DUCTILE IRON PIPE

DIPRA
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DIPRA®

Bill Carter

Ductile Iron pipe is specified by utilities and consulting engineers for its strength, durability, and proven longevity.

The Standard for Quality and Performance

Since its introduction into the marketplace in 1955, Ductile Iron pipe has been recognized as the industry standard for modern water and wastewater systems. More than four decades of field experience have proven its strength, durability, and reliability for transporting raw and potable water, sewage, slurries, and process chemicals.

Ductile's high degree of dependability is primarily due to its high strength, durability, and impact and corrosion resistance. Designed and manufactured to the industry's most stringent standards, Ductile Iron pipe resists damage during shipping and handling, and, once installed, withstands the most demanding operating conditions, including water hammer, frozen ground, deep trenches, areas of high water table and heavy traffic, river crossings, pipe on supports, rocky trenches, and areas of shifting, expansive, and unstable soils.

Installation is simple. Unlike some pipe materials, Ductile Iron pipe requires no complex line-and-grade drawings or laying schedules. It can be installed in a wide variety of trench and bedding conditions and can be easily cut in the field. Direct tapping, even in straight lines, doesn't affect its integrity. And, once installed, Ductile Iron pipe is virtually maintenance free.

The pipe is manufactured in 18- or 20-foot nominal laying lengths and 3- to 64-inch diameters in a range of standard pressure classes and nominal wall thicknesses. Ductile Iron is furnished with several different types of joints, and a wide variety of standard fittings are available without special order. Although Ductile Iron pipe is usually furnished with cement-mortar lining, optional internal linings are also available for a wide range of special applications.

And Ductile Iron's generally larger-than-nominal inside diameters, combined with its high flow coefficient, offer substantial savings on pumping and power costs over the life of the pipeline.

Continuing the Tradition of Service

The strength, durability, and long service life of Ductile's predecessor, Gray Cast Iron pipe, are widely recognized. The first official record of Gray Iron pipe installation was in 1455 in Siegerland, Germany. In 1664, French King Louis XIV ordered the construction of a Gray Iron pipe main extending 15 miles from a pumping station at Marly-on-Seine to Versailles to supply water to the fountains and town. This pipe served the palace gardens for more than 330 years.

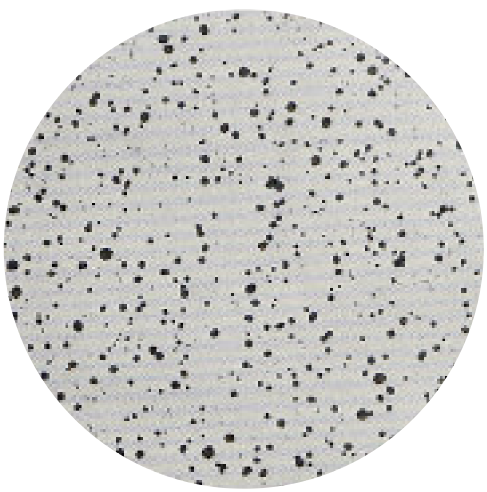
Gray Iron pipe was introduced to the United States as early as 1817, when it was installed in the Philadelphia water system. Today, more than 611 U.S. utilities have had Gray Iron distribution mains in continuous service for more than 100 years. At least 22 utilities have had Gray Iron mains in continuous service for more than 150 years.

Even Stronger and Tougher than Cast Iron

Ductile Iron not only retains all of Gray Iron's attractive qualities, such as machinability and corrosion resistance, but also provides additional strength, toughness, and ductility. Although its chemical properties are similar to those of Gray Iron, Ductile Iron incorporates significant casting refinements, additional metallurgical processes, and superior quality control.

Ductile Iron also differs from Gray Iron in that its graphite form is spheroidal, or nodular, instead of the flake form found in Gray Iron. This change in graphite form is accomplished by adding an inoculant, usually magnesium, to molten iron of appropriate composition during manufacture.

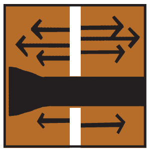
Due to its spheroidal graphite form, Ductile Iron has approximately twice the strength of Gray Iron as determined by tensile, beam, ring bending, and bursting tests. Its impact strength and elongation are many times greater than Gray Iron's.



Ductile Iron

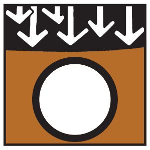
Gray Iron

As these photomicrographs show, Ductile Iron (above left) differs from Gray Iron (above right) in that its graphite is spheroidal, or nodular, instead of the flake form found in Gray Iron. Ductile's greater strength, ductility, and toughness are due to this change in microstructure.



Exhibits Tremendous Tensile Strength

A pipe must be able to withstand severe stresses caused externally by shifting ground and heavy loads and internally by water pressure and water hammer. Ductile Iron has minimum strength requirements of 60,000 psi tensile strength, 42,000 psi yield strength, and 10 percent minimum elongation.

