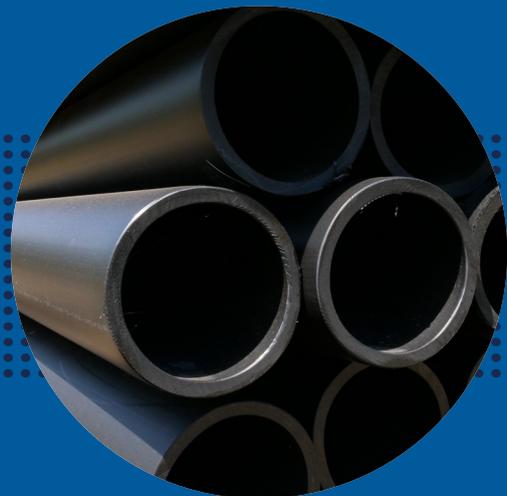




HDPE Irrigation Solutions



Precision-Built Pipe Systems.
Designed to Perform.





Rooted in Golf. Focused on Your Success.

In 1962, my father founded Kirchorfer Irrigation out of the back of his father's local hardware store—committed to quality, service and innovation in golf course irrigation. While we've evolved into ISCO Industries and expanded to serve various end markets, our roots in golf course irrigation remain strong.

Today, HDPE pipe is the gold standard for golf course irrigation, offering unmatched durability, efficiency, and performance. With 60+ years of experience, ISCO combines industry-leading expertise with a full range of products and services to ensure a seamless experience at every stage of your project—from system design and specification support to training, project management, and beyond.

At ISCO, we're more than the products we manufacture and sell—we're your partner in success. No company will work harder to earn your trust. Thank you for the opportunity to work with you. We look forward to making your next project a success.

Best,

Jimmy Kirchorfer
CEO - ISCO Industries



Kirchdorfer Irrigation Systems (KIS)

Unmatched expertise and reliability for golf course irrigation.

EXPERTISE AND EXPERIENCE. NATIONWIDE COVERAGE.

With 60+ years of golf course irrigation expertise and 30+ stocking locations across North America, KIS delivers the HDPE products and services trusted by courses nationwide.



PRODUCTS

- HDPE Pipe (Sticks & Coils)
- Snap-Tite® Liners
- Spirolite® Pipe
- Large-Diameter HDPE
- Fittings & Accessories
- Fabricated Structures (Wet Wells, Manholes, Tanks)
- Fusion Equipment & Tooling

SERVICES

- Prefabrication
- Technical Guidance
- Project Management
- Fusion Training
- Jobsite Support
- Equipment Rental/Purchase

EXPERIENCE

- Irrigation Piping
- Water Control
- Storage & Drainage
- Install/Maintain/Repair
- Field Technical Services



HDPE: Durable, Leak-Free Versatility

Superior to Every Traditional
Piping Material.

THE HDPE ADVANTAGE

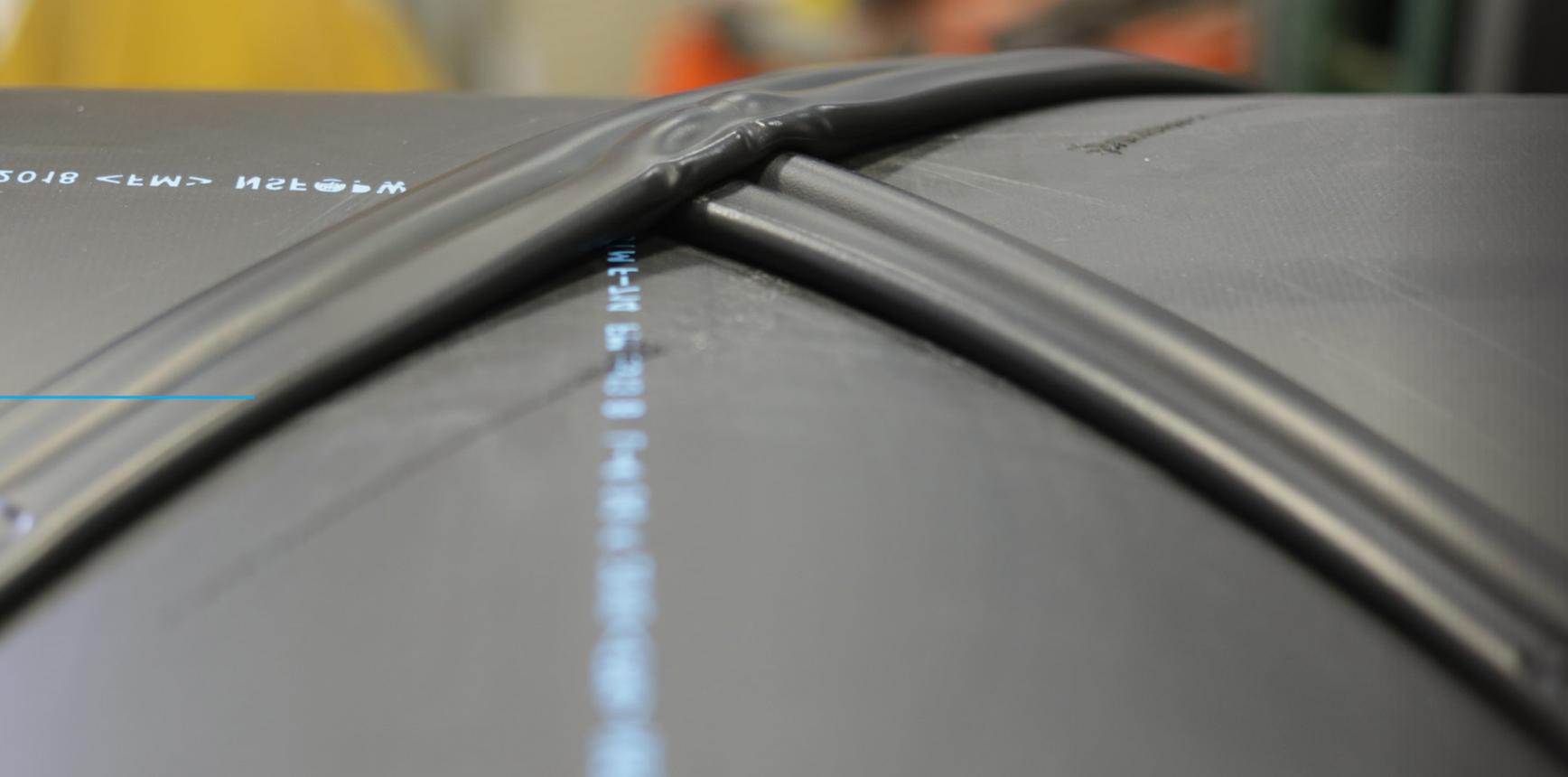
- Leak-free joints
- Durable, 100-year design life
- Lightweight/flexible
- Extreme surge tolerance
- Corrosion/chemical resistant
- Abrasion resistant
- Seismic resistant
- Faster/easier installation
- Low carbon footprint
- ASTM, ISO compliant

HDPE PERFORMS AT THE HIGHEST LEVEL

Its material strength, corrosion and chemical resistance, and leak-proof fusion joints contribute to 100-year product life and virtually maintenance-free solutions. It's lighter than steel, ductile iron or concrete for easier, faster and lower-cost installation, with a superior flow rate that lowers diameter requirements and material costs.

HDPE IS EASIER ON THE EARTH.

HDPE's material strength and leak-free joints keep liquids and gases in the pipe and out of the environment. Its flexibility provides a superior ability to withstand impacts, soil movement and seismic shifts, further ensuring against leaks. And HDPE's light weight contributes to a lower transportation carbon footprint.



HDPE IS BETTER.

COMPARE	HDPE ADVANTAGES	WHY HDPE?
HDPE vs. Carbon Steel/ Ductile Iron	<ul style="list-style-type: none"> - 100-year design life - No corrosion - Leak-proof joints - Lighter weight - Higher flow rates 	Steel and iron corrode, often causing leaks over time. HDPE is corrosion free, with leakfree fusion joinery; HDPE's lighter weight offers easier installation and environmental benefits. Higher flow ratings reduce pumping and pipe diameter requirements in HDPE.
HDPE vs. PVC	<ul style="list-style-type: none"> - 100-year design life - More durable/higher stress-crack resistance - Leakproof joints - Parts readily available 	Unlike HDPE, PVC is brittle, prone to crack runs, often requiring long section replacement. PVC uses bell & spigot joints; HDPE's fusion joining system is longer lasting and leakproof. PVC has been known to have parts availability issues.
HDPE vs. Fiberglass	<ul style="list-style-type: none"> - 100-year design life - Lower cost - No coatings 	Fiberglass often requires expensive coatings to extend design life. HDPE offers a much more durable, simpler and less costly solution.
HDPE vs. Concrete/Clay	<ul style="list-style-type: none"> - 100-year design life - High crack resistance - Leak-proof joints - Lighter weight - Higher flow rates 	HDPE is lighter weight and longer lasting, with significantly higher flow rates, crack resistance and leakproof joints, offering significant cost and environmental advantages over traditional concrete or clay pipe solutions.
HDPE vs. PEX	<ul style="list-style-type: none"> - HDPE proven/widely-adopted - No testing needed - Small- and large diameter applications 	PEX, a cross-linked polyethylene, is not widely adopted; often requires testing prior to specific application, which increases complexity and cost. PEX is appropriate only for smaller diameter applications.

