Section 11

AMERICAN Linings and Coatings

AMERICAN Linings for Pipe and Fittings

The principal standard covering cement lining is ANSI/AWWA C104/A21.4. This and other standards are referenced throughout this Section either by the full ANSI/AWWA designation or by only the AWWA numbering, such as AWWA C104.

Along with technical and metallurgical advancement in piping materials, research on lining requirements for pipe and fittings has resulted in the development of linings to meet many different service requirements. AMERICAN offers several types of linings, the most common being cement lining. Pipe and fittings furnished by AMERICAN are offered unlined or with linings as follows:

1. Cement Lined per AWWA C104.
2. Asphaltic Lined per AWWA C110, C115 or C151.
3. Fusion-Bonded Epoxy (for 4″-16″ Fastite fittings) per AWWAA C116.
4. Special Lining - for unusual service conditions

Cement Lining

Cement-mortar lining for ductile iron pipe and ductile and gray iron fittings for water service is in accordance with ANSI/AWWA C104/A21.4.

Cement-lined pipe is also furnished for some sewage service and a number of other applications. In fact, most pipe furnished is cement lined, providing improved flow characteristics and the required protection against internal corrosion. The cement lining is satisfactory for temperatures up to 212°F. If asphaltic seal coat is furnished, the lining is only adequate for temperatures up to 150°F. For other services contact **AMERICAN** regarding temperature limitations of cement lining.

The first recorded installation of cement-lined gray iron pipe was in 1922 at Charleston, S.C. This lining was developed by the Charleston Commission of Public Works in cooperation with American Cast Iron Pipe Company. Since this beginning, AMERICAN has furnished most of its pipe with cement lining. The lining is applied centrifugally with the speed of rotation designed to produce a smooth waterway surface, minimal voids, yet retaining enough moisture for proper curing. **AMERICAN** cement-lined pipe and fittings are listed by ANSI/NSF Standard 61 for potable water contact.

Flow tests on cement-lined pipe under varying service conditions have established that the Hazen-Williams flow coefficient remains as expected at about 140, and flow tests on cement-lined, large-diameter **AMERICAN** Ductile Iron pipe have confirmed flow coefficients much higher than 140.

Handling Cement-Lined Pipe and Fittings

Pipe and fittings with cement lining should be handled with rubber-covered hooks or other type equipment to prevent damage to the cement lining. Bare forklift arms or bare hooks should not be inserted into open ends.

Characteristics of Cement Lining

AWWA C104 allows for surface crazing and cracks of a specified nature and magnitude. Occasionally cracks and looseness in linings may occur prior to installation, particularly where pipe is stored for a considerable time. Many years' experience with cementlined pipe and fittings has verified that this condition is not detrimental to the perfor-

mance and effectiveness of the lining. When a cement-lined pipe is placed in service and filled with water, two reactions begin immediately. The first is a gradual elimination of the temperature differential between pipe and lining, thus eliminating any stresses in the lining due to this condition.

Secondly, the lining begins to absorb water into the pores of the cement and into the capillary channels of the calcium silicate gel. The water absorption causes the lining to swell, restoring it to intimate contact with the pipe wall and virtually closing any cracks present in the lining. This swelling process is relatively slow, taking up to several weeks for the lining to be restored to its maximum volume. This process has been demonstrated on a number of occasions to the satisfaction of customers, contractors and engineers by immersing a pipe or fitting in water for one or two weeks.

After a period of exposure to water, not only does the lining tighten against the pipe wall and the cracks close, but finally the surfaces of the cracks actually re-bond. This occurs by a process called autogenous healing.

This phenomenon, long recognized by the cement industry, has been documented by laboratory tests to occur in cement-lined ductile pipe. In one test, a 48" ductile iron pipe with severely cracked cement lining was held half full of water for several months. At the end of that period, the lining both above and below the water surface was found to be tight, with all cracks either healed completely or sealed by the formation of calcium carbonate.

Field inspections of lines that have been in service for many years have verified the laboratory results; cement linings do tighten and heal in service and provide the corrosion protection to the pipe and the high flow coefficients for which they were designed.