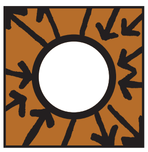


Withstands Severe Crushing Loads

Extreme traffic loads, heavy backfill, or earth movements caused by freezing, thawing, and soil swell pressures impose tremendous forces on buried pipes. Beam tests, free bend tests, and—toughest of all—ring tests, which determine the pipe's ability to resist concentrated loads, all demonstrate the superiority of Ductile Iron pipe.

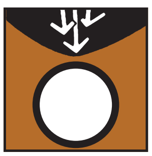
Has Great Beam Strength

Ductile Iron will bend or give considerably before it will ultimately fail. This characteristic is what makes its ductility so desirable. Ductile Iron's ability to bend under load greatly increases its resistance to beam load.



Is Corrosion Resistant

Numerous laboratory and field tests have proven that Ductile Iron's corrosion resistance is equal to or greater than that of Gray Iron, which has served a number of U.S. utilities for more than 150 years with no external corrosion protection. In the majority of soils, Ductile Iron needs no external corrosion protection. In most areas of highly corrosive soil, simple, economical polyethylene encasement has provided excellent corrosion protection for the pipe.



Has Extremely High Impact Resistance

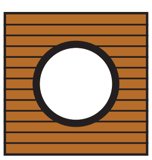
In test after test, Ductile Iron has exhibited tremendous impact resistance. Ductile's toughness makes it much less vulnerable to damage from improper handling or abnormal service conditions. And it stands up under heavy traffic conditions in unstable soil environments where other materials might fail due to the stresses caused by unusual loading.

Demonstrates Tremendous Bursting Strength

Ductile's tremendous bursting strength makes it ideally suited for high-pressure applications. Six-inch Pressure Class 350 Ductile Iron, for example, has a bursting pressure exceeding 3,500 psi. Ductile's bursting strength also provides an additional safety factor against water hammer.

Is Easy to Install

Ductile Iron is easy to install in the field. A wide variety of joints and standard fittings are available for every application. Ductile Iron can be cut and direct tapped in the field. And it requires no complex laying schedules or line-and-grade drawings.



Is Virtually Maintenance Free

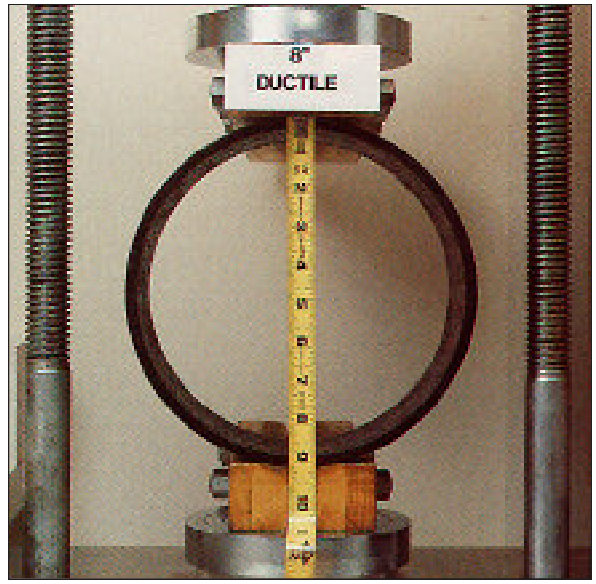
Years of experience in operating systems throughout the world have proven that, once installed, Ductile Iron requires little, if any, maintenance over the life of the pipeline. Ductile's longevity can be witnessed in the outstanding service records of Gray Iron pipe over the past 150 years.

Offers Impressive Energy Savings

Ductile's high flow coefficient (C=140) and generally larger-than-nominal inside diameters can result in increased flow capacity, lower head loss, lower pumping costs, and significant energy savings over the life of the pipeline.

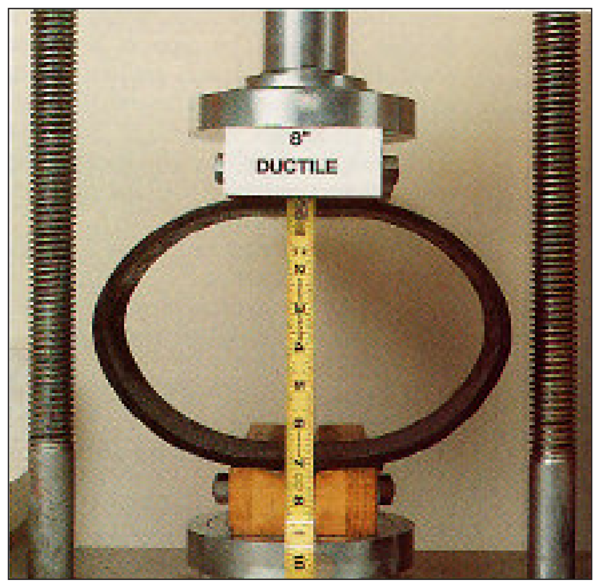
David Justus

Because of Ductile Iron's great beam strength and durability, it is ideally suited for challenging applications such as this pipe-on-supports installation.