SERVICES FOR GOLF COURSE IRRIGATION

FIELD FUSION TECHNICIANS

ISCO provides highly experienced, expert trained field fusion technicians for anything from conducting tailored fusion training programs to performing site work assistance for the contractor.

- **Fusion Training:** Our fusion technicians can conduct certification or demonstrative fusion training based on the needs of your project. All technicians hold McElroy fusion training certifications in accordance to ASTM 3190 training standards.
- **Fusion Hotline:** HDPE experts on call, staffed by trained McElroy mechanics and technicians
- **Field Fusion Assistance:** Fusion technicians can assist contractors or golf course staff with repairs, complex fusion parameters, or larger diameter fusion where contractor is not comfortable in fusion process or using larger diameter machines.

FUSION MACHINES

Whatever the project or need, ISCO has the HDPE fusion equipment and expertise to deliver the right solution.

ISCO is the industry leader in high density polyethylene (HDPE) piping solutions. With locations across the U.S. and Canada and fusion machine inventory we can get you exactly what you need, when and where you need it.

Rent, buy used or buy new. As North America's largest distributor of McElroy HDPE fusion machines, ISCO is your number one source, whether your preference is rental or purchase.

Largest and newest rental fleet in the industry. ISCO maintains the industry's largest and newest rental fleet. That means we have exactly the fusion machine you need, in great condition and ready to go to work.

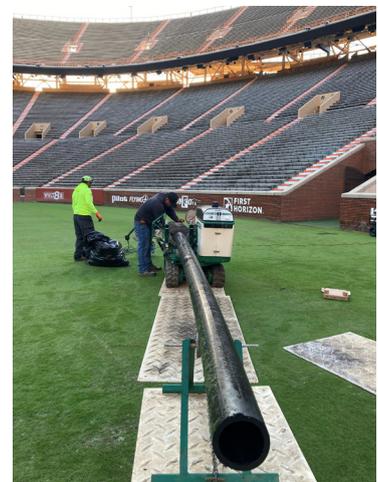
More than HDPE fusion machines. Total HDPE solutions. The right machine, along with the right pipe, fittings and fabrications. Provided with advice and training to make sure your project goes smoothly.

We excel at solving problems. Our fusion machine selection and expertise are second to none. Equally important is our attitude. We live to solve problems. Count on ISCO for customized, on-the-money solutions.

BUY-BACK PROGRAM

McElroy fusion equipment is in high demand, both for purchase and rental. We are always looking to expand inventory. The McElroy buy-back program is a win-win, both for ISCO and sellers. This is more than an opportunity for ISCO to expand its inventory of fusion equipment. It's a chance for fusion equipment owners to monetize assets they no longer need, working with a knowledgeable buyer that will put the equipment to good use.

If you are interested in selling your machine to ISCO, please visit isco-pipe.com/fusion-equipment/buyback-program



INSURANCE AND WARRANTY INFORMATION

25 YEAR LIMITED LIABILITY PRODUCT WARRANTY:

ISCO Industries warrants that, for a period of twenty-five years from the date of shipment, ISCO will replace any section of HDPE pipe, fitting, and/or valve product installed for the Project that is defective in materials or workmanship, provided that Buyer, upon delivery of a defect, promptly notifies ISCO of the defect and, as instructed by ISCO at such time, either returns the product to ISCO for inspection or allows ISCO to inspect at the place of installation.

If the product is determined to be defective, ISCO will provide new product of the same specification and same quality as the defective product and ISCO will bear the expense of freight to deliver the replacement product to the job site. ISCO does not warrant the installation of any product. Any defects introduced after the shipment of product by ISCO, whether due to handling, installation or other cause, are not covered by this warranty. This warranty does not cover labor or other cost of installing products. Buyer's sole remedy for defective product shall be to receive replacement product as provided in this limited warranty. Products found to be unsatisfactory in performance will not be considered for coverage under the terms of this warranty if no documented pressure testing was performed at the time of installation.

INSURANCE INFORMATION:

ISCO Industries, Inc. ("ISCO") carries certain product liability insurance coverages for the Project to protect ISCO and Buyer in the unlikely event of a Product failure caused by a manufacturing or design defect in the Products we supply.

Since 1962, ISCO has provided HDPE irrigation systems for golf courses across North America. With more than 60 years of experience, ISCO offers a complete range of HDPE pipe products and services, including system design assistance, specification support, certified training, and project coordination. ISCO has built a strong reputation for standing behind the products and services it provides, and remains committed to supporting its customers with proven expertise and responsive service. HDPE pipe systems are widely recognized for their long-term durability and performance in golf course irrigation applications.

Q: Does ISCO carry insurance coverage to cover material and labor costs in the event of a Product failure caused by a manufacturing or design defect in the Products we supply?

A: Yes. ISCO carries a general liability insurance policy and also a professional liability insurance policy. The coverage limits under these policies are individually \$5 million per occurrence and \$5 million in the aggregate.

Q: What does the general liability insurance policy cover?

A: This policy provides coverage in the event that a Product failure caused from a manufacturing or design defect results in bodily injury, including death, or third-party property damage. For property damage, ISCO's general liability insurance policy would cover such damage, including the material and labor costs associated with the removal of defective products, reinstallation of new replacement products (as provided under ISCO's limited warranty), and the repair of damage to the golf course.

Q: What does the professional liability insurance policy cover?

A: In the case where there is no property damage or bodily injury involved and the general liability insurance policy would not apply, the professional liability insurance policy further protects buyer by providing additional coverage for financial losses or loss of use suffered by Buyer directly associated with a Product failure caused by a manufacturing or design defect. This policy would also cover material and labor costs associated with the removal of defective products, and reinstallation of new replacement products (as provided under ISCO's limited warranty), including costs incurred to repair damage to the golf course caused by such removal and reinstallation.

HDPE PIPE

STANDARDS FOR HIGH DENSITY POLYETHYLENE (HDPE) PIPE

There are numerous standards and codes by which HDPE pipe and fittings are produced, designed and installed. Principle among these are the applicable standards published by ASTM International (formerly known as the American Society for Testing and Materials). Other additional standards and/or codes such as AWWA, DOT, API or others may apply to specific installations or uses of HDPE pipe as well. What follows is a partial listing of some of the principle standards pertaining to HDPE piping within the North American market area..

PIPE RESIN STANDARDS

ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fitting Materials. The quality of HDPE pipe starts with the resin from which it is produced. ASTM D3350 defines the basic physical property requirements of the polyethylene compound that is used to make the pipe or fittings.

PIPE DIMENSIONS AND MANUFACTURING STANDARDS

ASTM F714 - Standard Specification for Polyethylene (PE) Pipe (SDR-PR) Based on Outside Diameter. Pipe produced in accordance with this standard is used across a broad variety of municipal, industrial, and various water-related applications. This standard includes IPS, DIPS and metric sizing systems in nominal outside diameters from 3" - 54".

ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings. Polyethylene pipe and other plastics for natural gas distribution are described in great detail in this standard.

ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter. Most HDPE water tubing (½" to 3") is made to the dimensions in this standard. This standard was revised to include IPS sizes up through nominal 65" outside diameter and DIPS sizes up through nominal 48" outside diameter for municipally oriented PE pipe applications or services.

ASTM F2619 - Standard Specification for High Density Polyethylene (PE) Line Pipe. This standard includes HDPE pipe in sizes from ½" to 65" for various oil and gas producing applications such as oil, dry or wet gas, multiphase fluids and non-potable oil field water.

ASTM F3123 - Standard Specification for Metric Outside Diameter Polyethylene (PE) Plastic Pipe (DR-PN).

INSTALLATION STANDARDS

ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications

ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping

ASTM F585 - Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

ASTM F1668 - Standard Guide for Construction Practices for Buried Plastic Pipe

ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings

ASTM F2164 - Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure

HDPE PIPE

STANDARDS FOR HIGH DENSITY POLYETHYLENE (HDPE) PIPE (CONT.)

AMERICAN WATER WORKS ASSOCIATION STANDARDS

ANSI/AWWA C901 - Polyethylene Pressure Pipe and Tubing, .5 in. (13 mm) Through 3 in. (76 mm) for Water Service

ANSI/AWWA C906 - Polyethylene Pipe and Fittings, 4 in. (100 mm) through 63 in. (1,575 mm) for Water Distribution

PIPE JOINING STANDARDS

ASTM F2620 - Standard Practice for Heat Fusion of Polyethylene Pipe and Fittings

ASTM D2657 - Standard Practice of Heat Fusion Joining of Polyolefin Pipe and Fittings

ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

FITTING STANDARDS

ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM F1055 - Standard Specification for Electrofusion Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing

ASTM F1759 - Standard Practice for Design of High Density Polyethylene (HDPE) Manholes for Subsurface Applications

ASTM F2206 - Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock or Block Stock

ASTM F2880 - Standard Specification for Lap-Joint Type Flange Adapters for Polyethylene Pressure Pipe in Nominal Pipe Sizes 3/4 in. to 65 in.