Field Repair of Damaged Cement Linings

Cement lining will withstand normal handling; nevertheless, pipe or fittings may be found at times to have damaged linings which need to be repaired before placing in service.

AWWA C104 provides that damaged lining may be repaired, and the following repair procedure is recommended:

1. Cut out the damaged lining to the metal. Square the edges.
2. Thoroughly wet the cut-out area and adjoining lining.
3. With the damaged area cleaned and the adjoining lining wet, spread the mortar (see recommended mix below) evenly over the area to be patched. (See Table No. 11-1, next page, for lining thicknesses.) After the lining has become firm and adheres well to the surface, finish it with a wet 3" or 4" paint brush or similar soft bristle brush.
4. The repaired lining should be kept moist by tying canvas, wet burlap, or other wrap over the ends of the pipe or fitting for at least 24 hours. As an alternative the repaired lining may be seal coated with a cut back type of asphaltic seal coating. This must be sprayed or brushed on within five to 30 minutes after lining. To maintain NSF certification, patch must be made using a NSF certified cement for 4" pipe and larger, or the patch must be topcoated with NSF certified asphalt paint.

Recommended Cement Mix

Cement mix by volume: 3 parts of sand, 2 parts cement.

Precautions

1. Mortar for lining should not be used after it has been mixed for more than one hour.
2. Too rapid a loss of moisture from fresh linings due to hot weather or high wind will prevent proper cure, resulting in the lining being soft and powdery. To prevent this loss of moisture, (a) do not line hot castings and (b) close the ends of the castings with wet burlap.
3. Fresh linings that become frozen will not be serviceable. Avoid lining in freezing weather.

Cement Lining
ANSI/AWWA C104/A21.4
Thicknesses and Weights

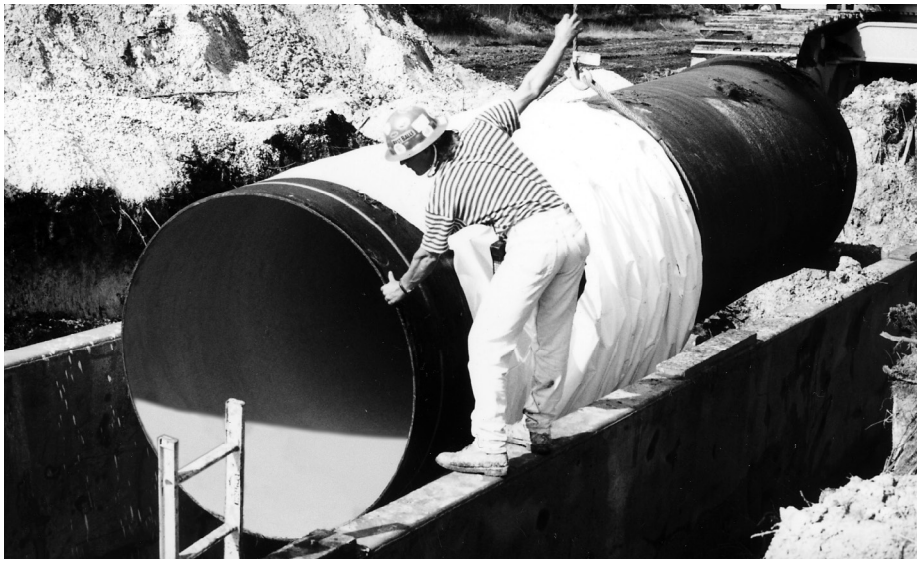
Table No. 11-1

Size in.	Nominal Pipe Length ft.	Standard Thickness			Double Thickness		
		Minimum Thickness in.	Weight Per Foot lb	Weight Per Length lb	Minimum Thickness in.	Weight Per Foot lb	Weight Per Nominal Length lb
4	18	1/16	.87	17	1/8	1.71	31
6	20	1/16	1.30	26	1/8	2.57	51
8	20	1/16	1.74	35	1/8	3.45	69
10	20	1/16	2.15	43	1/8	4.28	86
12	20	1/16	2.57	51	1/8	5.12	102
14	20	3/32	4.49	90	3/16	8.93	179
16	20	3/32	5.13	103	3/16	10.19	204
18	20	3/32	5.76	115	3/16	11.47	229
20	20	3/32	6.40	128	3/16	12.73	255
24	20	3/32	7.68	154	3/16	15.31	306
30	20	1/8	12.76	255	1/4	25.42	508
36	20	1/8	15.31	306	1/4	30.51	610
42	20	1/8	17.82	356	1/4	35.53	711
48	20	1/8	20.35	407	1/4	40.60	812
54	20	1/8	22.89	458	1/4	45.68	914
60	20	1/8	24.71	494	1/4	49.32	986
64	20	1/8	26.35	527	1/4	52.61	1052