Sylvia Caswell

Ductile Iron pipe can withstand severe crushing loads. The ring test, shown above, determines a pipe's ability to withstand load over a relatively small area, as would occur in rocky terrain where the pressure of a single rock, plus all the backfill above it, could cause weaker materials to fail. A deflection gauge on the ring-crushing apparatus has been adjusted to accurately record deflection at specified load intervals.



Sylvia Caswell

Above: This photograph was taken immediately after rupture occurred at the top of the ring. Note deflection of a full two inches in this 8-inch Ductile Iron pipe.

The Industry's Toughest Manufacturing Standard

Ductile Iron pipe is a centrifugally cast product. A controlled amount of molten iron is introduced into the rotating mold, which generates a centrifugal force that holds the iron in place against the mold until it solidifies. The pipe is then removed and furnace-annealed to obtain the prescribed physical properties.

The following acceptance test requirements set forth by ANSI/AWWA C151/A21.51 must be met before the pipe is declared ready for shipment:

1. Tensile test: Ultimate strength: 60,000 psi minimum. Yield strength: 42,000 psi minimum. Elongation: 10% minimum.
2. Impact test: 7 ft.-lb. minimum at 70°F. 3 ft.-lb. minimum at -40°F.
3. Hydrostatic test: Every piece of Ductile Iron pipe is subjected to a hydrostatic test of at least 500 psi before it leaves the foundry.

In addition to these acceptance tests, Ductile Iron manufacturers conduct additional quality-control tests throughout the manufacturing process to ensure the highest-quality castings.

The Industry's Most Comprehensive — and Conservative — Design Standard

Since Ductile Iron pipe's introduction in 1955, the American National Standards Institute Committee A21 (now the American Water Works Committee A21) has carefully evaluated extensive data on virtually every aspect of the pipe's performance. In 1965, the Committee's work resulted in the adoption of the American National Standard for the Thickness Design of Ductile Iron Pipe (ANSI/AWWA C150/A21.50).

This design standard is based upon the fact that Ductile Iron pipe, when subjected to internal pressure and underground loading conditions, behaves as a flexible conduit. The pipe is designed separately to withstand external loads and internal pressures. The resulting calculated thickness is greater than the thickness calculated by the appropriate equation for combining the two, and thus is more conservative.

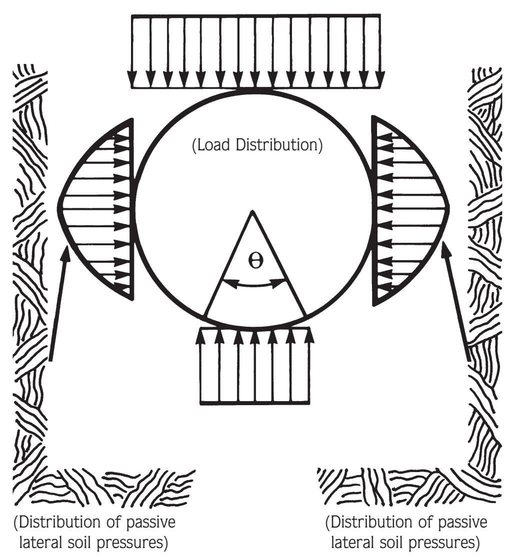
Briefly, the design procedure for Ductile Iron pipe includes:

1. Design for internal pressures (static pressure plus surge pressure allowance).
2. Design for bending stress due to external loads (earth load plus truck loads).
3. Select the larger resulting net wall thickness.
4. Add an 0.08-inch service allowance.
5. Check deflection.
6. Add a standard casting tolerance.

This procedure results in the total calculated design thickness, from which the appropriate pressure class is chosen. The addition of a casting tolerance and an 0.08-inch service allowance, which is unique to Ductile Iron pipe, thereby provides an additional margin of safety and dependability.

Important Design Criteria Include:

1. Earth load is based upon the prism load concept, a conservative assumption for loads experienced by a flexible pipe in a trench.
2. Truck loads are based upon a single AASHTO H-20 truck with 16,000 pounds wheel load and an impact factor of 1.5 at all depths.
3. External load design includes calculation of both ring bending stress and deflection. Ring bending stress is limited to 48,000 psi, providing a safety factor of 2.0 based upon minimum ultimate bending stress.
4. Deflection of the pipe ring is limited to a maximum of 3 percent for cement-lined pipe. Again, this limit provides a safety factor of at least 2.0 against applicable performance limits of the lining. (Unlined pipe and pipe with flexible linings are capable of withstanding greater deflections.)
5. Five trench types have been defined in the Standard (see Figure 1 on page 8) to give the designer a selection of laying conditions. This ensures a cost-effective trench section design.
6. Internal pressure design is based upon working pressure plus a surge allowance of 100 psi. A safety factor of 2.0 is applied to this calculation.