CANADIAN STANDARDS ASSOCIATION

CAN/CSA137 - Thermoplastic Pressure Piping Compendium

OTHER USEFUL REFERENCES

Handbook of Polyethylene Pipe, A publication of the Plastics Pipe Institute (www.plasticpipe.org)

AWWA M55, PE Pipe - Design and Installation, A Manual of Water Supply Practices published by the American Water Works Association

Questions?
800-345-ISCO (4726)

PIPE

**Keeping your course flowing smoothly.
We've got irrigation covered nationwide.**



ISCO Industries, Inc. Headquarters
100 Witherspoon Street | Louisville, KY 40202
isco-pipe.com



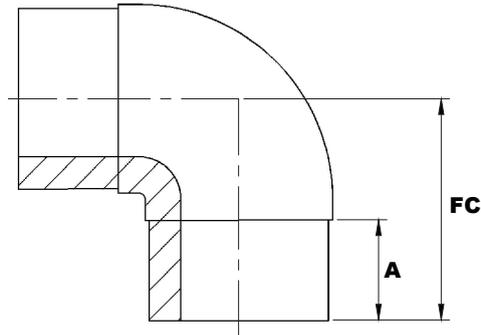
4710 HDPE PIPE SIZES - IPS

DR	9	11	13.5	17
PE4710 Pressure Rating	250 psi	200 psi	160 psi	125 psi

Product No.	Description	Actual OD	Min Wall (in)	Avg ID (in)	Weight (lb/ft)
10021116	2" DR 11 IPS PIPE HDPE NSF D3035	2.375	0.216	1.917	0.642
10021123	2" DR 11 IPS 500' COILS HDPE NSF	2.375	0.216	1.917	0.642
10021120	2" DR 11 IPS 2000' COILS PIPE HDPE NSF	2.375	0.216	1.917	0.642
10021315	2" DR 13.5 IPS PIPE HDPE NSF	2.375	0.176	2.002	0.534
10021310	2" DR 13.5 IPS 500' COILS HDPE	2.375	0.176	2.002	0.534
10021318	2" DR 13.5 IPS PIPE 2000' COILS HDPE	2.375	0.176	2.002	0.534
10031118	3" DR 11 IPS PIPE HDPE NSF	3.5	0.318	2.825	1.395
10031119	3" DR 11 IPS 500' COILS PIPE HDPE NSF	3.5	0.318	2.825	1.395
10031311	3" DR 13.5 IPS PIPE HDPE NSF	3.5	0.259	2.95	1.16
10031313	3" DR 13.5 IPS 500' COILS NSF	3.5	0.259	2.95	1.16
10041121	4" DR 11 IPS PIPE HDPE AWWA	4.5	0.409	3.633	2.31
10041312	4" DR 13.5 IPS PIPE HDPE AWWA	4.5	0.333	3.793	1.92
10061122	6" DR 11 IPS PIPE HDPE AWWA	6.625	0.602	5.348	4.93
10061314	6" DR 13.5 IPS PIPE HDPE AWWA	6.625	0.491	5.585	4.152
10081122	8" DR 11 IPS PIPE HDPE AWWA	8.625	0.784	6.963	8.47
10081314	8" DR 13.5 IPS PIPE HDPE AWWA	8.625	0.639	7.271	7.04
10101117	10" DR 11 IPS PIPE HDPE AWWA	10.75	0.977	8.678	13.16
10101313	10" DR 13.5 IPS PIPE HDPE AWWA	10.75	0.796	9.062	10.932
10121118	12" DR 11 IPS PIPE HDPE AWWA	12.75	1.159	10.293	18.51
10121311	12" DR 13.5 IPS PIPE HDPE AWWA	12.75	0.944	10.748	15.38
10141116	14" DR 11 IPS PIPE HDPE AWWA	14	1.273	11.302	22.32
10141310	14" DR 13.5 IPS PIPE HDPE AWWA	14	1.037	11.801	18.54
10161115	16" DR 11 IPS PIPE HDPE AWWA	16	1.455	12.916	29.15
10161313	16" DR 13.5 IPS PIPE HDPE AWWA	16	1.185	13.487	24.22

- Pressures are based on using water at 23°C (73°F).
- Average inside diameter calculated using actual OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
- Standard Lengths:
 - 40' for 2"-24"
 - 50' for 26" and larger
 - Coils available for ¾ - 4" (6" by special order)
- More sizes & DRs available upon request. Color striping is also available upon request.

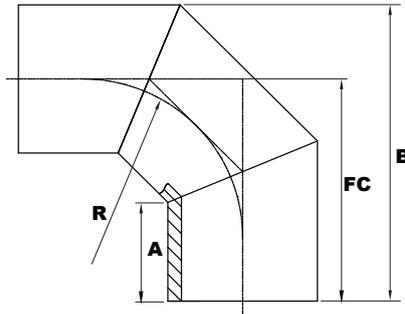
90° Elbow Molded



DR	17	11	9	7
Pressure Rating	125 psi	200 psi	250 psi	335 psi

Product No.	Description	OD (in)	A (in)	FC (in)
50021117	2" DR 11 IPS 90 DEG ELBOW MOLDED	2.375	2.54	4.68
50031114	3" DR 11 IPS 90 DEG ELBOW MOLDED	3.5	3.16	6.75
50041121	4" DR 11 IPS 90 DEG ELBOW MOLDED	4.5	3.875	6.38
50061124	6" DR 11 IPS 90 DEG ELBOW MOLDED	6.625	4.5	8.63
50081123	8" DR 11 IPS 90 DEG ELBOW MOLDED	8.625	6.1	11.1
50101113	10" DR 11 IPS 90 DEG ELBOW MOLDED	10.75	6	13.25
50121114	12" DR 11 IPS 90 DEG ELBOW MOLDED	12.75	8	15.25

90° Elbow Fabricated Three-Segment Mitered Bend

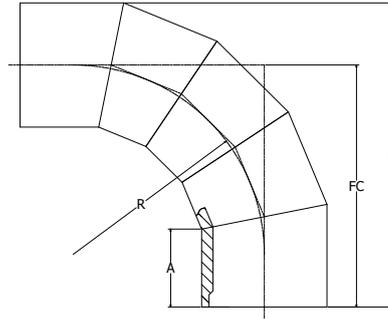


Feedstock DR	17	13.5	11	9	7
Pressure Rating	100 psi	125 psi	160 psi	200 psi	250 psi
EDR	21	17	13.5	11	9

Product No.	Description	OD (in)	A (in)	B (in)	FC (in)	R (in)
40081113	8" DR 11 IPS 90 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	8.625	6.5	19.7212	15.4087	12.1587
40101112	10" DR 11 IPS 90 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	10.75	6.5	21.4926	16.1176	12.6176
40121112	12" DR 11 IPS 90 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	12.75	8.5	25.4926	19.1176	13.6176
40141159	14" DR 11 IPS 90 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	14	8.5	26.7426	19.7426	14.2426
40161112	16" DR 11 IPS 90 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	16	8.5	29.4497	21.4497	16.4497

1. Elbows other than 90° and 45° are available as an FM Approved fabricated fitting. Contact your ISCO representative for availability and dimensions.
2. EDR (Equivalent Dimensional Ratio) - The EDR is the DR of the piping system for which the fabricated fittings is intended to be butt fused.
3. Larger sizes available upon request.

90° Elbow Fabricated Five-Segment Mitered Bend

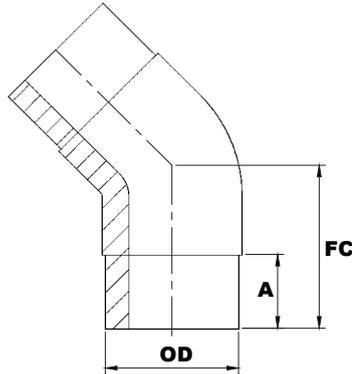


Feedstock DR	17	13.5	11	9	7
Pressure Rating	100 psi	125 psi	160 psi	200 psi	250 psi
EDR	21	17	13.5	11	9

Product No.	Description	OD (in)	A (in)	B (in)	FC (in)	R (in)
40081127	8" DR 11 IPS 90 DEG ELBOW 5-SEG FAB HDPE EDR 13.5	8.625	6.5	24.6899	20.3774	16.2524
40101128	10" DR 11 IPS 90 DEG ELBOW 5-SEG FAB HDPE EDR 13.5	10.75	6.5	26.8149	21.4399	17.3149
40121135	12" DR 11 IPS 90 DEG ELBOW 5-SEG FAB HDPE EDR 13.5	12.75	8	31.2211	24.8461	19.4461
40141131	14" DR 11 IPS 90 DEG ELBOW 5-SEG FAB HDPE EDR 13.5	14	8	33.2766	26.2766	21.0766
40161138	16" DR 11 IPS 90 DEG ELBOW 5-SEG FAB HDPE EDR 13.5	16	8	36.8875	28.8875	24.0875

1. Elbows other than 90° and 45° are available as an FM Approved fabricated fitting. Contact your ISCO representative for availability and dimensions.
2. EDR (Equivalent Dimensional Ratio) - The EDR is the DR of the piping system for which the fabricated fittings is intended to be butt fused.
3. Larger sizes available upon request.