Weights are based on the minimum lining thicknesses for minimum pressure classes of Fastite ductile iron pipe. Actual lengths and weights may differ from above.

Linings may taper at the ends.

AMERICAN recommends the use of standard thickness cement lining per AWWA C104 for all normal installations.



This 64" Ductile Iron Fastite Joint water transmission main was furnished with standard cement lining for continuing high flow performance.

Other Linings Available From AMERICAN

ASPHALTIC LINING

AMERICAN furnishes some pipe and fittings lined with an asphaltic material in accordance with AWWA C110, C115, C153 and C151. After thoroughly drying, the lining has no deleterious effect upon the quality, color, taste or odor of potable water. Asphaltic lining is not normally used in water service; the majority of ductile water lines are cement lined. Asphaltic lining or seal-coat, if furnished, on cement lining is adequate for temperatures up to 150°F.

SPECIAL LININGS

Cement lining has proven effective as a lining for iron pipe in most water service applications, and an industry standard for cement lining is in place. Cement lining is applied at the pipe casting factory as part of routine manufacturing.

When service conditions go beyond basic water, a more thorough evaluation is called for, and a special lining applied by a third-party applicator may be indicated. This may include glass lining, epoxy lining and other special linings.

Because of the variables and complexities involved in special linings other than cement for special services other than basic water, AMERICAN directs inquiries for technical assistance and referrals to various lining manufacturers and their products, services, terms and conditions.

OTHER SPECIAL LININGS

Customers can request pipe and fittings with special linings other than those listed above (e.g., glass lining, etc.). Because of the variables and complexities involved in the selection of a proper lining for a given service, AMERICAN invites inquiries for technical assistance, availability and cost.

UNLINED

Because some service applications may require unlined pipe & fittings, AMERICAN furnishes any of its products without lining when so specified at time of purchase.

AMERICAN Coatings and Primers for Pipe and Fittings

Several different types of exterior primers for pipe and fittings are available from AMERICAN. Because of variables and complexities involved in the selection and application of a proper coating for a given service, AMERICAN invites inquiries for technical assistance.

ASPHALTIC

AMERICAN furnishes most pipe and fittings coated outside with an asphaltic coating approximately one mil thick per AWWA C151 for ductile iron pipe, AWWA C115 for flanged pipe and AWWA C110 and C153 for fittings.

All across the United States ductile iron and gray iron pipe and fittings with this standard coating have provided trouble-free service for decades. Unless otherwise specified, an asphaltic coating is applied to the outside of all pipe and fittings manufactured by AMERICAN.

The asphaltic coating works in conjuction with manufacturing annealing scale to provide a barrier to corrosion. If soils are deemed to be corrosive to ductile iron pipe when evaluated in accordance with the Design Decision Model™ (DDM™*) or Appendix A of AWWA C105, zinc coating with or without V-Bio polyethylene wrap should be used.

Asphaltic coating is not compatible with most top coats. See the following alternative coating and primer recommendations.

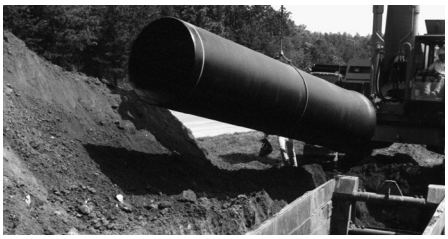
*DDM™ (Design Decision Model™) developed jointly by Corrpro Companies, Inc., and the Ductile Iron Pipe Research Association.
See american–usa.com, dipra.org or corrpro.com for details.

