



WEAVER CONSTRUCTION MANAGEMENT, INC.

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SUBMITTAL TRANSMITTAL

September 12, 2011

WGC Submittal No: 02615-002

PROJECT: Harold Thompson Regional WRF
Birdsall Rd.
Fountain, CO 80817
Job No. 2908

ENGINEER: GMS, Inc.
611 No. Weber St., #300
Colorado Springs, CO 80903
719-475-2935 Roger Sams

OWNER: Lower Fountain Metropolitan
Sewage Disposal District
901 S. Santa Fe Ave.
Fountain, CO 80817
719-382-5303 James Heckman

CONTRACTOR: Always Plumbing & Heating
P.O. Box 25215
Colorado Springs, Colorado 80936
719-532-1344 Ed Buss
info@alwaysph.com

SUBJECT: Plumbing Submittal for Head Works Building - Ductile Iron Pipe & Fittings - Protective Coatings - TYTON Joint Pipe C153 Mechanical Joint Compact Fittings, Protecto 401 Ceramic Epoxy

SPEC SECTION: 02615: Ductile Iron Pipe

PREVIOUS SUBMISSION DATES: n/a

DEVIATIONS FROM SPEC: ___ YES X NO

CONTRACTOR'S STAMP: This submittal has been reviewed by Weaver General Construction and approved with respect to the means, methods, techniques, & safety precautions & programs incidental thereto. Weaver General Construction also warrants that this submittal complies with contracted documents and comprises on deviations thereto:

Contractor's Stamp:

Engineer's Stamp:

Date: 9/12/11
Reviewed by: H.C. Myers
(X) Reviewed Without Comments
() Reviewed With Comments

**ENGINEER'S
COMMENTS:** _____

Ductile Iron Pipe & Fittings
Protective Coatings

2008 EDITION

4"-64"

TYTON JOINT[®] Pipe

DUCTILE IRON

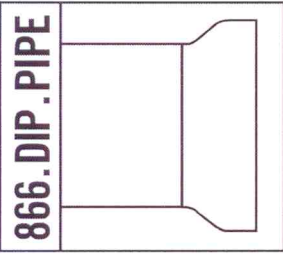


FOR WATER & WASTEWATER, FIRE PROTECTION & INDUSTRIAL APPLICATIONS

Submit under 02615

MORE
THAN
JUST
PIPE.

U.S.
PIPE



TYTON JOINT® Pipe



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TYTON JOINT Pipe

TYTON JOINT is U.S. Pipe's trademark for pipe with a push-on type connection. Simplicity, sturdiness and water-tightness of the system are built into the system by design. Convincing proof of its worldwide acceptance is shown by the fact that more than 95% of the pipe now sold by U.S. Pipe is TYTON JOINT Pipe.

TYTON JOINT Pipe is available in sizes 4" through 64". Sizes 4" through 42" are available in nominal 18-foot laying lengths. 16", 20" and 24" sizes along with sizes 48" through 64" are available in nominal 20-foot laying lengths.

TYTON JOINT Pipe in sizes 4" through 36" are UL Listed and sizes 4" through 16" are FM Approved.

When TYTON JOINT Pipe are used for bridge crossings or other above-ground installations, each length of pipe must be supported in a manner to restrict both vertical and horizontal movement.

TYTON® Gasket is the only accessory required when installing TYTON JOINT Pipe. It is a circular rubber gasket which has a modified bulb shape in cross section. Gaskets are furnished in accordance with ANSI/AWWA C111/A21.1. Composition and dimensions of the gasket have been carefully engineered to ensure a water-tight and lasting seal. The standard TYTON Gasket is manufactured of SBR - styrene butadiene rubber. Gaskets of special elastomers may be ordered for special applications. The gasket contour and bell socket contour ensure that the gasket will remain seated during proper assembly of the pipe. When joint restraint is required for push-on joint pipe, two options are available from U.S. Pipe. For joint restraint of 4" through 24", FIELD LOK 350® Gaskets may be used and for joint restraint for 30" and 36", FIELD LOK® Gaskets may be used. FIELD LOK 350 Gaskets are rated for 350 psi in sizes 4" through 24". In addition, for 4" through 64" sizes, TR FLEX® Pipe and Fittings may be used. TR FLEX Pipe and Fittings are rated for working pressures for 350 psi in 4" through 24" sizes, 250 psi in sizes 30" through 48", and 200 psi in sizes 54" through 64". For higher pressure applications contact your U.S. Pipe representative. Complete details on both FIELD LOK 350 Gaskets and TR FLEX Pipe and Fittings can be found on our website, www.uspipe.com.

NOTE: U.S. Pipe qualifies for Federal Procurement under Public Law No. 94-580, Section 6002, known as the Resource Recovery Act of 1976, since, due to modern technology, recycled iron and steel scrap is used to a large degree in our Ductile Iron Pipe production.

The plain end of the pipe is furnished beveled or with a quarter ellipse on the edge to allow assembly. More than 40 years of successful experience have proved its sealing capabilities. Hydrostatic tests have shown that the system will withstand pressures far in excess of rated pressures.

ANSI/AWWA Standards

ANSI/AWWA C151/A21.5, Ductile-Iron Pipe, Centrifugally Cast for Water.

Ductile Iron TYTON JOINT Pipe is centrifugally cast in metal molds in accordance with ANSI/AWWA C151/A21.5.

The asphaltic outside coating is in accordance with ANSI/AWWA C151/A21.51.

As specified in ANSI/AWWA C151/A21.51, pipe weights have been calculated using standard barrel weights and weights of bells being produced.

~~ANSI/AWWA C104/A21.4, Cement-Mortar Lining For Ductile-Iron Pipe and Fittings For Water.~~

~~The cement-mortar lining and inside coating are in accordance with ANSI/AWWA C104/A21.4. Special linings and/or coatings can be furnished for specific conditions.~~

P401 epoxy lined

ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

TYTON® Gaskets are furnished in accordance with ANSI/AWWA C111/A21.11.