45° Elbow Molded

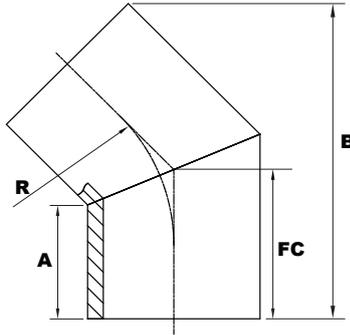


DR	17	11	9	7
Pressure Rating	125 psi	200 psi	250 psi	333 psi

Product No.	Description	OD (in)	A (in)	FC (in)
50021116	2" DR 11 IPS 45 DEG ELBOW MOLDED	2.375	2.45	3.5
50031113	3" DR 11 IPS 45 DEG ELBOW MOLDED	3.5	3.55	6
50041120	4" DR 11 IPS 45 DEG ELBOW MOLDED	4.5	3.75	6.25
50061123	6" DR 11 IPS 45 DEG ELBOW MOLDED	6.625	4.75	8.5
50081122	8" DR 11 IPS 45 DEG ELBOW MOLDED	8.625	6.55	9.75
50101112	10" DR 11 IPS 45 DEG ELBOW MOLDED	10.75	6.25	13.38
50121113	12" DR 11 IPS 45 DEG ELBOW MOLDED	12.75	8	15.75

1. Some size/DR combinations may have limited availability.
2. Other DRs available with counter-bored ID at fitting end.
3. Larger sizes available upon request.

45° Elbow Fabricated Two-Segment Mitered Bend

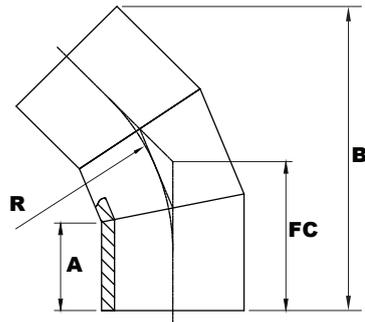


Feedstock DR	17	13.5	11	9	7
Pressure Rating	100 psi	125 psi	160 psi	200 psi	250 psi
EDR	21	17	13.5	11	9

Product No.	Description	OD (in)	A (in)	B (in)	FC (in)	R (in)
40081139	8" DR 11 IPS 45 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	8.625	6.5	17.195	8.2863	12.1587
40101111	10" DR 11 IPS 45 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	10.75	6.5	18.6976	8.7264	12.6176
40121105	12" DR 11 IPS 45 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	12.75	8.5	23.526	11.1406	13.6176
40141110	14" DR 11 IPS 45 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	14	8.5	24.4099	11.3995	14.2426
40161164	16" DR 11 IPS 45 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	16	8.5	25.8241	11.8137	15.2426

1. Elbows other than 90° and 45° are available as an FM Approved fabricated fitting. Contact your ISCO representative for availability and dimensions.
2. EDR (Equivalent Dimensional Ratio) - The EDR is the DR of the piping system for which the fabricated fittings is intended to be butt fused.
3. Larger sizes available upon request.

45° Elbow Fabricated Three-Segment Mitered Bend

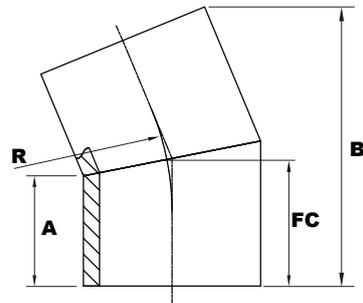


Feedstock DR	17	13.5	11	9	7
Pressure Rating	100 psi	125 psi	160 psi	200 psi	250 psi
EDR	21	17	13.5	11	9

Product No.	Description	OD (in)	A (in)	B (in)	FC (in)	R (in)
40081126	8" DR 11 IPS 45 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	8.625	6.5	21.5834	10.857	16.2524
40101132	10" DR 11 IPS 45 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	10.75	6.5	23.0860	11.2971	17.3149
40121133	12" DR 11 IPS 45 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	12.75	8	27.4766	13.4548	19.4461
40141130	14" DR 11 IPS 45 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	14	8	28.7301	13.9302	21.0766
40161137	16" DR 11 IPS 45 DEG ELBOW 3-SEG FAB HDPE EDR 13.5	16	8	30.8834	14.7774	24.0875

1. Elbows other than 90° and 45° are available as an FM Approved fabricated fitting. Contact your ISCO representative for availability and dimensions.
2. EDR (Equivalent Dimensional Ratio) - The EDR is the DR of the piping system for which the fabricated fittings is intended to be butt fused.
3. Larger sizes available upon request.

22.5° Elbow Fabricated Two-Segment Mitered Bend

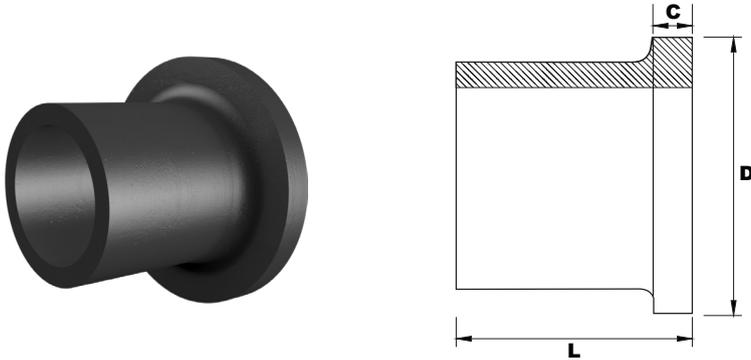


Feedstock DR	17	13.5	11	9	7
Pressure Rating	100 psi	125 psi	160 psi	200 psi	250 psi
EDR	21	17	13.5	11	9

Product No.	Description	OD (in)	A (in)	B (in)	FC (in)	R (in)
40021141	2" DR 11 IPS 22.5 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	2.375	4	8.6044	4.2362	13.1274
40031112	3" DR 11 IPS 22.5 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	3.5	4	9.0349	4.3481	13.6899
40041117	4" DR 11 IPS 22.5 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	4.5	5	11.3415	5.4476	14.1899
40061118	6" DR 11 IPS 22.5 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	6.625	6	14.0786	6.6589	15.2524
40081125	8" DR 11 IPS 22.5 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	8.625	6.5	15.8059	7.3578	16.2524
40101126	10" DR 11 IPS 22.5 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	10.75	6.5	16.6191	7.5692	17.3149
40121130	12" DR 11 IPS 22.5 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	12.75	8	20.2703	9.2681	19.4461
40141129	14" DR 11 IPS 22.5 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	14	8	20.7486	9.3924	21.0766
40161136	16" DR 11 IPS 22.5 DEG ELBOW 2-SEG FAB HDPE EDR 13.5	16	8	21.514	9.5913	24.0875

1. Elbows other than 90° and 45° are available as an FM Approved fabricated fitting. Contact your ISCO representative for availability and dimensions.
2. EDR (Equivalent Dimensional Ratio) - The EDR is the DR of the piping system for which the fabricated fittings is intended to be butt fused.
3. Larger sizes available upon request.

Flange Adapter

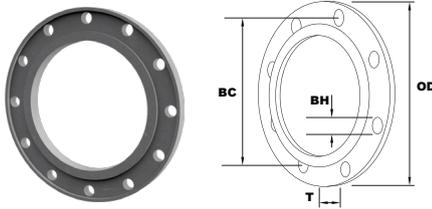


DR	17	13.5	11	9	7
Pressure Rating	125 psi	160 psi	200 psi	250 psi	333 psi

Product No.	Description	OD (in)	D (in)	L (in)	T (in)
50021115	2" DR 11 IPS FLANGE ADAPTER	2.375	4	6	0.45
50031112	3" DR 11 IPS FLANGE ADAPTER	3.5	5	6	0.67
50041119	4" DR 11 IPS FLANGE ADAPTER	4.5	6.598	6	0.896
50061122	6" DR 11 IPS FLANGE ADAPTER	6.625	8.5	8	0.895
50081121	8" DR 11 IPS FLANGE ADAPTER	8.625	10.598	9	1.12
50101117	10" DR 11 IPS FLANGE ADAPTER	10.75	12.799	10.75	1.455
50121119	12" DR 11 IPS FLANGE ADAPTER	12.75	15.252	11	1.725
50141114	14" DR 11 IPS FLANGE ADAPTER	14	17.5	11	1.905
50161113	16" DR 11 IPS FLANGE ADAPTER	16	20	12	2.13