PHENOLIC ALKYD PRIMER

This is a fast-drying, lead- and chromate-free, corrosion-resistant primer formulated to accept a wide variety of topcoats. It is well suited for applications where the generic topcoats are unknown but its service is limited to atmospheric exposure. Refer to **AMERICAN** Alkyd-Phenolic Primer. **NOTE: NOT RECOMMENDED FOR IMMERSION. MUST ALLOW UP TO 30 DAYS OF CURING BEFORE TOPCOATING WITH CERTAIN COATINGS.**

EPOXY PRIMER

This is a high-solids, chemical- and corrosion-resistant coating for protection against abrasion, moisture, corrosive fumes, chemical attack and immersion.



This 30" AMERICAN Ductile Iron Fastite joint treated-water transmission main was furnished and installed—as is most ductile iron pipe—with standard asphaltic coating approximately one mil thick on the outside.

High-build properties provide outstanding corrosion protection with fewer coats, particularly on edges. Such high solids, high film-build epoxies are compatible with most catalyzed finish coats.

Typical (field) finish coatings include: epoxies (amine, polyamide, polyamidoamine, water-borne, coal-tar) and polyurethane. Refer to **AMERICAN** Polyamidoamine Epoxy Primer. **NOTE: AFTER 60 DAYS OF CURING, THIS PRIMER SHOULD BE UNIFORMLY SCARIFIED BY BRUSH-BLASTING WITH FINE ABRASIVE BEFORE TOPCOATING.**

OTHER SPECIAL COATINGS

AMERICAN can also furnish other special exterior coating systems. Contact **AMERICAN** for technical assistance in the selection of special exterior coating systems, lead times and costs. See pages 11-9 through 11-11 for additional information related to metallic zinc coating.

UNCOATED PIPE

Because some customer applications may require piping or fittings that have no coating applied to the exterior, AMERICAN furnishes, when specified at time of purchase, any of its products without exterior coatings.

While AMERICAN can supply uncoated, bare pipe to meet customer specifications, it is recommended to use an asphaltic or other approved coating on the spigot when assembling a joint to reduce the probability of displacing a gasket and to reduce the overall assembly load.

NOTE: AMERICAN also has the ability to furnish other primers, but this may affect price and availability.

AMERICAN Cast Iron Pipe Company
Standard O.D. Shop Primer Systems

RECOMMENDED AND PREFERRED PRIMER

Alkyd-Phenolic Primer
Interior/Exterior/Non-Immersion (Above Grade Only)
- Single-coat thickness: 2.0-4.0 mils DFT (50-101 microns).
- Typical Topcoats: alkyds, aluminums, epoxies, and urethanes.
- Coating must be cured for 30 days before being overcoated with certain topcoats.
- This primer is **not** recommended for immersion service.
- This primer is compliant with NSF Standard 61 **as an exterior surface coating only.**

Polyamidoamine Epoxy Primer
Interior/Exterior/Immersion (Above and Below Grade)
- Single-coat thickness: 3.0-8.0 mils DFT (76-203 microns).
- Typical Topcoats: epoxies and urethanes.
- This coating must be lightly blast cleaned before topcoating if it has not been exterior exposed for 60 days or longer.
- This primer is compliant with ANSI/NSF Standard 61 for potable water contact for pipe, fittings, and valves when combined with approved topcoats.

Zinc-Coated Ductile Iron Pipe

AMERICAN is proud to introduce the latest advancement in corrosion control for iron pipe, zinc coating. Zinc has been used to effectively eliminate corrosion in iron pipe for more than 50 years. Internationally, this advanced coating system has been used to protect millions of feet of cast and ductile iron pipe in corrosive environments.

AMERICAN began supplying zinc coating for our export orders starting in the early 1980s. Now, we're pleased to offer this proven system to domestic markets. Zinc coating significantly extends the life of an already rugged and reliable product – ductile iron pipe.

A Brief History of Zinc Coatings

Zinc dust was first added to paints for corrosion control as early as 1837. Since then, zinc-rich paints have received widespread acceptance for metallic corrosion control around the world.