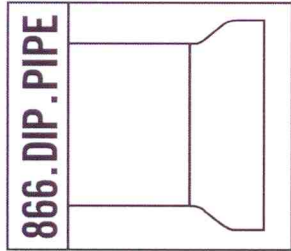
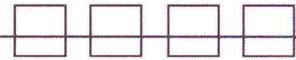
ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems.

If specifiers and users believe that corrosive soils will be encountered where our products are to be installed, please refer to ANSI/AWWA C105/A21.5, for proper external protection procedures.

ASTM A746-03 "Standard specification for Ductile Iron Gravity Sewer Pipe."

4" through 64" Ductile Iron Gravity Sewer Pipe centrifugally cast with push-on joints.

TYTON®, TYTON JOINT®, TR FLEX® and FIELD LOK 350® are Registered Trademarks of U.S. Pipe and Foundry Company, LLC.



TYTON JOINT® Pipe



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Assembly

Figure 1. Insertion of Gasket

All foreign matter in the socket must be removed, i.e., mud, sand, cinders, gravel, pebbles, trash, frozen material, etc. The gasket seat should be thoroughly inspected to be certain it is clean. Foreign matter in the gasket seat may cause a leak. The gasket must be wiped clean with a clean cloth, flexed, and then placed into the socket with the rounded bulb end entering first. Looping the gasket in the initial insertion will facilitate seating the gasket heel evenly around the retainer seat. 4" through 12" sizes require only one loop. For larger sizes, additional loops may be required: 14" through 36", two to three loops; 42" through 54", four to six loops; 60" and 64", six or more loops. When installing TYTON JOINT Pipe in sub-freezing weather, the gaskets, prior to their use, must be kept at a temperature of at least 40°F by suitable means, such as storing in a heated area or keeping them immersed in a tank of warm water. If the gaskets are kept in warm water, they should be dried before placing in the pipe socket.

Figure 2. Application of Lubricant

A thin film of TYTON JOINT® Lubricant should be applied to the inside surface of the gasket, which will come in contact with the plain end of the pipe. Spray-on lubricants should not be used as it may not provide sufficient lubricity. The plain end of the pipe must be cleaned of all foreign matter on the outside from the end to the stripes. Frozen materials may cling to the pipe in cold weather and must be removed. A thin film of lubricant is applied to the outside of the plain end for about 3" back from the end. Do not allow the plain end to touch the ground or trench side after lubricating since foreign matter may adhere to the plain end and cause a leak.

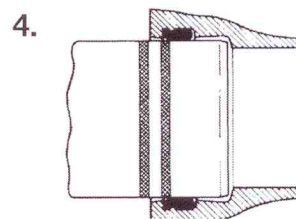
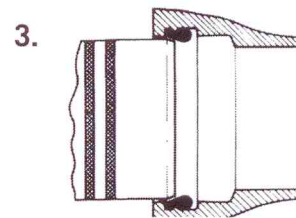
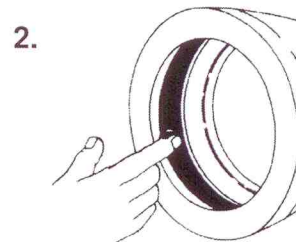
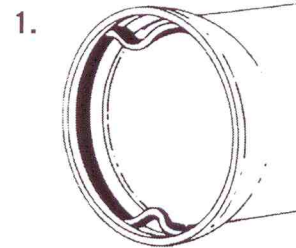
Figure 3. Initial Entry of Plain End in Socket

The plain end of the pipe should be aligned and carefully entered into the socket until it just makes contact with the gasket. This is the starting position for the final assembly of the joint. Note the two painted stripes on the plain end.

Figure 4. Completely Assembled Joint

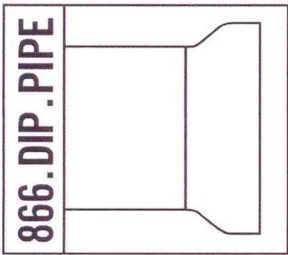
Joint assembly should be completed by forcing the plain end of the entering pipe past the gasket (which is thereby compressed) until the plain end makes contact with the bottom of the socket. Note that the first painted stripe will have disappeared into the socket and the front edge of the second stripe will be approximately flush with the bell face. Joint deflection may be achieved after the pipe is fully inserted. If assembly is not accomplished with the application of reasonable force by the methods indicated, the plain end of the pipe should be removed to check for the proper positioning of the gasket, adequate lubrication, and removal of foreign matter in the joint.

A feeler gage may be inserted between the bell and the plain end of the assembled joint to verify the position of the gasket. When the gage encounters the gasket, increased resistance will be felt. Note the depth of insertion of the gage. Continue probing around the periphery of the joint, noting the depth to resistance each time. If the depth of insertion is uniform, the gasket has remained in place. If, at any point, the depth of insertion increases significantly, this indicates a dislodged gasket. The joint should be disassembled, thoroughly cleaned with water, and examined for any condition that might have caused the gasket to become dislodged before attempting to reassemble the joint.



NOTE: When using FIELD LOK 350® Gaskets or pipe with special linings, assemble the joint until the inside edge of the first painted stripe (or the assembly mark) is flush with the bell face.

CAUTION: The inside of the socket, the gasket, and the plain end to be inserted must be kept clean through-out the assembly. Joints are only as water-tight as they are clean. If the joint is somewhat difficult to assemble, inspect for proper gasket positioning, adequate lubrication, and foreign matter in the joint.



TYTON JOINT[®] Pipe



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Alternate Methods of Assembly

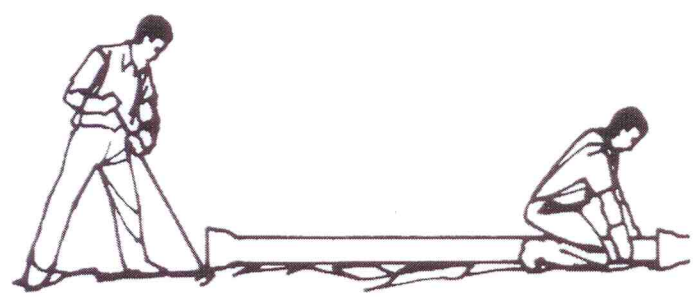
Procedures outlined in figures 1-3 on page 3, showing the assembly of TYTON JOINT Pipe, should be followed before proceeding with the methods shown below.

