruces

New York
Painted Post
Queens
Staten Island
Watervilet

North Carolina
Ashville
Carolina Beach
Charlotte
Durham
Fayetteville
Goldsboro
Greensboro
Hendersonville
High Point
Jacksonville
Kannapolis
Kernersville
Kinston
Raleigh
Salisbury
Statesville
Stedman
Wilmington
Wilkesboro
Windsor
Winston-Salem

North Dakota
Mandan

Ohio
Akron
Batavia
Beavercreek
Chillicothe
Cincinnati
Cleveland County
Dayton
Findlay
Hamilton
Lockland
Mason
Miamisburg
Monroe
Montgomery
New Richmond
Ontario
Riverside
Sharonville
Spring Valley
Stow

Oklahoma
Cleveland
Durant
Edmond
Enid
Guthrie
Miami
Moore
Oklahoma City
Owasso
Pryor
Sand Springs
Tulsa
Vinita

Oman

Oregon
Grants Pass
Portland
Woodburn

Pennsylvania
Bethlehem
Blue Bell
Coudersport
East Earl
Ephrata
Johnstown
Lancaster
Lansdale
Millersville
Monesssen
Muncy
Warminster

Puerto Rico
Guaynabo
San Juan

South Carolina
Berkeley Cty.
Cayce
Charleston
Charlotte
Clover
Columbia
Duncan
Elon
College
Goose
Creek
Greenville
Greenwood
Greer
James Island
Kingstree
Lancaster
Lexington
Marion
Mt. Pleasant
Myrtle Beach
North Charleston
Orangeburg

Tennessee
Clinton
Collierville
Cordova
Franklin
Jackson
Johnson City
Knoxville
Memphis
Nashville
Murfreesboro
Smyrna
Vicksburg

Texas
Austin
Allen
Beaumont
Belton
Canyon
Cedar Park
Corpus Christi
Denton
Grand Prairie
Houston
Kaufman
KilleenKingwood
Longview
Lubbock
McAllen
Mesquite
Moody
Pflugerville
Roundrock
Richland Hills
San Marcos
Sweeny
Temple
Tyler
Victoria
Waco

United Arab Emirates

Utah
Provo
Salt Lake City

Venezuela

Virginia
Chesapeake
Chester
Chesterfield
Christiansburg
Gainsville
Lorton
Manassas
Newport News
Norfolk
Richmond
Suffolk
Virginia Beach
Williamsburg

Washington DC

Washington
Bremerton
Lakewood
Naselle
Othello
Pierce County
Renton
Tacoma

West Virginia
Beckley

Wisconsin
Delavan
La Crosse
Madison
Milwaukee

THE PROVEN CERAMIC EPOXY LINING. PROTECTO 401

POTABLE WATER LINING FOR DUCTILE IRON PIPE

PROTECTO 401

All information in this book is available at Protecto401.com

Look Beneath The Surface.

INDURON

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