The water industry first began using zinc coatings on iron pipe in Europe in 1955. As a result of zinc's widespread use there, the ISO standards 8179 and BSEN 545/598 were both developed and widely adopted.

Beginning in the early 1980s the mass of zinc applied to iron pipe was increased from the original 130 grams per square meter (g/m^2) to the current 200 g/m^2. This amount, with a protective topcoat, has proven optimal for life extension of iron pipe. Also, in the early 1980s, AMERICAN began supplying the zinc-rich ISO coatings on ductile iron pipe for our international orders.

Key Dates in the Development of Zinc Coatings for Ductile Iron Pipe

1958	**Zinc coating was first applied to cast iron pipe in Europe for corrosion protection.**
1963	**Standard bitumen/coal-tar paint was applied for normal environments in Europe.**
1963	**Polyethylene sleeve was recommended for soil resistivities of less than 400 ohm-centimeter by French pipe maker Pont-à-Mousson.**
1972	**Germany and Austria began to standardize the use of zinc coatings on iron pipe.**
1982	**AMERICAN supplied its first international order with a zinc coating.**
1984	**All ductile iron manufacturers in the United Kingdom started supplying all new ductile iron pipe in the diameter range 80 - 800mm with a zinc coating.**
1984	**Zinc spray of 130 g/m^2 under bitumen paint became common in Europe.**
1995	**Zinc spray of 200 g/m^2 under bitumen paint became the standard in Europe.**

Zinc Coatings for Iron Pipe Today

The advances in zinc coatings over the past 60 years have resulted in a highly effective corrosion inhibiting product. According to the International Zinc Association, products coated with zinc *"are slow to enter the recycling circuit due to the very nature of their durability. The life of zinc-containing products is variable and can range from 10-15 years for cars or household appliances, to over 100 years for zinc sheet used for roofing."* With a projected lifespan of well over 100 years, zinc coating on ductile iron pipe is the most effective and dependable way to further extend the lifespan of an already rugged and durable product.

A Specification for Zinc Coating on Ductile Iron Pipe

A. Standards: Ductile iron pipe shall conform to AWWA C150 and C151, subject to the following supplemental requirements. The pipe shall be of the diameter and class shown, shall be furnished complete with rubber gaskets as indicated in the Contract Documents, and all specials and fittings shall be provided as required under the Contract Documents. The ductile iron pipe shall be manufactured or supplied by AMERICAN Ductile Iron Pipe or pre-approved equal. Joints shall conform to AWWA C111, cement linings to AWWA C104, fittings to AWWA C153 or C110.

B. Markings: Upon request, the CONTRACTOR shall require the MANUFACTURER to legibly mark specials in accordance with a laying schedule and marking diagram. All other cast marks and other marks shall be in accordance with applicable Standards.

C. Laying Lengths: Pipe laying lengths shall be provided in 20 foot nominal lengths with allowable trim pipe lengths in accordance with AWWA C151 and special shorter lengths provided as required by the Drawings.

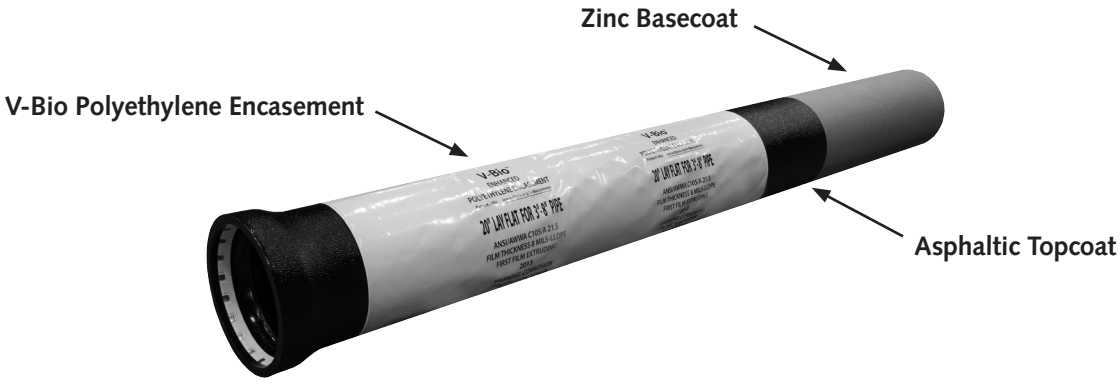
D. Joint Design: Ductile iron pipe shall be furnished with push-on joints or push-on restrained joints. Restrained joints shall be AMERICAN Fast-Grip, Flex-Ring, or Lok-Ring.