Backhoe Method of Assembly

A backhoe may be used to assemble pipe of intermediate and larger sizes. The plain end of the pipe should be carefully guided by hand into the bell of the previously assembled pipe. The bucket of the backhoe may then be used to carefully push the pipe until fully seated. A timber header should be used between the pipe and the backhoe bucket to avoid damage to the pipe. Caution: Avoid "slamming" the pipe home to prevent damage to lining material inside the bell at the back of the socket.

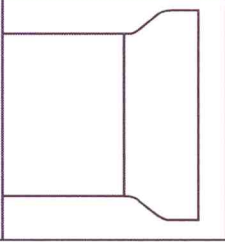
Crowbar Method of Assembly

Smaller sizes of pipe may be assembled using a crowbar as a lever and pushing against the face of the bell.



Come-along Method of Assembly

Installers may prefer to use come-alongs to assemble pipe of all sizes. Two (2) 3/4 ton chain hoists, 24 feet of chain and two (2) bell choker slings for 4"-24" sizes or two (2) 1-1/2 ton (minimum) chain hoists for 30"-64" sizes.



TYTON JOINT® Pipe



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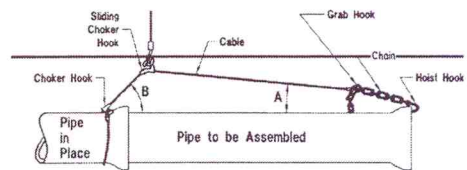
Alternate Methods of Assembly (cont.)

The most common field method of assembling larger diameter TYTON JOINT Pipe is to use a backhoe to push against the face of the bell end of the pipe to be assembled. Occasionally, there are installations where a backhoe cannot be located in line with the pipe and it is, therefore, difficult to develop enough axial force to assemble the pipe. In such cases, it may be possible to use the method described below to assemble the pipe from the side of the trench. With this method, the weight of the pipe is used to provide the axial force required for assembly. In general, a choker chain or cable is hooked around the bell of the previously laid pipe. The spigot end of the pipe to be assembled is first inserted as far as possible into the bell end of the previously laid pipe. The end of the choker is then hooked into the bell end of the pipe to be laid.

One such rigging is made from a long cable with a choker on one end and a chain grab hook on the other end with a sliding choker hook between the two other hooks. A second section of the rigging is a shorter chain with a wide throat hoisting hook on one end. The cable is first "choked" around the bell of the previously laid pipe using the fixed choker hook. The chain is hooked into the bell end of the pipe to be laid. The cable is hooked to the chain with the grab hook. The connected length of the rigging can thus be adjusted with the connection between the cable grab hook and the chain. The pipe assembly is made by lifting up on the sliding choker hook.

A few rules of thumb:

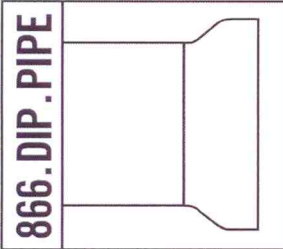
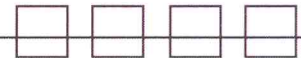
1. Angle 'A' should be no greater than 15 degrees.
2. Angle 'B' should be from 45 to 60 degrees.
3. The sliding choker hook should be located from 2 to 8 feet from the bell of the previously laid pipe.
4. Trial assembly may be made to get a "feel" for the correct amount of slack to be left in the rigging and the proper location of the sliding choker hook.



A few precautions:

1. The smaller the angle (A), the larger will be the assembly force and the tension in the rigging. The assembly force and the tension will generally range from 2 to 10 times the weight of the pipe being assembled. These forces are at a maximum when the assembly is bottomed out and lift is still being applied to the rigging. To minimize the loads on the rigging, it is recommended that the assembly be made slowly and the assembly stopped as soon as the joint is bottomed out.
2. The rigging should be properly designed to accommodate the diameter, length, and weight of the pipe on the job and the loads previously described.

NOTE: This method should not be employed when installing FIELD LOK 350® Gaskets since alignment of the joint cannot be assured. For the proper installation practice, refer to U.S. Pipe Brochure FIELD LOK 350® Gasket Joint Restraint for 4"-24" Ductile Iron Pipe for Water, Wastewater, Fire Protection and Industrial Applications.



TYTON JOINT[®] Pipe



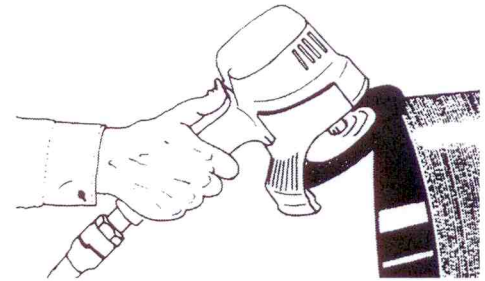
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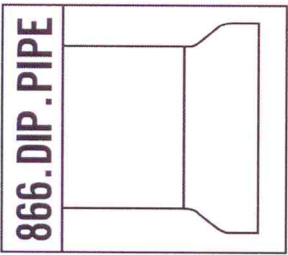
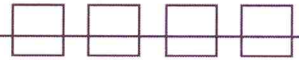
Field Cut Pipe

When pipe are cut in the field, the cut end may be readily conditioned so that it can be used to make up the next joint. The outside of the cut end should be beveled with a portable grinder about 1/4 - inch at an angle of about 30 degrees. This operation removes any sharp, rough edges which otherwise might damage the gasket.

When Ductile Iron pipe 14" and larger is to be cut in the field, the material should be ordered as "GAUGED FULL LENGTH." A *Full Length Gauged Pipe* is a pipe whose barrel outside diameter is within the spigot diameter dimensional specifications as determined by diameter tape measurements over the pipe's length to within approximately two feet of the bell chime. Pipe that is "gauged full length" is specially marked to avoid confusion. ANSI/AWWA C151 Standard for Ductile Iron pipe requires factory gauging of the spigot end. Accordingly, pipe selected for field cutting should also be field gauged in the location of the cut and ensured to be within the tolerances shown in the table on page 8. In the field a mechanical joint gland can be used as a gauging device.