In summary, ANSI/AWWA C150/A21.50 design criteria include: ring bending stress of 48,000 psi, ring deflection of 3 percent, AASHTO H-20 truck loading at all depths with 1.5 impact factor, prism earth load for all pipe sizes, and five types of laying conditions. Although minimum safety factors are set, actual total field service safety factors far exceed these values.

Ductile Iron pipe standards

- **ANSI/AWWA C104/A21.4—**
  American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

- **ANSI/AWWA C105/A21.5—**
  Polyethylene Encasement for Ductile-Iron Pipe Systems

- **ANSI/AWWA C110/A21.10—**
  American National Standard for Ductile-Iron and Gray-Iron Fittings, for Water

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

- **ANSI/AWWA C115/A21.15—**
  Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

- **ANSI/AWWA C116/A21.16—**
  Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings for Water Supply Service

- **ANSI/AWWA C150/A21.50—**
  Thickness Design of Ductile-Iron Pipe

- **ANSI/AWWA C151/A21.51—**
  American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water

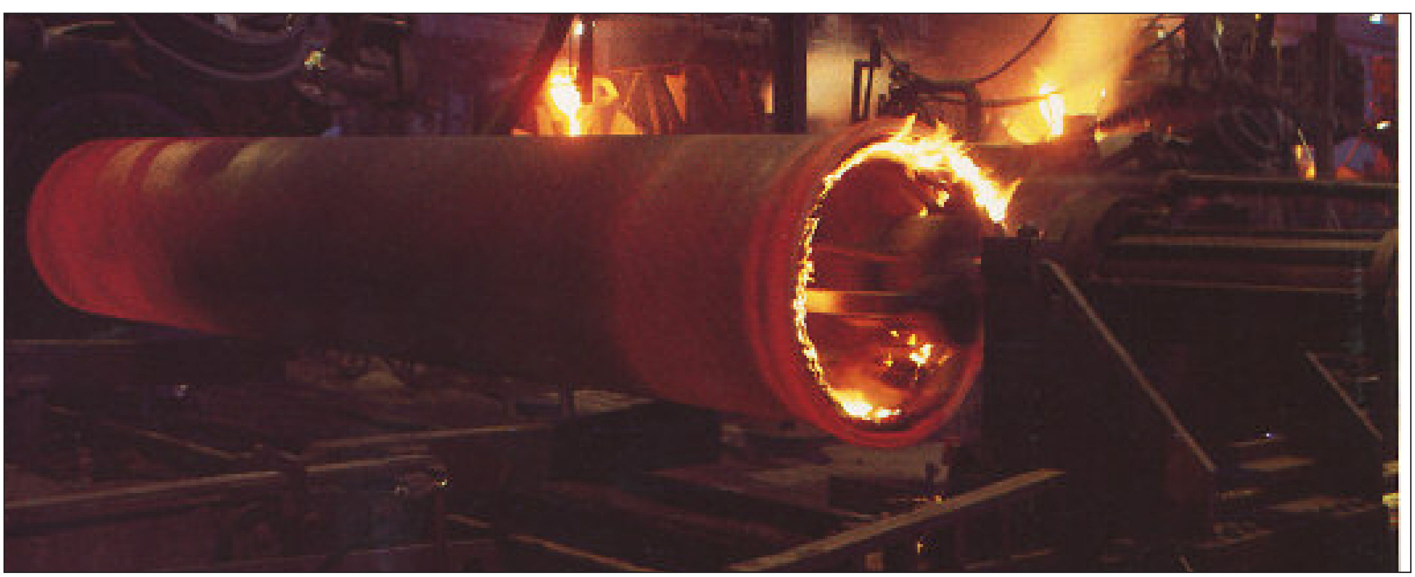
- **ANSI/AWWA C153/A21.53—**
  Ductile-Iron Compact Fittings for Water Service

- **ANSI/AWWA C600—**
  Installation of Ductile-Iron Water Mains and Their Appurtenances

- **ASTM A674—**
  Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids

- **ASTM A716—**
  Standard Specification for Ductile Iron Culvert Pipe

- **ASTM A746—**
  Standard Specification for Ductile Iron Gravity Sewer Pipe



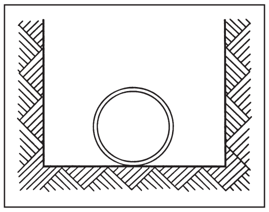
The industry's most stringent design and manufacturing standards, coupled with exacting quality-control measures by Ductile Iron manufacturers, ensure the pipe's integrity.

Ductile Iron Pipe Design Standards Offer the Most Flexible Range of Trench Conditions and Pressure Classes.