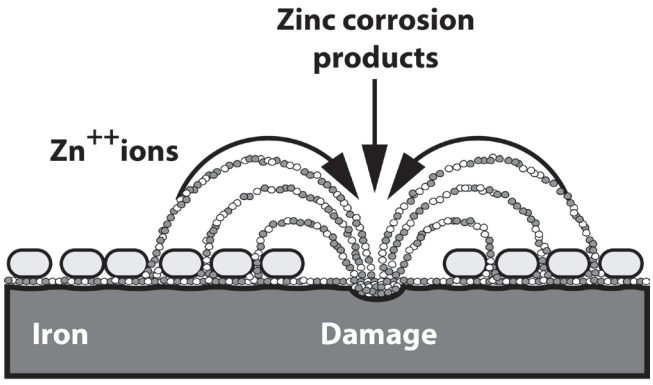
E. Lining: Except otherwise provided herein, interior surfaces of all ductile iron pipe, fittings, and specials shall be cleaned and lined at the pipe casting facility with a standard thickness cement mortar lining applied in conformity with AWWA C104. A seal coat shall not be applied to the surface of the cement-mortar lining.

F. Coating: The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m^2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The coating system shall conform in every respect to ISO 8179-1 "Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01."

G. Installation: Ductile iron pipe shall be loaded, transported, unloaded, installed, and tested in accordance with AWWA C600.

Zinc Coated Ductile Iron Pipe for Corrosion Control





Zinc is anodic to iron. That means iron is the more stable, more noble, of the two elements. Zinc will cathodically protect the iron pipe as long as zinc is present, and over time, will convert to zinc compounds that provide an enduring passivating layer under the topcoat, which protects the pipe against further corrosive attack. Zinc is an anode, uniformly adhered to the surface of the pipe.

Repair Instructions for Ductile Iron Pipe Coated with Metallized Zinc and Asphaltic Top Coat

In general, the zinc layer does not require touch-up if its damaged area is less than 0.75^2 and/or less than 0.188 in. wide. Should the damage or scratch exceed this size or width use the procedure below to repair both the zinc and the asphaltic topcoat. For scratches and damage less than this width and area that exhibit rusting, follow the surface preparation guidelines and simply re-apply the asphaltic coating.

Read and follow all pipe and paint manufacturers' cautions and instructions included in product data sheets, application guides and SDS sheets.

Surface Preparation

Remove any contaminants or loose coating from the damaged area by using a wire brush, sand paper and/or solvent.

Repair

1. Remove the asphaltic topcoat from the area surrounding the damage using a wire brush and/or solvent cleaning. Remove the asphalt at least 1" beyond the damage area.

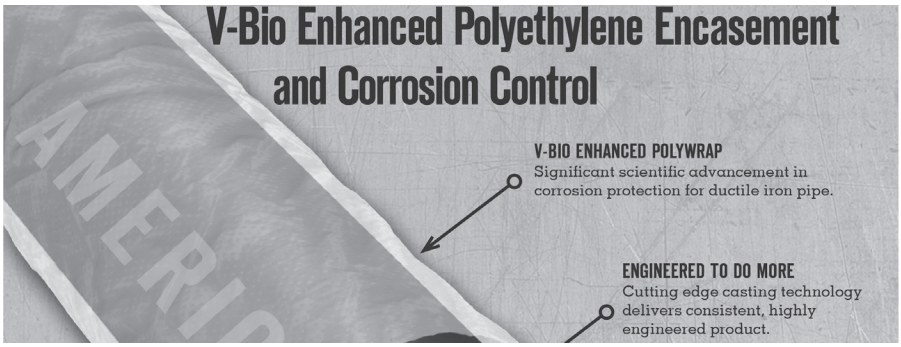
2. Apply one coat of zinc-rich paint overlapping the undamaged zinc coating.