NOTE: When necessary, pipe may be rounded in accordance with U.S. Pipe's Brochure, *Recommended Methods For Rounding The Cut Ends Of Out-Of-Round 14" And Larger Diameter Ductile Iron Pipe.*



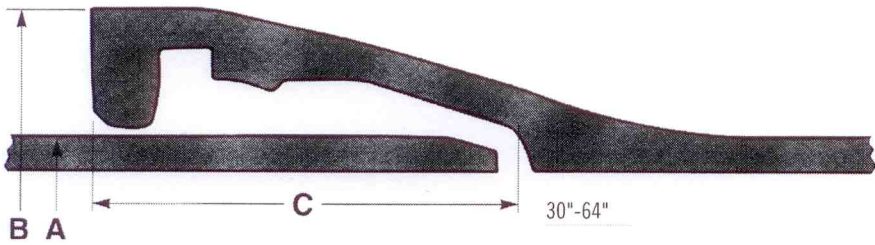
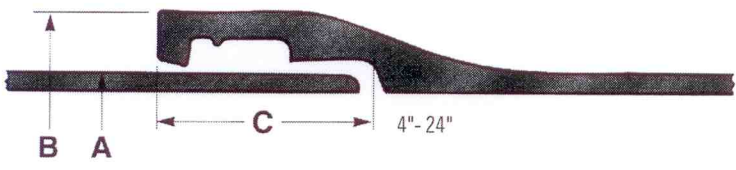
TYTON JOINT[®] Pipe



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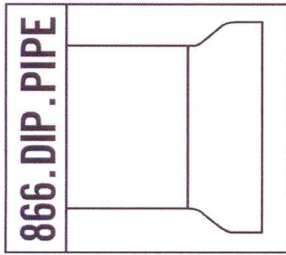
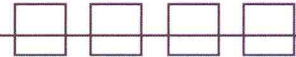
Bell Dimensions



NOTE: Actual bell configuration may vary from illustration shown.

SIZE Inches	A PIPE OUTER DIAMETER Inches	B BELL OUTER DIAMETER Inches	C SOCKET DEPTH Inches
4	4.80	6.52	3.15
6	6.90	8.66	3.38
8	9.05	10.82	3.69
10	11.10	12.91	3.75
12	13.20	15.05	3.75
14	15.30	17.67	5.00
16	17.40	19.79	5.00
18	19.50	21.91	5.00
20	21.60	24.03	5.50
24	25.80	28.21	5.95
30	32.00	35.40	6.55
36	38.30	41.84	7.00
42	44.50	49.36	7.90
48	50.80	55.94	8.60
54	57.56	63.38	9.40
60	61.61	67.38	10.10
64	65.67	71.56	10.65

*Subject to manufacturing tolerances. Dimensions in inches.



TYTON JOINT[®] Pipe



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Pressure Class

Nominal Thickness for Standard Pressure Classes of Ductile Iron Pipe

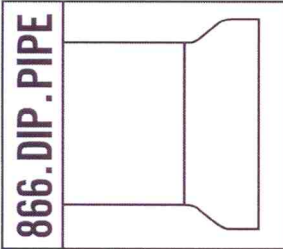
SIZE Inches	OUTSIDE DIAMETER Inches	NOMINAL THICKNESS Inches					CASTING TOLERANCES Inches
		PRESSURE CLASS*					
		150	200	250	300	350	
3	3.96	—	—	—	—	0.25**	0.05
4	4.80	—	—	—	—	0.25**	0.05
6	6.90	—	—	—	—	0.25**	0.05
8	9.05	—	—	—	—	0.25**	0.05
10	11.10	—	—	—	—	0.26	0.06
12	13.20	—	—	—	—	0.28	0.06
14	15.30	—	—	0.28	0.30	0.31	0.07
16	17.40	—	—	0.30	0.32	0.34	0.07
18	19.50	—	—	0.31	0.34	0.36	0.07
20	21.60	—	—	0.33	0.36	0.38	0.07
24	25.80	—	0.33	0.37	0.40	0.43	0.07
30	32.00	0.34	0.38	0.42	0.45	0.49	0.07
36	38.30	0.38	0.42	0.47	0.51	0.56	0.07
42	44.50	0.41	0.47	0.52	0.57	0.63	0.07
48	50.80	0.46	0.52	0.58	0.64	0.70	0.08
54	57.56	0.51	0.58	0.65	0.72	0.79	0.09
60	61.61	0.54	0.61	0.68	0.76	0.83	0.09
64	65.67	0.56	0.64	0.72	0.80	0.87	0.09

NOTE: Per ANSI/AWWA C150/A21.50 the thicknesses in above table include the 0.08" service allowance and the casting tolerance by size ranges.

Dimensions and weights of Special Classes (Thickness Classes) are found on pages 13, 14, 15 and 16.

* Pressure Classes are defined as the rated water pressure of the pipe in psi. The thicknesses shown are adequate for the rated water working pressure plus a surge allowance of 100 psi. Calculations are based on a minimum yield strength of 42,000 and a 2.0 safety factor times the sum of the working pressure and 100 psi surge allowance.

** Calculated thickness for these sizes and pressure ratings are less than those shown above. Presently these are the lowest nominal thicknesses available in these sizes.