The design standards provide for five standard laying conditions, giving the designer the flexibility to choose the most economical combination of pipe thickness and trench conditions.

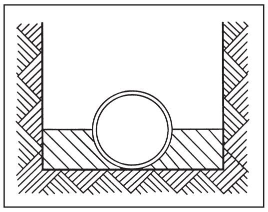
Figure 1

Standard Laying Conditions for Ductile Iron Pipe



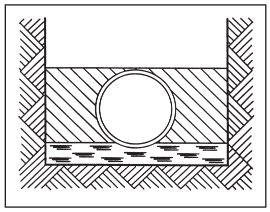
Type 1*

Flat-bottom trench.†
Loose backfill.



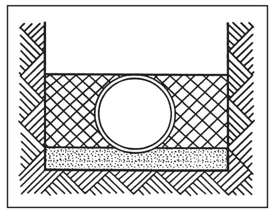
Type 2

Flat-bottom trench.†
Backfill lightly consolidated to centerline of pipe.



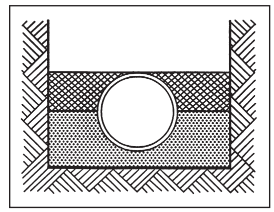
Type 3

Pipe bedded in 4-inch minimum loose soil.‡ Backfill lightly consolidated to top of pipe.



Type 4

Pipe bedded in sand, gravel, or crushed stone to depth of 1/8 pipe diameter, 4-inch minimum. Backfill compacted to top of pipe. (Approximately 80% Standard Proctor, AASHTO T-99.)



Type 5

Pipe bedded to its centerline in compacted granular material, 4-in. minimum under pipe. Compacted granular or select‡ material to top of pipe. (Approximately 90% Standard Proctor, AASHTO T-99.)

* For 14-inch and larger pipe, consideration should be given to the use of laying conditions other than Type 1.

† "Flat-bottom" is defined as undisturbed earth.

‡ "Loose soil" or "select material" is defined as native soil excavated from the trench, free of rocks, foreign material, and frozen earth.

TABLE I
Nominal Thicknesses for Standard Pressure Classes of Ductile Iron Pipe

Size in.	Outside Diameter in.	Pressure Class				
		150	200	250	300	350
		Nominal Thickness—in.				
3	3.96	–	–	–	–	0.25*
4	4.80	–	–	–	–	0.25*
6	6.90	–	–	–	–	0.25*
8	9.05	–	–	–	–	0.25*
10	11.10	–	–	–	–	0.26
12	13.20	–	–	–	–	0.28
14	15.30	–	–	0.28	0.30	0.31
16	17.40	–	–	0.30	0.32	0.34
18	19.50	–	–	0.31	0.34	0.36
20	21.60	–	–	0.33	0.36	0.38
24	25.80	–	0.33	0.37	0.40	0.43
30	32.00	0.34	0.38	0.42	0.45	0.49
36	38.30	0.38	0.42	0.47	0.51	0.56
42	44.50	0.41	0.47	0.52	0.57	0.63
48	50.80	0.46	0.52	0.58	0.64	0.70
54	57.56	0.51	0.58	0.65	0.72	0.79
60	61.61	0.54	0.61	0.68	0.76	0.83
64	65.67	0.56	0.64	0.72	0.80	0.87

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

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

Thickness can be calculated for rated water working pressure and surges other than the above.

Ductile Iron pipe is available for water working pressures greater than 350 psi.

Pipe is available with thicknesses greater than Pressure Class 350.

Joints

All joints available for use with Ductile Iron pipe are designed to be bottle-tight and can be easily assembled. Some of the most common joints include:

Push-on joint

Developed in 1956, the rubber-gasketed push-on joint is the fastest, easiest-to-assemble, and thus most widely used joint for water and wastewater service today. Because they are bottle-tight, push-on joints can be used in wet-trench conditions and in underwater applications.

Mechanical joint

Although replaced by the push-on joint for most applications, the mechanical joint is still used in some underground installations, primarily on fittings.

Restrained joint

A special type of push-on or mechanical joint designed to provide longitudinal restraint, the restrained joint is used in conjunction with or in lieu of thrust blocks to provide restraint against thrust forces due to internal pressures. Various types of restrained joints are available in all sizes from 3 to 64 inches.

Flanged joint

A rigid joint primarily used in aboveground installations such as open bays and pipe galleries, the flanged joint employs a gasket inserted between two flanges that are joined with a series of nuts and bolts to produce a watertight seal.