*Other sizes and DRs available upon request

Ductile Iron Back Up Rings - For use with Flange Adapter



Product No.	Description	Pipe OD (in)	Pressure Rating (psi)	OD (in)	BC (in)	BH (in)	T (in)	Bolt #
53020022	2" DR 11 IPS BACKUP RING DUCTILE IRON	2.375	200	6	4.75	0.75	0.5	4
53030022	3" DR 11 IPS BACKUP RING DUCTILE IRON	3.5	200	7.5	6	0.75	0.53	4
53040024	4" DR 11 IPS BACKUP RING DUCTILE IRON	4.5	200	9	7.5	0.75	0.55	8
53060031	6" DR 11 IPS BACKUP RING DUCTILE IRON	6.625	200	11	9.5	0.875	0.63	8
53080032	8" DR 11 IPS BACKUP RING DUCTILE IRON	8.625	200	13.5	11.75	0.875	0.85	8
53100028	10" DR 11 IPS BACKUP RING DUCTILE IRON	10.75	200	16	14.25	1	0.98	12
53120030	12" DR 11 IPS BACKUP RING DUCTILE IRON	12.75	200	19	17	1	1.25	12

Stainless Steel Back Up Rings - For use with Flange Adapter

Product No.	Description	Pipe OD (in)	Pressure Rating (psi)	OD (in)	BC (in)	BH (in)	T (in)	Bolt #
53020012	2" DR 7 IPS 316 SS BACKUP RING	2.375	335	6	4.75	0.75	0.75	4
53030716	3" DR 7 IPS 316 SS BACKUP RING	3.5	335	7.5	6	0.75	0.94	4
53040721	4" DR 7 IPS 316 SS BACKUP RING	4.5	335	9	7.5	0.75	0.94	8
53060713	6" DR 7 IPS 316 SS BACKUP RING	6.625	335	11	8.5	0.875	1	8
53080715	8" DR 7 IPS 316 SS BACKUP RING	8.625	335	13.5	11.75	0.875	1.13	8
53100718	10" DR 7 IPS 316 SS BACKUP RING	10.75	335	16	14.25	1	1.19	12
53120717	12" DR 7 IPS 316 SS BACKUP RING	12.75	335	19	17	1	1.5	12

Epoxy Coated Ductile Iron Back Up Rings - For use with Flange Adapter

Product No.	Description	Pipe OD (in)	Pressure Rating (psi)	OD (in)	BC (in)	BH (in)	T (in)	Bolt #
53020710	2" DR 7 IPS EPOXY COATED D.I. BACKUP RING	2.375	335	6.46	4.75	0.75	0.71	4
53030710	3" DR 7 IPS EPOXY COATED D.I. BACKUP RING	3.5	335	7.72	6	0.75	0.73	4
53040719	4" DR 7 IPS EPOXY COATED D.I. BACKUP RING	4.5	335	9.33	7.5	0.75	0.98	8
53060717	6" DR 7 IPS EPOXY COATED D.I. BACKUP RING	6.625	335	11.69	9.5	0.875	1.18	8
53080718	8" DR 7 IPS EPOXY COATED D.I. BACKUP RING	8.625	335	13.94	11.75	0.875	1.34	8
53100715	10" DR 7 IPS EPOXY COATED D.I. BACKUP RING	10.75	335	16.73	14.25	1	1.52	12
53120713	12" DR 7 IPS EPOXY COATED D.I. BACKUP RING	12.75	335	19.57	17	1	2.01	12

*Other sizes and DRs available upon request

*Standard surface treatment is painted primer. Optional surface treatments are available as galvanized, epoxy-coated, or powder-coated. Availabilities may be extended.

Zinc Plated Boltpacks - For use with Flange Adapter

Product No.	Description
53021014	2" STD BOLTPACK MFA & BUR (4) 5/8" X 4" BOLT W/ NUT & WASH (ZN-PLATED)
53031011	3" STD BOLTPACK MFA & BUR (4) 5/8" X 5" BOLT W/ NUT & WASH (ZN-PLATED)
53041011	4" STD BOLTPACK MFA & BUR (8) 5/8" X 5 1/4" BOLT W/ NUT & WASH (ZN-PLATED)
53061012	6" STD BOLTPACK MFA & BUR (8) 3/4" X 5 1/7" BOLT W/ NUT & WASH (ZN-PLATED)
53080070	8" STD BOLTPACK MFA & BUR (8) 3/4" X 6 1/8" BOLT W/ NUT & WASH (ZN-PLATED)
53100045	10" STD BOLTPACK MFA & BUR (12) 7/8" X 7 3/4" BOLT W/ NUT & WASH (ZN-PLATED)
53120038	12" STD BOLTPACK MFA & BUR (12) 7/8" X 8 1/2" BOLT W/ NUT & WASH (ZN-PLATED)

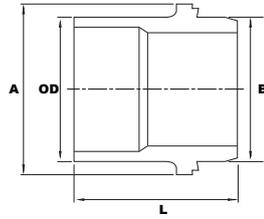
Stainless Steel Boltpacks - For use with Flange Adapter

Product No.	Description
53021012	2" (304 SS) STD BOLTPACK (4) 5/8" X 4" STUD, NUT, WSH
53031012	3" (304 SS) STD BOLTPACK (4) 5/8" X 5" STUD, NUT, WSH
53041012	4"(304 SS) STD BOLTPACK (8) 5/8" X 5 1/4" STUD, NUT, WSH
53061013	6" (304 SS) STD BOLTPACK (8) 3/4" X 5 7/8" STUD, NUT, WSH
53080072	8" (304 SS) STD BOLTPACK (8) 3/4" X 6 1/8" STUD, NUT, WSH
53100047	10" (304 SS) STD BOLTPACK (12) 7/8" X 7 3/4" STUD, NUT, WSH
53120040	12"(304 SS) STD BOLTPACK (12) 7/8" X 8 1/2" STUD, NUT, WSH

Neoprene Gaskets - For use with Flange Adapter

Product No.	Description
53021018	2" NEOPRENE GASKET 1/8" THICK
53031017	3" NEOPRENE GASKET 1/8" THICK
53041018	4" NEOPRENE GASKET 1/8" THICK
53061016	6" NEOPRENE GASKET 1/8" THICK
53080076	8" NEOPRENE GASKET 1/8" THICK
53100048	10" NEOPRENE GASKET 1/8" THICK
53120046	12" NEOPRENE GASKET 1/8" THICK

Mechanical Joint Adapters



DR	17	11	9
Pressure Rating	125 psi	200 psi	250 psi

Product No.	Description	OD (in)	A (in)	B (in)	L (in)
53021135	2" DR 11 IPS MJ ADAPTER ONLY PE W/ SS STIFFENER	2.375	3.5	2.5	8
53031133	3" DR 11 IPS MJ ADAPTER ONLY PE W/ SS STIFFENER	3.5	5.37	3.96	8.5
53041138	4" DR 11 IPS MJ ADAPTER ONLY PE W/ SS STIFFENER	4.5	6.63	4.8	8
53061133	6" DR 11 IPS MJ ADAPTER ONLY PE W/ SS STIFFENER	6.625	8.63	6.9	9.5
53081129	8" DR 11 IPS MJ ADAPTER ONLY PE W/ SS STIFFENER	8.625	10.75	9.05	11.5
53101126	10" DR 11 IPS MJ ADAPTER ONLY PE W/ SS STIFFENER	10.75	12.75	11.1	13
53121125	12" DR 11 IPS MJ ADAPTER ONLY PE W/ SS STIFFENER	12.75	15.25	13.2	13.5

*MJ adapters are available without stiffener. Stiffener not required.

Mechanical Joint Accessory Kits



Product No.	Description
53020074	2" ACCESSORY KIT C110 FOR MJ ADAPTER W/ GLAND, BOLTS, GASKET
53030056	3" ACCESSORY KIT C110 FOR MJ ADAPTER W/ GLAND, BOLTS, GASKET
53040073	4" ACCESSORY KIT C110 FOR MJ ADAPTER W/ GLAND, BOLTS, GASKET
53060081	6" ACCESSORY KIT C110 FOR MJ ADAPTER W/ GLAND, BOLTS, GASKET
53080093	8" ACCESSORY KIT C110 FOR MJ ADAPTER W/ GLAND, BOLTS, GASKET
53100063	10" ACCESSORY KIT C110 FOR MJ ADAPTER W/ GLAND, BOLTS, GASKET
53120059	12" ACCESSORY KIT C110 FOR MJ ADAPTER W/ GLAND, BOLTS, GASKET

*C153 also available.

Mechanical Joint Accessory Kits - Stainless Steel



Product No.	Description
53030123	3" ACC KIT C110 FOR MJ ADAP W/ GLAND BOLTS
53040132	4" ACC KIT C110 FOR MJ ADAP W/ GLAND BOLTS
53060140	6" ACC KIT C110 FOR MJ ADAP W/ GLAND BOLTS
53080150	8" ACC KIT C110 FOR MJ ADAP W/ GLAND BOLTS
53100117	10" ACC KIT C110 FOR MJ ADAP W/ GLAND BOLTS
53120117	12" ACC KIT C110 FOR MJ ADAP W/ GLAND BOLTS

*Larger sizes available upon request

*C153 Stainless Steel also available.

Mechanical Joint Accessory Kits - Cor-Blue



Description:

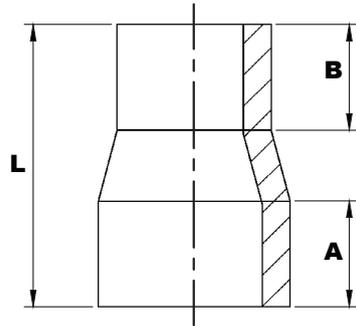
Non-stick fluoropolymer coating that offers exceptional durability and resistance when used in severe environments.