TYTON JOINT® Pipe



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Pressure Class – Thickness, Dimensions and Weight

SIZE Inches	PRESSURE CLASS psi	THICKNESS Inches	OUTSIDE DIAMETER* Inches	18-FOOT LAYING LENGTH		20-FOOT LAYING LENGTH	
				WEIGHT PER LENGTH† Pounds	AVG. WEIGHT PER FOOT†† Pounds	WEIGHT PER LENGTH† Pounds	AVG. WEIGHT PER FOOT†† Pounds
→ 4	350	0.25	4.80	205	10.9	—	—
→ 6	350	0.25	6.90	305	16.0	—	—
8	350	0.25	9.05	400	21.1	445	21.1
10	350	0.26	11.10	515	27.1	—	—
12	350	0.28	13.20	660	34.8	730	34.8
14	250	0.28	15.30	780	40.4	865	40.4
14	300	0.30	15.30	920	43.3	1010	43.3
14	350	0.31	15.30	860	44.7	945	44.7
16	250	0.30	17.40	950	49.3	1050	49.3
16	300	0.32	17.40	1010	52.5	1115	52.5
16	350	0.34	17.40	1065	55.8	1175	55.8
18	250	0.31	19.50	1095	57.2	1210	57.2
18	300	0.34	19.50	1195	62.6	1320	62.6
18	350	0.36	19.50	1260	66.2	1390	66.2
20	250	0.33	21.60	1285	67.5	1420	67.5
20	300	0.36	21.60	1395	73.5	1540	57.2
20	350	0.38	21.60	1465	77.5	1620	73.5
24	200	0.33	25.80	1550	80.8	1710	77.5
24	250	0.37	25.80	1725	90.5	1905	80.8
24	300	0.40	25.80	1855	97.7	2050	90.5
24	350	0.43	25.80	1985	104.9	2195	97.9
30	150	0.34	32.00	2005	103.5	—	104.9
30	200	0.38	32.00	2220	115.5	—	—
30	250	0.42	32.00	2595	127.5	—	—
30	300	0.45	32.00	2810	136.5	—	—
30	350	0.49	32.00	2685	148.4	—	—
36	150	0.38	38.30	2945	138.5	—	—
36	200	0.42	38.30	2940	152.9	—	—
36	250	0.47	38.30	3265	170.9	—	—
36	300	0.51	38.30	3525	185.3	—	—
36	350	0.56	38.30	3845	203.2	—	—

NOTE: Thicknesses and dimensions of 4" through 64" Ductile Iron pipe conform to ANSI/AWWA C151/A21.51. Weights may vary from the standard because of differences in bell weights.

*Tolerance of O.D. of spigot end: 4-12 in., ±0.06 in.; 14-24 in., +0.05 in., -0.08 in.; 30-48 in., +0.08 in., -0.06 in.; 54-64 in., +0.04 in., -0.10 in.

† Including bell; calculated weight of pipe rounded off to nearest 5 lbs.

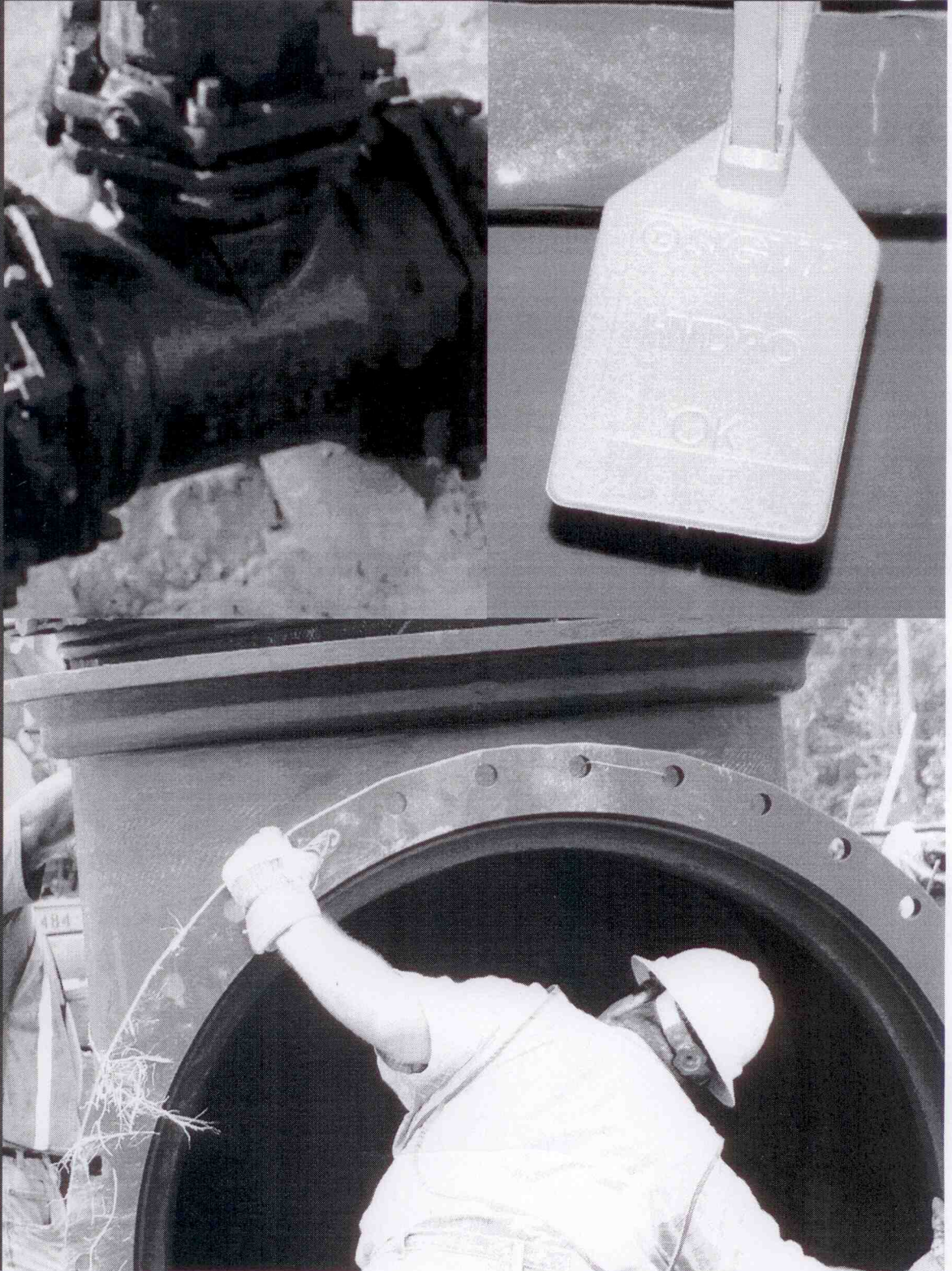
†† Including bell; average weight, per foot, based on calculated weight of pipe before rounding.