Ball-and-socket joint

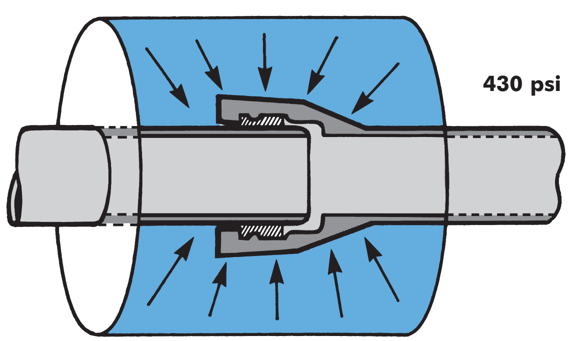
Boltless configurations of ball-and-socket joints provide flexibility (maximum deflection = 15° per joint) and restraint against joint separation. These joints are often specified in subaqueous crossings, locations requiring large changes in alignment and grade, and in geologically hazardous (earthquake-prone) areas.

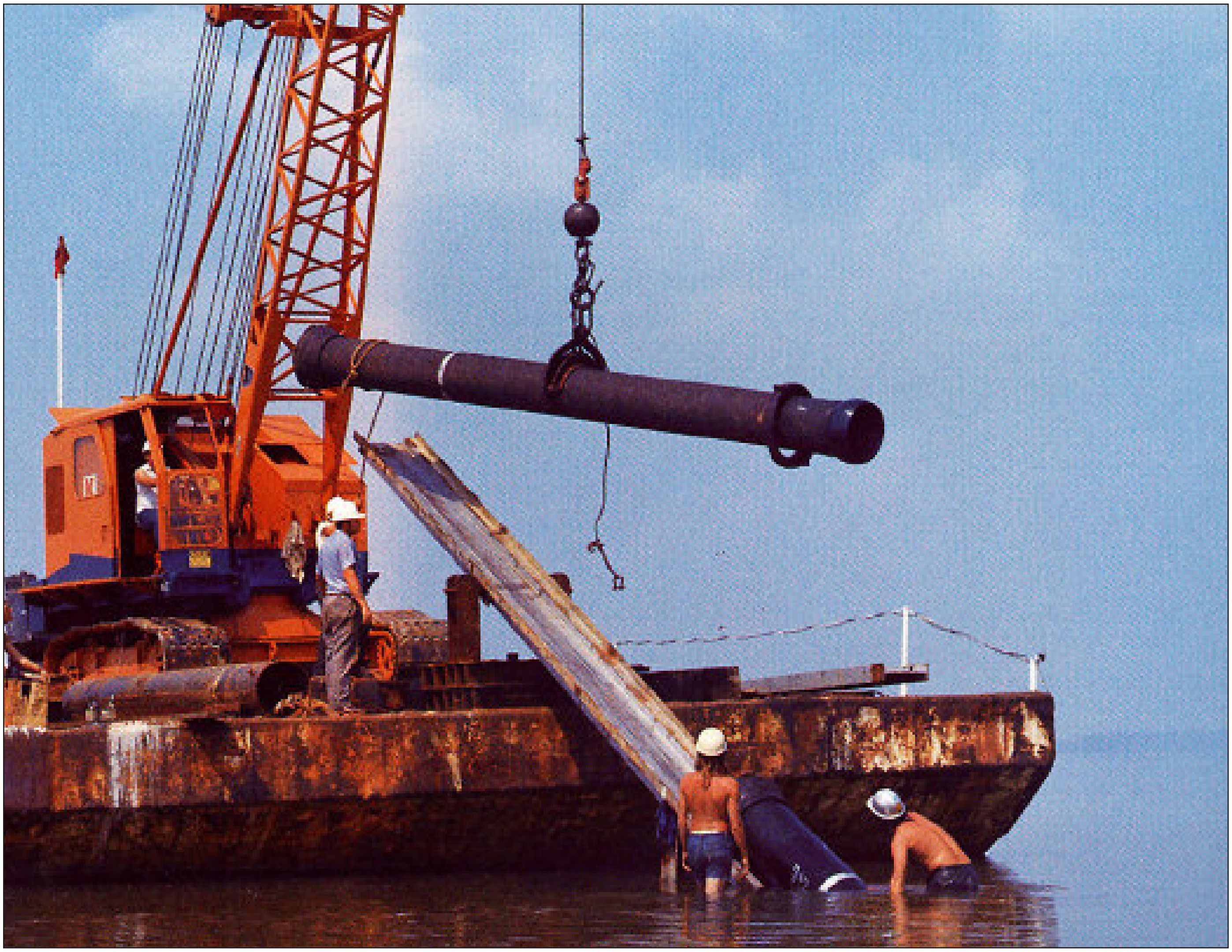
Miscellaneous joints

A variety of joints, most of which are modifications of the mechanical joint or stuffing box configuration, have been developed for use with tapping sleeves, repair sleeves, couplings, connectors, and other related products.

Ductile Push-on Joint Test

Tested: **1,000 psi internal pressure**
430 psi external pressure
14 psi negative air pressure
Results: **No leakage, no infiltration**





Clyde Wood

Although the push-on joint is most commonly used, Ductile Iron offers a variety of joint configurations for special applications. Ball-and-socket joints, which provide a 15° deflection, are often installed in subaqueous crossings or in earthquake-prone areas.