Product No.	Description
53030118	3" ACC KIT C153 FOR MJ ADAP W/ GLAND BOLTS GASKET COR-BLUE USA
53040130	4" ACC KIT C153 FOR MJ ADAP W/ GLAND BOLTS GASKET COR-BLUE USA
53060136	6" ACC KIT C153 FOR MJ ADAP W/ GLAND BOLTS GASKET COR-BLUE USA
53080146	8" ACC KIT C153 FOR MJ ADAP W/ GLAND BOLTS GASKET COR-BLUE USA
53100113	10" ACC KIT C153 FOR MJ ADAP W/ GLAND BOLTS GASKET COR-BLUE USA
53120113	12" ACC KIT C153 FOR MJ ADAP W/ GLAND BOLTS GASKET COR-BLUE USA

*Larger sizes available upon request

*C110 also available.

Concentric Reducers

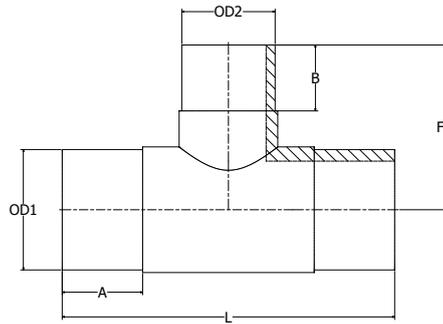


DR	17	11	9
Pressure Rating	125 psi	200 psi	250 psi

Product No.	Description	OD1 (in)	OD2 (in)	A (in)	B (in)	L (in)
50011117	1-1/2" x 1" DR 11 IPS CONCENTRIC REDUCER	1.9	1.315	3.7	1.35	6.35
50021125	2" X 1" DR 11 IPS CONCENTRIC REDUCER	2.375	1.315	3	1.525	6.15
50021122	2" X 1-1/2" DR 11 IPS CONCENTRIC REDUCER	2.375	1.9	3.125	2.8	7.2
50031122	3" X 2" DR 11 IPS CONCENTRIC REDUCER	3.5	2.375	3.25	2.63	7.15
50041129	4" X 2" DR 11 IPS CONCENTRIC REDUCER	4.5	2.375	3.38	2.75	7.88
50041132	4" X 3" DR 11 IPS CONCENTRIC REDUCER	4.5	3.5	3.38	3.25	7.88
50061132	6" X 3" DR 11 IPS CONCENTRIC REDUCER	6.625	3.5	5.06	3.78	11.18
50061136	6" X 4" DR 11 IPS CONCENTRIC REDUCER	6.625	4.5	4.38	3.75	9.25
40081133	8" X 4" DR 11 IPS CONCENTRIC REDUCER	8.625	4.5	4.65	3.55	11.425
50081138	8" X 6" DR 11 IPS CONCENTRIC REDUCER	8.625	6.625	5.06	4.88	11.75
40101137	10" X 6" DR 11 IPS CONCENTRIC REDUCER	10.75	6.625	6	6	12
50101126	10" X 8" DR 11 IPS CONCENTRIC REDUCER	10.75	8.625	6.5	6.5	15
50121135	12" X 8" DR 11 IPS CONCENTRIC REDUCER	12.75	8.625	6.65	6.55	15
50121121	12" X 10" DR 11 IPS CONCENTRIC REDUCER	12.75	10.75	6.5	6.5	15.25
40141135	14" X 10" DR 11 IPS CONCENTRIC REDUCER	14	10.75	7	7	14
40141137	14" X 12" DR 11 IPS CONCENTRIC REDUCER	14	12.75	7	7	14

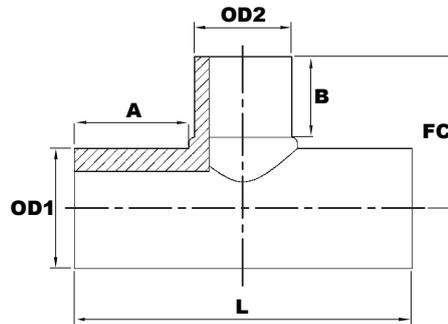
*More sizes available upon request.

Reducing Tees Molded



Product No.	Description	OD1 (in)	OD2 (in)	A (in)	B (in)	FC (in)	L (in)
50031138	3" X 2" DR 11 IPS REDUCING TEE MOLDED	3.5	2.375	3.62	2.48	5.9	11.8
50041156	4" X 2" DR 11 IPS REDUCING TEE MOLDED	4.5	2.375	3.94	2.48	6.89	13.78
50041160	4" X 3" DR 11 IPS REDUCING TEE MOLDED	4.5	3.5	3.94	3.62	6.89	13.78
50061168	6" X 2" DR 11 IPS REDUCING TEE MOLDED	6.625	2.375	4.72	2.48	9.06	18.1
50061169	6" X 3" DR 11 IPS REDUCING TEE MOLDED	6.625	3.5	4.72	3.62	9.06	18.1
50061166	6" X 4" DR 11 IPS REDUCING TEE MOLDED	6.625	4.5	4.72	3.94	9.06	18.1
50081173	8" X 3" DR 11 IPS REDUCING TEE MOLDED	8.625	3.5	5.71	3.62	11.8	23.6
50081168	8" X 4" DR 11 IPS REDUCING TEE MOLDED	8.625	4.5	5.71	3.94	11.8	23.6
50081169	8" X 6" DR 11 IPS REDUCING TEE MOLDED	8.625	6.625	5.71	4.72	11.8	23.6
50101149	10" X 4" DR 11 IPS REDUCING TEE MOLDED	10.75	4.5	6.3	3.94	13.78	27.4
50101150	10" X 6" DR 11 IPS REDUCING TEE MOLDED	10.75	6.625	6.3	4.72	13.78	27.4
50101151	10" X 8" DR 11 IPS REDUCING TEE MOLDED	10.75	8.625	6.3	5.71	13.78	27.4
50121173	12" X 6" DR 11 IPS REDUCING TEE MOLDED	12.75	6.625	7.48	4.72	15.95	31.4
50121172	12" X 8" DR 11 IPS REDUCING TEE MOLDED	12.75	8.625	7.48	5.71	15.95	31.4

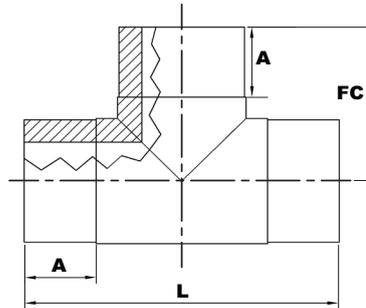
Reducing Tee Fabricated



Feedstock DR	17	13.5	11	9
Pressure Rating	125 psi	160 psi	200 psi	250 psi
EDR	17	13.5	11	9

Product No.	Description	OD1 (in)	OD2 (in)	A (in)	B (in)	FC (in)	L (in)
40031117	3" X 2" DR 11 IPS REDUCING TEE FABBED	3.5	2.375	6.675	5.85	8.175	16
40041126	4" X 2" DR 11 IPS REDUCING TEE FABBED	4.5	2.375	6.675	5.85	8.675	16
40041127	4" X 3" DR 11 IPS REDUCING TEE FABBED	4.5	3.5	10	4.875	7.5	24
40061123	6" X 2" DR 11 IPS REDUCING TEE FABBED	6.625	2.375	6.675	5.85	9.7375	16
40061125	6" X 3" DR 11 IPS REDUCING TEE FABBED	6.625	3.5	10	4.875	8.8125	24
40061126	6" X 4" DR 11 IPS REDUCING TEE FABBED	6.625	4.5	9.5	4.8	8.9875	24
40081131	8" X 2" DR 11 IPS REDUCING TEE FABBED	8.625	2.375	6.675	5.85	10.7375	16
40081132	8" X 3" DR 11 IPS REDUCING TEE FABBED	8.625	3.5	10	4.875	9.8125	24
40081134	8" X 4" DR 11 IPS REDUCING TEE FABBED	8.625	4.5	9.5	4.8	10.2375	24
40081137	8" X 6" DR 11 IPS REDUCING TEE FABBED	8.625	6.625	10.3125	6.625	11.4125	28
40101133	10" X 2" DR 11 IPS REDUCING TEE FABBED	10.75	2.375	6.675	5.85	11.8	16
40101134	10" X 3" DR 11 IPS REDUCING TEE FABBED	10.75	3.5	10	4.875	10.875	24
40101135	10" X 4" DR 11 IPS REDUCING TEE FABBED	10.75	4.5	9.5	4.8	11.3	24
40101138	10" X 6" DR 11 IPS REDUCING TEE FABBED	10.75	6.625	10.3125	6.625	13.125	28
40101141	10" X 8" DR 11 IPS REDUCING TEE FABBED	10.75	8.625	10.375	6.575	13.575	30
40121142	12" X 2" DR 11 IPS REDUCING TEE FABBED	12.75	2.375	6.675	5.85	12.8	16
40121143	12" X 3" DR 11 IPS REDUCING TEE FABBED	12.75	3.5	10	4.875	11.875	24
40121144	12" X 4" DR 11 IPS REDUCING TEE FABBED	12.75	4.5	9.5	4.8	12.3	24
40121146	12" X 6" DR 11 IPS REDUCING TEE FABBED	12.75	6.625	10.3125	6.625	14.125	28
40121151	12" X 8" DR 11 IPS REDUCING TEE FABBED	12.75	8.625	10.3750	6.575	14.575	30
40121141	12" X 10" DR 11 IPS REDUCING TEE FABBED	12.75	10.75	9.25	6	12.875	30