Table continued on next page.

 **SIGMA**

C153 Mechanical Joint Ductile Iron Fittings

**C
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Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

C153 Mechanical Joint Compact Fittings

3-48" Ductile Iron Mechanical Joint Fittings Class 350

MATERIAL: Ductile Iron ASTM A536 ←

PRESSURE: 350PSI WATER WORKING PRESSURE (CLASS 350) 3" - 24": & 250 PSI 30" - 48"

TESTING: In accordance with ANSI / AWWA C153 / A21.53 & UL - FM requirements

LAYING LENGTH: Short body design - straight section of body deleted to provide a compact and lighter fitting without reducing strength or flow characteristics, in accordance with ANSI / AWWA C153 / A21.53

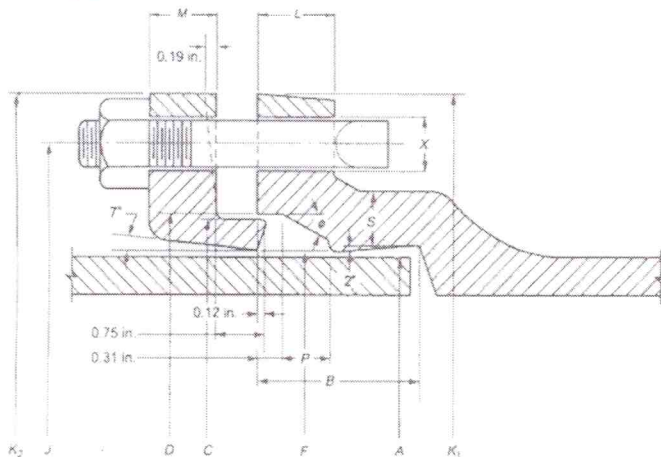
CEMENT LINING: In accordance with ANSI / AWWA C104 / A21.4 COATING: Tar coated (bituminous) inside and out in accordance with ANSI / AWWA C104 / A21.4

GASKETS: SBR in accordance with ANSI / AWWA C111 / A21.11

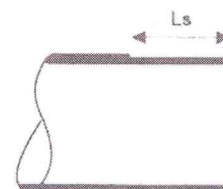
T-BOLTS: Low Alloy corrosion resistant high strength steel in accordance with ANSI / AWWA C111 / A21.11

APPROVALS: 3"-16" Underwriters Laboratories listed and Factory Mutual Approved.

STANDARDS: Certified to NSF61 Standard ANSI / AWWA C153 / A21.53 for Compact Ductile Iron Fittings 3"-48" for water and other liquids.



Mechanical Joint Detail



Plain End Detail

Size	A	B	C	D	F	J	K1	K2	L	M	P	S	X	Bolts			
														No	Size	Len	L _s
3	3.96	2.50	4.84	4.94	4.06	6.19	7.62	7.69	0.58	0.62	0.63	0.39	3/4	4	5/8	3.0	5.5
4	4.80	2.50	5.92	6.02	4.90	7.50	9.06	9.12	0.60	0.75	0.75	0.39	7/8	4	3/4	3.5	5.5
6	6.90	2.50	8.02	8.12	7.00	9.50	11.06	11.12	0.63	0.88	0.75	0.43	7/8	6	3/4	3.5	5.5
8	9.05	2.50	10.17	10.27	9.15	11.75	13.31	13.37	0.66	1.00	0.75	0.45	7/8	6	3/4	3.5	5.5
10	11.10	2.50	12.22	12.34	11.20	14.00	15.62	15.62	0.70	1.00	0.75	0.47	7/8	8	3/4	3.5	5.5
12	13.20	2.50	14.32	14.44	13.30	16.25	17.88	17.88	0.73	1.00	0.75	0.49	7/8	8	3/4	3.5	5.5
14	15.30	3.50	16.40	16.54	15.44	18.75	20.25	20.25	0.79	1.25	0.75	0.55	7/8	10	3/4	4.0	8.0
16	17.40	3.50	18.50	18.64	17.54	21.00	22.50	22.50	0.85	1.31	0.75	0.58	7/8	12	3/4	4.0	8.0
18	19.50	3.50	20.60	20.74	19.64	23.25	24.83	24.75	1.00	1.38	0.75	0.68	7/8	12	3/4	4.0	8.0
20	21.60	3.50	22.70	22.84	21.74	25.50	27.08	27.00	1.02	1.44	0.75	0.69	7/8	14	3/4	4.0	8.0
24	25.80	3.50	26.90	27.04	25.94	30.00	31.58	31.50	1.02	1.56	0.75	0.75	7/8	16	3/4	4.5	8.0
30	32.00	4.00	33.29	33.46	32.17	36.88	39.12	39.12	1.31	2.00	1.00	0.82	1 1/8	20	1	5.5	8.0
36	38.30	4.00	39.59	39.76	38.47	43.75	46.00	46.00	1.45	2.00	1.00	1.00	1 1/8	24	1	5.5	8.0
42	44.50	4.00	45.79	45.96	44.67	50.62	53.12	53.12	1.45	2.00	1.00	1.25	1 3/8	28	1 1/4	6.0	8.0
48	50.80	4.00	52.09	52.26	50.97	57.50	60.00	60.00	1.45	2.00	1.00	1.35	1 3/8	32	1 1/4	6.0	8.0