Fittings

Numerous Ductile and Gray Iron fittings equipped with mechanical, push-on, restrained, or flanged joints, or plain ends are readily available for installation at the job site. This wide variety of fittings, combined with Ductile's ability to be cut in the field, enables installers to bypass unexpected obstacles during installation—a major advantage of Ductile Iron over other materials.

Standard Ductile Iron fittings for water and other liquids are manufactured in accordance with two national standards: ANSI/AWWA C110/A21.10—Ductile-Iron and Gray-Iron Fittings, and ANSI/AWWA C153/A21.53—Ductile-Iron Compact Fittings. C110/A21.10 fittings are available in Gray or Ductile Iron and C153/A21.53 compact fittings are available only in Ductile Iron.

Although shorter and lighter than C110/A21.10 fittings, compact fittings incorporate Ductile Iron's high strength while maintaining comparable pressure ratings. A variety of configurations are included in the two standards.

Special fittings such as long radius fittings, reducing elbows, reducing-on-the-run tees, side outlet fittings, eccentric reducers, wall pipe, welded-on bosses, dual purpose and transition sleeves, and lateral and true wyes are also available from some manufacturers.

Valves and Hydrants

Valves and hydrants for use with Ductile Iron pipe are manufactured for a variety of applications, including fire protection, isolation, backflow prevention, and flow control. The most commonly used include metal-seated and resilient-seated gate valves, rubber-seated butterfly valves, swing-check valves, and dry- and wet-barrel fire hydrants. Other valves are also available to perform special functions.

Linings

Ductile Iron pipe installed in water systems today is normally furnished with a cement-mortar lining conforming to ANSI/AWWA C104/A21.4. Cement-mortar lining prevents tuberculation by creating a high pH condition at the pipe wall as well as providing a barrier between the water and the pipe wall. Additionally, cement linings create a smooth surface inside the pipe, thus maintaining a hydraulically smooth flow surface, which means less friction and thus less head loss. (The Hazen-Williams coefficient, or "C" value, is 140 for Ductile Iron pipe with cement-mortar lining.)

Special Linings

Special linings are available for applications where cement-mortar linings are not applicable. Consult your DIPRA member company regarding the availability and proper use of these special linings.

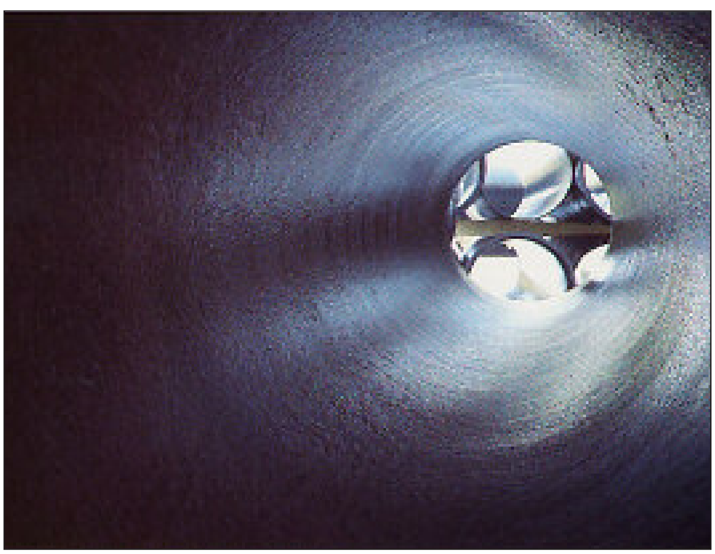
Polyethylene Encasement

Ductile Iron pipe, which is manufactured with an asphaltic shop coating, needs no external corrosion protection in the majority of installations. There are, however, highly aggressive soil conditions where the use of external protection is warranted. In these cases, DIPRA normally recommends encasing the pipe with polyethylene in accordance with ANSI/AWWA C105/A21.5.

Polyethylene encasement has been used for corrosion protection of Gray and Ductile Iron pipe in the United States for more than 45 years. First researched by DIPRA and its member companies in 1951, polyethylene was first used to protect Gray Iron pipe in an operating water system in 1958. Since then, polyethylene encasement has been used to protect thousands of miles of Gray and Ductile Iron pipe in installations throughout the United States. In addition to the U.S. standard, several other countries have adopted standards for polyethylene encasement. An international standard (ISO 8180) was adopted in 1985.

Because polyethylene is installed at the job site during pipeline construction, it is much less likely to be damaged than factory-applied coatings. Moreover, the initial cost of material and installation is very low and, once properly installed, polyethylene encasement has no maintenance costs.

Polyethylene's effectiveness has been well documented by its excellent service history and numerous investigations of both test sites and field installations. These results have demonstrated the effectiveness of properly installed polyethylene encasement as a corrosion protection system for Ductile Iron pipe.