3. Allow the zinc-rich painted section to dry to touch/handle per the paint manufacturer's recommendations.

4. Apply one coat of asphaltic paint on top of the zinc-rich paint overlapping the adjacent asphaltic paint.

5. Recommended products include Tnemic Zinc Series 90-98, Sherwin Williams Corothane® Galvapac 1k Zinc Primer, and Ergon Asphaltic R-17-A Topcoat.

V-Bio Enhanced Polyethylene Encasement



Product Description

V-Bio, the latest advancement in corrosion control for ductile iron pipe, is an enhanced polyethylene encasement that targets anaerobic bacteria on the surface of the pipe and inhibits the formation of corrosion cells under the wrap.

Already known for its corrosion control properties, polyethylene encasement has been used to successfully protect cast and ductile iron pipe in aggressive environments since its first use in a water system in 1958. And now, with V-Bio, this wrap offers even greater protection of the industry's most dependable, economic and long lasting pipe material.

Key facts about the V-Bio enhanced polyethylene encasement:

• Builds on a proven method of corrosion control — polyethylene encasement – that has been protecting iron pipe from aggressive soils since it was first installed in 1958.

• Represents a significant evolutionary advancement in corrosion protection for ductile iron pipe.

• Consists of three layers of co-extruded linear low-density polyethylene (LLDPE) film fused into one.

• Features an inside surface that is infused with a proprietary blend of an anti-microbial compound to mitigate microbiologically influenced corrosion ("MIC") and a volatile corrosion inhibitor ("VCI") to control galvanic corrosion.

• Protects against corrosion without consuming or degrading the compound or the corrosion inhibitor. The film's enhanced properties will last over time.

• Meets all requirements of the American National Standards Institute and the American Water Works Association (ANSI/AWWA C105/A21.5) standard for polyethylene encasement.

• The most advanced method of corrosion control.

For details about V-Bio enhanced polyethylene encasement, ductile iron pipe or the Ductile Iron Pipe Research Association visit: www.dipra.org/v-bio/

Standard Dimensions and Weights

Table No. 11-2

Pipe Size (in.)	Lay Flat size	Length Per Roll[1]	Tape Required[2] per Joint (ft.)	Weight Per Roll[1]
4	20	500	5	72
6	20	500	6	72
8	20	500	8	72
10	27	380	9	73.9
12	27	380	10	73.9
14	34	300	11	73.44
16	34	300	12	73.44
18	41	260	13	73.8
20	41	260	15	73.8
24	54	210	17	81.6
30	67	175	21	72.4
36	81	175	25	75.27
42	81	175	28	75.27
48	95	110	32	82
54	108	110	35	83.64
60	108	110	36	83.64
64	121	100	39	74.96

[1] Weights and lengths subject to change.

[2] Based on one turn at each end, six 4" long strips to secure loose wrap plus approximately 5% extra.

A Specification for V-Bio Enhanced Polyethylene Encasement for Ductile Iron Pipe

Polyethylene encasement for use with ductile iron pipe shall meet all the requirements for ANSI/AWWA C105/A21.5, *Polyethylene Encasement for Ductile Iron Pipe Systems*.

In addition, polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight mils.

The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of antimicrobial compound to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

Ductile iron pipe and the polyethylene encasement used to protect it shall be installed in accordance with AWWA C600 and ANSI/AWWA C105/A21.5 and also in accordance with all recommendations and practices of the AWWA M41, *Manual of Water Supply Practices – Ductile Iron Pipe and Fittings.* Specifically, the wrap shall be overlapped one foot in each direction at joints and secured in place around the pipe, and any wrap at tap locations shall be taped tightly prior to tapping and inspected for any needed repairs following the tap.

All installations shall be carried out by personnel trained and equipped to meet these various requirements.

The installing contractor shall submit an affidavit stating compliance with the requirements and practices of ANSI/AWWA C150/A21.50, ANSI/AWWA C151/A21.51, ANSI/AWWA C105/A21.5, AWWA C600 and M41.