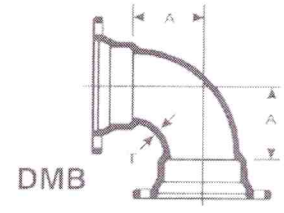
C153 Mechanical Joint Compact Fittings

90 Degree Bends

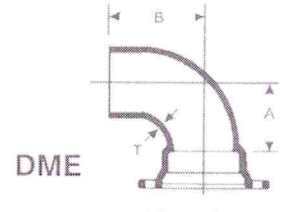
MJ x MJ

~~MJ x PE~~

Size	Item No.	Wt.	A	Item No.	Wt.	A	B	t
2	DMB290	17	3.00	DME390	16	3.25	8.50	0.30
3	DMB390	19	3.50	DME490	22	4.00	9.50	0.33
4	DMB490	25	4.00	DME690	41	5.00	11.50	0.34
6	DMB690	39	5.00	DME890	58	6.50	12.50	0.36
8	DMB890	57	6.50	DME1090	88	7.50	13.00	0.38
10	DMB1090	89	7.50	DME1290	114	9.00	14.50	0.40
12	DMB1290	108	9.00	DME1490	211	11.50	19.50	0.42
14	DMB1490	210	11.50	DME1690	248	12.50	20.50	0.47
16	DMB1690	264	12.50	DME1890	325	14.00	21.00	0.50
18	DMB1890	335	14.00	DME2090	390	15.00	22.50	0.54
20	DMB2090	400	15.00	DME2490	575	17.00	25.00	0.57
24	DMB2490	565	16.75	DME3090	865	21.50	30.50	0.61
30	DMB3090	930	21.50	DME3690	1,355	24.50	33.50	0.66
36	DMB3690	1,450	24.50	DME4290	2,055	29.25	38.25	0.74
42	DMB4290	2,205	29.25	DME4890	2,805	33.25	42.25	0.82
48	DMB4890	2,990	33.25					0.90



MJ x MJ 90°



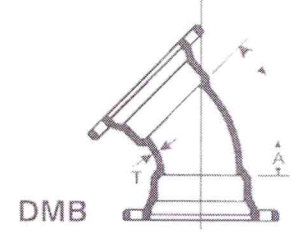
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45 Degree Bends

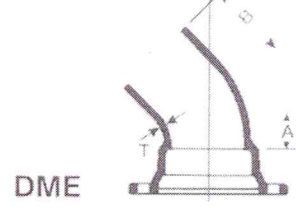
MJ x MJ

~~MJ x PE~~

Size	Item No.	Wt.	A	Item No.	Wt.	A	B	T
2	DMB245	10	1.50	DME345	13	1.50	7.00	0.30
3	DMB345	16	1.50	DME445	19	2.00	7.50	0.33
4	DMB445	22	2.00	DME645	34	3.00	8.50	0.34
6	DMB645	32	3.00	DME845	49	3.50	9.00	0.36
8	DMB845	46	3.50	DME1045	70	4.50	10.00	0.38
10	DMB1045	70	4.50	DME1245	93	5.50	11.00	0.40
12	DMB1245	86	5.50	DME1445	146	5.00	13.00	0.42
14	DMB1445	160	5.00	DME1645	212	5.50	13.50	0.47
16	DMB1645	202	5.50	DME1845	235	6.00	13.00	0.50
18	DMB1845	250	6.00	DME2045	290	7.00	14.00	0.54
20	DMB2045	305	7.00	DME2445	390	7.50	14.50	0.57
24	DMB2445	405	7.50	DME3045	715	10.50	19.50	0.61
30	DMB3045	780	10.50	DME3645	1,040	12.00	21.00	0.66
36	DMB3645	1,135	11.50	DME4245	1,460	14.00	23.00	0.74
42	DMB4245	1,610	14.00	DME4845	1,905	15.00	24.00	0.82
48	DMB4845	2,090	15.00					0.90



MJ x MJ 45°



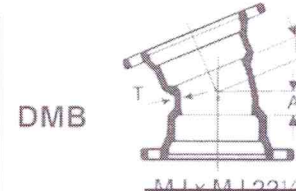
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22-1/2 Degree Bends

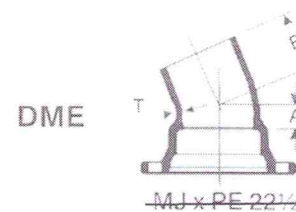
MJ x MJ

~~MJ x PE~~

Size	Item No.	Wt.	A	Item No.	Wt.	A	B	T
3	DMB322	15	1.00	DME322	12	1.00	6.50	0.33
4	DMB422	18	1.50	DME422	18	1.50	7.00	0.34
6	DMB622	31	2.00	DME622	29	2.00	7.50	0.36
8	DMB822	46	2.50	DME822	43	2.50	8.00	0.38
10	DMB1022	64	3.00	DME1022	61	3.00	8.50	0.40
12	DMB1222	80	3.50	DME1222	79	3.50	9.00	0.42
14	DMB1422	136	3.75	DME1422	133	3.75	11.25	0.47
16	DMB1622	172	3.75	DME1622	166	3.75	11.75	0.50
18	DMB1822	255	4.50	DME1822	235	6.00	13.00	0.54
20	DMB2022	310	4.50	DME2022	300	7.00	14.00	0.57
24	DMB2422	412	4.50	DME2422	395	7.50	14.50	0.61
30	DMB3022	665	6.75	DME3022	600	6.75	15.75	0.66
36	DMB3622	960	7.75	DME3622	865	7.75	16.75	0.74
42	DMB4222	1,350	9.00	DME4222	1,200	9.00	18.00	0.82
48	DMB4822	1,760	10.00	DME4822	1,575	10.00	19.00	0.90



~~MJ x MJ 22 1/2°~~



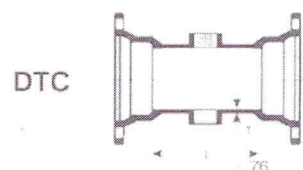
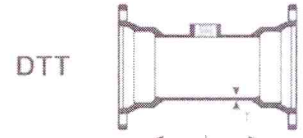
~~MJ x PE 22 1/2°~~



C153 Mechanical Joint Compact Fittings

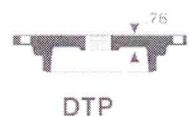
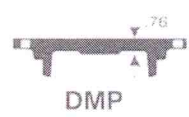
Tapped Tees and Crosses