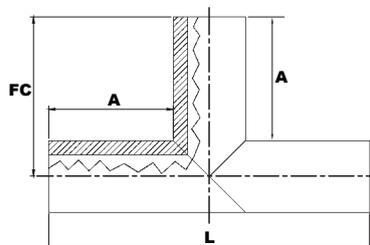
Molded Tees



DR	17	11	9	7
Pressure Rating	125 psi	200 psi	250 psi	333 psi

Product No.	Description	OD (in)	A (in)	FC (in)	L (in)
50021119	2" DR 11 IPS TEE MOLDED	2.375	2.54	4.63	9.25
50031116	3" DR 11 IPS TEE MOLDED	3.5	3.19	5.88	11.83
50041123	4" DR 11 IPS TEE MOLDED	4.5	3.88	7.25	14.5
50061126	6" DR 11 IPS TEE MOLDED	6.625	5.5	9	18.13
50081125	8" DR 11 IPS TEE MOLDED	8.625	6.13	11.75	23.5
50101118	10" DR 11 IPS TEE MOLDED	10.75	6.44	13.38	26.75
50121118	12" DR 11 IPS TEE MOLDED	12.75	7.88	15.94	32.13

Fabricated Tees

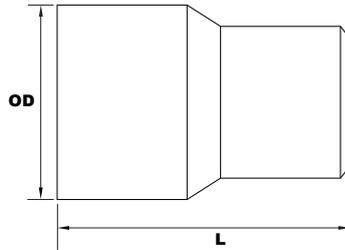


Feedstock DR	17	13.5	11	9	7
Pressure Rating	100 psi	125 psi	160 psi	200 psi	250 psi
EDR	21	17	13.5	11	9

Product No.	Description	OD (in)	A (in)	FC (in)	L (in)
40101130	10" DR 11 IPS TEE FAB HDPE EDR 13.5	10.75	6.5	11.875	23.75
40121137	12" DR 11 IPS TEE FAB HDPE EDR 13.5	12.75	8	14.375	28.75

*Larger sizes available upon request.

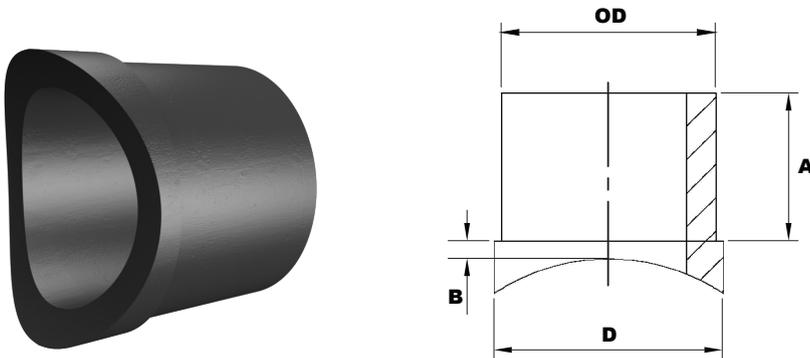
Molded End Caps



DR	17	11	9	7
Pressure Rating	125 psi	200 psi	250 psi	333 psi

Product No.	Description	OD (in)	L (in)
50021118	2" DR 11 IPS END CAP MOLDED HDPE	2.375	2.94
50031115	3" DR 11 IPS END CAP MOLDED HDPE	3.5	7.33
50041122	4" DR 11 IPS END CAP MOLDED HDPE	4.5	7.56
50061125	6" DR 11 IPS END CAP MOLDED HDPE	6.625	6.19
50081124	8" DR 11 IPS END CAP MOLDED HDPE	8.625	8
50101116	10" DR 11 IPS END CAP MOLDED HDPE	10.75	10.05
50121115	12" DR 11 IPS END CAP MOLDED HDPE	12.75	12.25

Branch Saddles

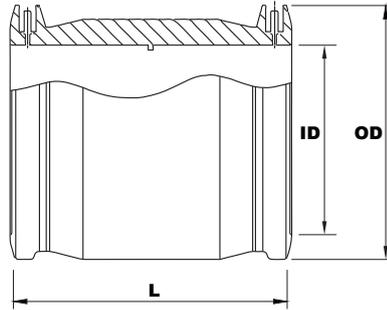


DR	17	11	9	7
Pressure Rating	125 psi	200 psi	250 psi	333 psi

Product No.	Description	OD (in)	A (in)	B (in)	D (in)
50031121	3"x2" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	2.375	5.85	0.95	2.65
50041128	4"x2" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	2.375	5.85	0.95	2.65
50061129	6"x2" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	2.375	5.85	0.95	2.65
50081131	8"x2" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	2.375	5.85	0.95	2.65
50101119	10"x2" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	2.375	5.85	0.95	2.65
50121122	12"x2" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	2.375	5.85	0.95	2.65
50041131	4"x3" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	3.5	4.875	1	4
50061130	6"x3" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	3.5	4.875	1	4
50081133	8"x3" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	3.5	4.875	1	4
50101120	10"x3" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	3.5	4.875	1	4
50121124	12"x3" DR11 IPS BRANCH SADDLE HDPE ROUND BASE	3.5	4.875	1	4

1. Any size (IPS/DIPS) main available, but must be larger than outlet size.
2. Hole saws for field cutting coupons are available for purchase.
3. Saddles are typically matched to the DR of the main. Thinner DR outlets may be available. Contact your ISCO representative for availability.

Electrofusion Coupling



Product No.	Description	ID Max (in)	ID Min (in)	Coupling OD (in)	L (in)
56020012	2" IPS ELECTROFUSION COUPLING	2.42	2.395	3.78	4.72
56030012	3" IPS ELECTROFUSION COUPLING	3.56	3.545	5.18	5.59
56040015	4" IPS ELECTROFUSION COUPLING	4.545	4.51	6.51	6.14
56060016	6" IPS ELECTROFUSION COUPLING	6.69	6.655	8.7	8.35
56080014	8" IPS ELECTROFUSION COUPLING	8.7	8.67	11.2	9.48
56100014	10" IPS ELECTROFUSION COUPLING	10.801	10.766	13.41	10.5
56120014	12" IPS ELECTROFUSION COUPLING	12.795	12.74	15.84	11.5
56140011	14" IPS ELECTROFUSION COUPLING	14.01	13.98	17.24	12.13
56160011	16" IPS ELECTROFUSION COUPLING	16.01	15.98	19.65	13.54
56180011	18" IPS ELECTROFUSION COUPLING	18.01	17.98	22.13	14.96

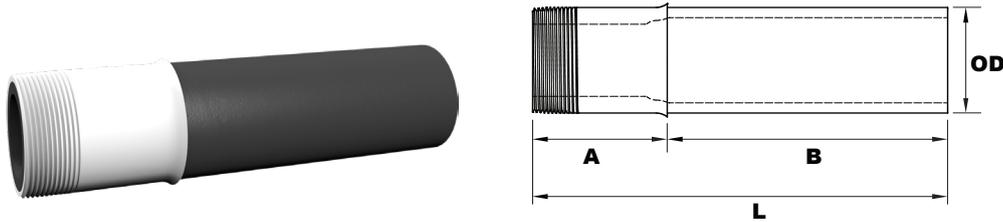
1. Couplings are typically rated for water service up to 200 psi using DR 7-17 pipe.
2. For sizes above 24" contact your ISCO representative

Socket Fusion Fittings



Product No.	Description
52020031	2" X 2" X 2" IPS TEE SOCKET FUSION
52020011	2" IPS 90 DEG ELBOW SOCKET FUSION
52020014	2" CAP SOCKET FUSION
52020015	2" IPS COUPLING SOCKET FUSION
52031120	3" X 3" X 3" DR 11 IPS TEE BLACK SOCKET FUSION
52031118	3" DR 11 IPS 90 DEG ELBOW SOCKET FUSION BLACK
52031115	3" DR 11 IPS CAP SOCKET FUSION BLACK
52031119	3" DR 11 IPS COUPLING SOCKET FUSION BLACK

Transition Fitting HDPE to Male NPT Threaded Metal

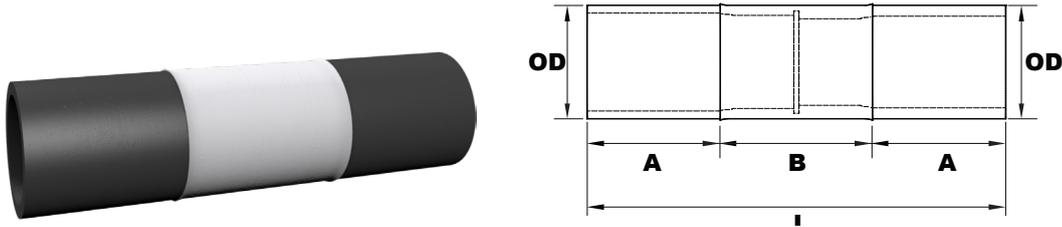


DR	17	11	9	7
Pressure Rating	125 psi	200 psi	250 psi	333 psi

Product No.	Description	OD (in)	A (in)	B (in)	L (in)
53021123	2" DR 11 IPS MPT TRANS FIT STAINLESS STEEL 304	2.375	3	5	8
53031121	3" DR 11 IPS MPT TRANS FIT STAINLESS STEEL 304	3.5	4	4	8
53041126	4" DR 11 IPS MPT TRANS FIT STAINLESS STEEL 304	4.5	4	8	12
53061124	6" DR 11 IPS MPT TRANS FIT STAINLESS STEEL 304	6.625	5	8	13
53081127	8" DR 11 IPS MPT TRANS FIT STAINLESS STEEL 304	8.625	7	8	15

1. Available in Brass, Carbon Steel (Epoxy Coated), 304 and 316 Stainless Steel
2. FPT threaded transitions are also available upon request.