Sylvia Caswell

Cement-mortar-lined Ductile Iron pipe has a Hazen-Williams "C" value of 140, a realistic value that is maintained over time — even when the pipe is transporting highly aggressive waters.

Sylvia Caswell

This polyethylene-encased Ductile Iron pipe was installed in a highly corrosive tidal basin in Charleston in 1967. When uncovered in 1988, both the pipe and the polyethylene were in excellent condition.

Allan B. Webb

More than 45 years of successful field usage have proven that properly installed polyethylene encasement is an economical and effective method of corrosion protection for Gray and Ductile Iron pipe in most soil environments.

More Than 90 Years of Service to Water and Wastewater Professionals

From its inception more than 90 years ago, the Ductile Iron Pipe Research Association (DIPRA) has provided accurate, reliable engineering information about Gray Iron—and now Ductile Iron—pipe to a wide variety of utility and consulting engineers.

Founded in 1915 as the Cast Iron Pipe Publicity Bureau, the organization's initial role was to promote the superior qualities of Gray Iron pipe through advertising programs. During the 1920s, the nature of the bureau's activities became increasingly technical and research-oriented, prompting a name change to the Cast Iron Pipe Research Association (CIPRA).

After Ductile Iron pipe had completely replaced Gray Iron pipe as the modern standard for pressure pipe, CIPRA became DIPRA in 1979. Today, the association provides numerous services, including the Regional Engineer Program, a variety of brochures and publications, representation on standards-making committees, and technical research on a variety of topics, including corrosion, corrosion protection and the design of Ductile Iron pipe.

Regional Engineer Program

A major addition to the association occurred in the late 1950s when the first field representative—the forerunner of today's Regional Engineer—was hired. Today, DIPRA has 12 Regional Engineers throughout the United States and Canada, including experts in virtually every aspect of pipe design and pipeline engineering.

Each is a Professional Engineer and many are certificated by NACE International as Corrosion Specialists. Many joined DIPRA after years of experience with utilities or engineering consulting firms. All play a vital role in assisting pipe specifiers and users in the proper design and application of Ductile Iron pipe.

The Regional Engineers live in the area they serve so they can provide timely information and assistance to consulting engineers and utilities on specific design and installation questions, corrosion control, and the investigation of problems with pipe in service. They conduct soil surveys and stray current investigations, make technical presentations at utility, engineering, and student conference meetings, and play an active role in local waterworks associations.

Research

DIPRA's Birmingham Headquarters' staff of engineers and researchers provides a variety of services, including supporting the Regional Engineer Program, participating in the development of Ductile Iron pipe standards, editing and publishing DIPRA brochures, magazines, and technical papers, and managing the association's advertising program. DIPRA Headquarters engineers, who answer thousands of technical queries from utility and consulting engineers each year, have amassed a comprehensive library of research and technical information on Ductile Iron pipe.

DIPRA's Research Department has contributed much of the available data on corrosion, corrosion protection, thrust restraint, and the structural design of Ductile Iron pipe. This department coordinates field research at test sites throughout the United States and conducts numerous tests in the Birmingham laboratory. It also provides state-of-the-art laboratory assistance as backup for the Regional Engineers' activities.

Standards Development

From the earliest days of standardization in the United States, DIPRA has played an active role in the development of voluntary consensus standards. Association representatives sit on the standards-making committees of AWWA, ASME, ASCE, ASTM, NACE, NFPA, and ISO, ensuring that design and manufacturing standards for Ductile Iron pipe remain the most stringent and comprehensive in the industry.

Publications

The association provides a variety of brochures, magazines, and technical papers, including the popular *Installation Guide for Ductile Iron Pipe*, a handy pocket reference used by installation and maintenance crews and inspectors, and the *Ductile Iron Pipe News*, an online publication with news and features about the waterworks industry. DIPRA also offers numerous technical brochures, reports, and computer software programs at no charge to Ductile Iron pipe designers and users. These items can also be downloaded from DIPRA's Web site at www.dipra.org.

Call Us. We Want to Work With You.

We welcome consulting and utility engineers to take advantage of our many services. Contact your Regional Engineer if you have a problem or if you want to discuss what we have to offer. And you're welcome to contact our Birmingham Headquarters, 205 402-8700, at any time.

Technical research has been a vital part of DIPRA's operation since the organization's inception. Research into a variety of areas involving Ductile Iron pipe is conducted both in DIPRA's well-equipped laboratory in Birmingham and in numerous field test sites throughout the nation.

DIPRA's Regional Engineer Program offers the services of registered professional engineers who are knowledgeable in all aspects of Ductile Iron pipe. DIPRA's Regional Engineer services are available at no charge to utilities and consulting engineers throughout the United States and Canada.

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DUCTILE IRON PIPE
RESEARCH ASSOCIATION

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