Size	TEE		CROSS		T	L	Tap Size
	Item No.	Wt.	Item No.	Wt.			
3	DTT3	35	DTC3	19	0.33	6.0	2
4	DTT4	45	DTC4	23	0.34	8.0	2
6	DTT6	70	DTC6	37	0.36	10.0	2
8	DTT8	95	DTC8	53	0.38	13.0	2
10	DTT10	130	DTC10	68	0.40	14.0	2
12	DTT12	165	DTC12	88	0.42	17.5	2
16	DTT16	178	DTC16	178	0.50	23.0	2
20	DTT20	259	DTC20	259	0.57	28.0	2
24	DTT24	320	DTC24	320	0.61	32.0	2



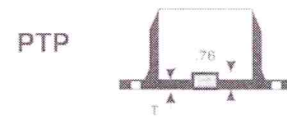
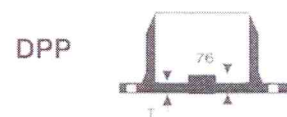
Caps and Plugs

Size	CAP		Wt.	PLUG		Wt.
	SOLID	TAPPED		SOLID	TAPPED	
	Item No.	Item No.		Item No.	Item No.	
3	DMK3	DTK3	8	DMP3	DTP3	8
4	DMK4	DTK4	9	DMP4	DTP4	10
6	DMK6	DTK6	15	DMP6	DTP6	16
8	DMK8	DTK8	22	DMP8	DTP8	26
10	DMK10	DTK10	32	DMP10	DTP10	36
12	DMK12	DTK12	42	DMP12	DTP12	46
14	DMK14	DTK14	66	DMP14	DTP14	75
16	DMK16	DTK16	92	DMP16	DTP16	95
18	DMK18	DTK18	114	DMP18	DTP18	121
20	DMK20	DTK20	125	DMP20	DTP20	135
24	DMK24	DTK24	166	DMP24	DTP24	175
30	DMK30	DTK30	345	DMP30	DTP30	355
36	DMK36	DTK36	628	DMP36	DTP36	688



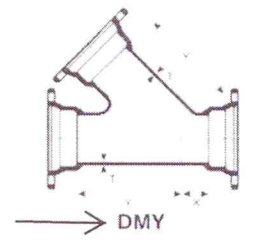
Push In Plugs

Size	SOLID	TAPPED	Wt.	T
	PLUG	PLUG		
	Item No.	Item No.		
4	DPP4	PTP4	12	0.43
6	DPP6	PTP6	20	0.47
8	DPP8	PTP8	27	0.49
10	DPP10	PTP10	36	0.52
12	DPP12	PTP12	47	0.54
16	DPP16	PTP16	59	0.60



Wyes (45 degree laterals)

Size	Run		Item No.	X	Y	T	T1	Wt.
	Run	Branch						
3	3		DMY33	2.0	8.5	.34	.34	36
4	4		DMY44	2.5	9.5	.35	.35	45
6	4		DMY64	1.5	11.0	.37	.35	67
6	6		DMY66	3.0	13.0	.37	.37	93
8	4		DMY84	0.5	13.0	.39	.35	93
8	6		DMY86	2.0	14.5	.39	.37	113
8	8		DMY88	3.5	16.0	.39	.39	136
10	4		DMY104	0.0	15.0	.41	.35	118
10	6		DMY106	1.0	16.0	.41	.37	136
10	8		DMY108	2.5	17.0	.41	.39	170
10	10		DMY1010	3.5	19.0	.41	.41	199
12	4		DMY124	0.0	16.5	.43	.35	150
12	6		DMY126	1.5	18.5	.43	.37	186
12	8		DMY128	1.5	18.5	.43	.39	188
12	10		DMY1210	3.0	20.0	.43	.41	223
12	12		DMY1212	4.5	22.5	.43	.43	272



PROTECTO 401 CERAMIC EPOXY

CALL TOLL FREE 1-888-SPEC401 or Email

Standard For Lining Ductile Iron Pipe and Fittings For Sewer Service

QUALIFIED UNDER

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

Standard Test Methods

PROTECTO 401 Table of Contents

--- Select Item Below ---

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

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



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

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

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

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

PROTECTO 401 CERAMIC EPOXY

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

TEST	RESULTS
120°F Water Immersion	2.0 years No undercutting at scribe. No effect when rated using ASTM D-714-87
160°F Distilled Water Immersion	2.0 years No undercutting at scribe. No effect when rated using ASTM D-714-87
140°F 25% Sodium Hydroxide Immersion	2.0 years No effect when rated using ASTM D-714-87
20% Sulfuric Acid Immersion	2.0 years No effect when rated using ASTM D-714-87
ASTM B-117-85 Salt Spray 5% Salt @ 98°F	2.0 years No undercutting at scribe. No other effect when rated using ASTM D-714-87
EN 598-1994 Section 7.8 Abrasion Resistance	.002 inch (.05mm) loss After one million cycles

Note: All Immersion tests are currently ongoing.

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PROTECTO 401 CERAMIC EPOXY

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Tel: (713) 852-7600
Fax: (713) 852-8777

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

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

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

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

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

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

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

CERTIFIED



Dr. George Mills

PROTECTO 401 CERAMIC EPOXY

CALL TOLL FREE 1-888-SPEC401 or Email

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

PROTECTO 401 JOINT COMPOUND TECHNICAL DATA

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

LIMITATIONS: This material should be used on spigots and in bell sockets only after the pipe or fitting is lined with Protecto 401 Ceramic Epoxy. Protecto Joint Compound can be used over Protecto 401 or on bare substrate. **Note: Do not apply Protecto 401 over Protecto Joint Compound.**

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

DRY FILM THICKNESS: As outlined in specifications.

APPLICATION DATA

APPLICATION: Brush, roll, or airless spray.

THINNING: Thin or clean up with Methyl Ethyl Ketone.

PHYSICAL DATA:

VOLATILE ORGANIC CONTENTS:

< 1.40 lbs. per gal. mixed unthinned

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

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PROTECTO 401 CERAMIC EPOXY

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Tel: (713) 852-7600
Fax: (713) 852-8777

DATE: March 14, 1994

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

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

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

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

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

CERTIFIED



Dr. George Mills

Date: 12 July 1994

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TEST REPORT PROTECTO 401 CERAMIC EPOXY

March 2, 1995

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

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

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

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

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

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

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

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