Traditional Polyethylene Encasement

In areas where severely aggressive soils are encountered, the use of a polyethylene tube or sheet encasement has been proven to provide highly effective, economical protection. The protection against corrosion provided by loose polyethylene is different in several ways and should not be confused with coatings applied directly to the barrel of the pipe. The most significant difference is its ability to protect without creation of concentration cells at holidays. Also, since the encasement is applied when the pipe is actually put in the ground, coating damage due to shipping, handling, etc., is minimized.

As water may be present in the soil around the pipe, water may also be present between the pipe and wrap. Water inside the polyethylene tubing initially bears some characteristics of the soil environment, and corrosion may start. But within a short period of time initial oxidation depletes the oxygen supply in the water, and other electrochemical corrosion reactions also progress to completion. At this point a state of chemical equilibrium is reached.

Since the first field installation of polyethylene wrap on gray iron pipe in 1958, installations have been made in severely corrosive soils throughout the United States. The success of the polyethylene encasement procedure developed in the United States has been adopted by several other countries, and an International Standard for Polyethylene Sleeving (ISO- 8180) has been developed.

Research by the Ductile Iron Pipe Research Association at several severely corrosive test sites has verified that polyethylene encasement provides a high degree of protection and results in minimal and generally insignificant exterior surface corrosion of either ductile or gray iron pipe thus protected. These findings have been confirmed by the results of numerous investigations of field installations.

Field tests have also indicated that the dielectric capability of polyethylene provides shielding for ductile and gray iron pipe against stray current at most levels encountered in the field.

Because polyethylene encasement is a passive method of protecting ductile iron pipe in aggressive soils, it can effect greater reliability and savings than cathodic protection systems which require continual monitoring, maintenance and other operating expenses, and trained personnel. Cathodic protection systems can also cause collateral harm in some cases to nearby unprotected ferrous structures.

For protection in areas of severely aggressive soils, AWWA C105 covers materials and installation procedures for polyethylene encasement of underground installations of ductile iron piping for water and other liquids.

Polyethylene wrap in tube or sheet form for piping encasement is manufactured of virgin polyethylene material conforming to the requirements of ANSI/ASTM Standard Specification D1248. The specified minimum thickness for linear low-density polyethylene film is 0.008 in. (8 mils). The specified minimum thickness for high-density, cross-laminated polyethylene film is 0.004 in. (4 mils).

Material, required markings, and installation methods are all in accordance with the requirements of AWWA C105. This standard and more detailed publications by DIPRA regarding loose polyethylene encasement are available from AMERICAN.

Traditional Polyethylene Tubing and Tape
ANSI/AWWA C105/A21.5

Tubing in Roll

Table No. 11-3

Pipe Size in.	Flat Tube† Min. Width in.	Approximate Weight in Pounds 8 mil low-density P.E.		Approx. weight (lb.) per 500' roll 4 mil high-density cross-laminated P.E.	Tape Required* Per Joint ft.
		Per 1000' of Tube	Per 22' Long Individual Tube		
4	14	89	2	21	5
6	16	102	3	24	6
8	20	128	3	30	8
0	24	154	4	36	9
12	27	173	4	40	10
14	30	192	5	45	11
16	34	218	5	51	12
18	37	237	6	55	13
20	41	262	6	61	15
24	54	346	8	80	17
30	67	429	10	100	21
36	81	518	12	120	25
42	81	518	12	120	28
48	95	608	14	141	32
54	108	689	16	161	35
60	108	689	16	161	36
64	121	772	18	180	39

*Based on one turn at each end, six 4"–long strips to secure loose wrap plus approximately 5% extra.
†Flat tube widths are shown for Fastite, Flex–Ring, Lok–Ring, and MJ Joints. Check AMERICAN for Flat tube widths required for Flex–Lok Joints.
The standard color for low–density polyethylene is black. It can also be furnished white, green, red, buff, royal blue, and lavender on special order. The standard color for high–density, cross–laminated polyethylene is white. It can also be furnished black on special order.

Installation of Polyethylene Encasement

Installment methods as set forth in ANSI/AWWA C105/A21.5 and DIPRA's "Polyethelyne Encasement" brochure should be followed.