Transition Fitting HDPE to Plain End PVC

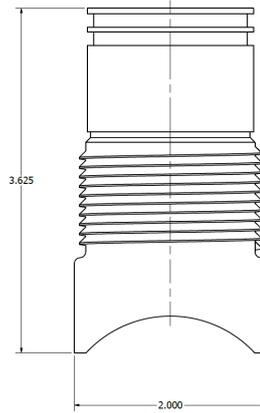


DR	17	11	9	7
Pressure Rating	125 psi	200 psi	250 psi	333 psi

Product No.	Description	OD (in)	A (in)	B (in)	L (in)
53030015	3" DR 11 IPS X PLAIN END SCH 80 PVC TRANS FITTING	3.5	5.5	5	16
53040010	4" DR 11 IPS X PLAIN END SCH 80 PVC TRANS FITTING	4.5	5	6	16
53060010	6" DR 11 IPS X PLAIN END SCH 80 PVC TRANS FITTING	6.625	9	8	26
53080068	8" DR 11 IPS X PLAIN END SCH 80 PVC TRANS FITTING	8.625	10.5	9	30

1. PVC available as Schedule 40 or Schedule 80.
2. Metal available as Carbon Steel (Epoxy Coated) or Stainless Steel.

Swing Joint Saddle



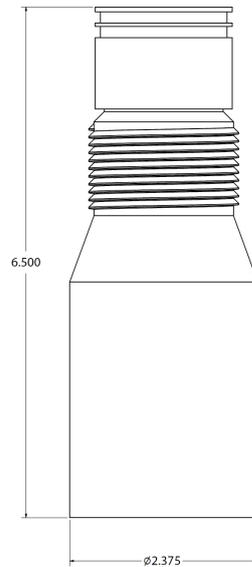
Description:

The KIS Swing Joint Saddle provides a fused, leak-free branch on 2" HDPE laterals. Integral buttress threads and double O-ring seal to connect with industry-standard PVC swing joints.

- Installs quickly and easily with McElroy LYNQS™ fusion machine using ASTM F2620 fusion procedure.
- Compatible with 2" DR 9-13.5.
- Made from corrosion-resistant HDPE and 304 stainless steel.
- Uses FKM (Viton) O-rings and creep-proof stainless steel for enduring leak-free connection to PVC swing joints.
- Pressure-rated up to 250 psi for reliable performance.
- HDPE fitting tested in accordance with ASTM D3261.
- O-ring seal tested in accordance with ASTM D3139.
- Large saddle base for strong, durable fusion joints.
- Manufacturing date permanently marked on saddle for traceability.

Product No.	Description
KIS02005	2" IPS KIS SWING JOINT SW SADDLE x 1-1/2" SS 304 BUTTRESS THREAD

End of Line Fitting



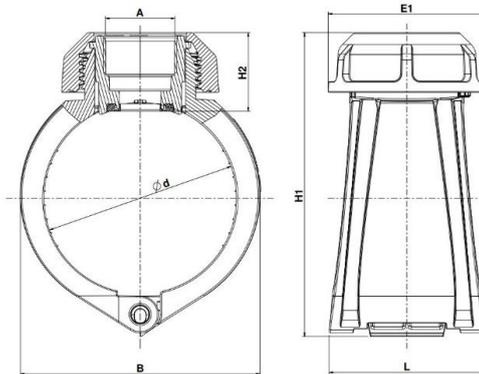
Description:

The KIS End of Line fitting fuses to the end of 2" HDPE laterals, preventing build up of debris that can occur in end caps. Integral buttress threads and double O-ring seal to connect with industry-standard PVC swing joints.

- Installs quickly and easily with standard butt-fusion or socket-fusion equipment using ASTM F2620 fusion procedure.
- Compatible with 2" DR 9-13.5.
- Made from corrosion-resistant HDPE and 304 stainless steel.
- Uses FKM (Viton) O-rings and creep-proof stainless steel for enduring leak-free connection to PVC swing joints.
- Pressure-rated up to 250 psi for reliable performance.
- HDPE fitting tested in accordance with ASTM D3261.
- O-ring seal tested in accordance with ASTM D3139.
- Manufacturing date permanently marked on saddle for traceability.

Product No.	Description
KIS02006	2" IPS KIS END OF LINE BUTT END x 1-1/2" 5S 304 BUTTRESS THREAD

ACME Mechanical Saddle



Part	Material
Body	Glass reinforced polypropylene
Nut	Glass reinforced polyamide
Seal	EPDM
Thread	Polypropylene, high-grade copolymer
Retainer	Polypropylene

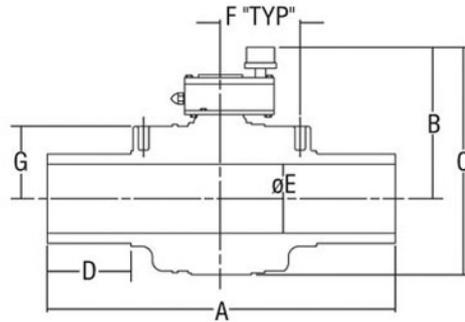
Description:

The Plassaddle, manufactured by Plasson, is a polypropylene mechanical saddle designed for a fast, bolt free ACME thread connection to a PVC swing joint.

- Fast and innovative tightening mechanism
- No bolts or metal components - Non-corrosive, strong and durable Polypropylene parts
- Pressure rated to 230 PSI
- 50 year limited warranty
- Suitable for PE and PVC pipe

Product No.	Size (d x A)	B	L	E1	H1	H2	Max Cutting Dia.
48020217	2" X 1" IPS PP MECHANICAL SADDLE ACME THREAD 1630ME020010	3.58	3.5	4.02	5.35	1.93	0.91
48020218	2" X 1¼" IPS PP MECHANICAL SADDLE ACME THREAD 1630ME020013	3.58	3.5	4.02	5.75	2.28	0.91
48020219	2" X 1½" IPS PP MECHANICAL SADDLE ACME THREAD 1630ME020015	3.58	3.5	4.02	5.35	1.93	0.91
48030142	3" X 1" IPS PP MECHANICAL SADDLE ACME THREAD 1630ME030010	4.69	3.7	4.02	6.42	1.93	0.94
48030143	3" X 1¼" IPS PP MECHANICAL SADDLE ACME THREAD 1630ME030013	4.69	3.7	4.02	6.81	2.28	0.94
48030144	3" X 1½" IPS PP MECHANICAL SADDLE ACME THREAD 1630ME030015	4.69	3.7	4.02	6.42	1.93	0.94
48040077	4" X 1" IPS PP MECHANICAL SADDLE ACME THREAD 1630ME040010	5.71	3.82	4.02	7.24	1.93	0.94
48040078	4" X 1¼" IPS PP MECHANICAL SADDLE ACME THREAD 1630ME040013	5.71	3.82	4.02	7.64	2.28	0.94
48040079	4" X 1½" IPS PP MECHANICAL SADDLE ACME THREAD 1630ME040015	5.71	3.82	4.02	7.24	1.93	0.94
98025031	1½" - 2" IPS PP MECHANICAL SADDLE TIGHTENING WRENCH 07990005	N/A	N/A	N/A	N/A	N/A	N/A

HDPE Quarter Turn Ball Valves



Description:

These ball valves have a quarter-degree turn for easy open and close functionality. Fully operated from open to close by key while under working pressure.

- Durable, drop-tight, shut-off, fused-body shell
- No metal internal parts, rust-free, eliminating corrosion
- Part of a full, leak-free HDPE system
- Uninhibited full-bore design for unrestricted flow, maximum capacity and performance
- NSF certified for use in potable water systems
- Operating pressure of 200 PSI

Product No.	Description	A	B	C	D	E	Weight (kg)
KIS02001	2" FULL PORT HDPE WATER BALL VALVE FOR KIS ONLY BALL VALVE	14.7	6.4	9.1	4.2	1.82	3.8
KIS03001	3" FULL PORT HDPE WATER BALL VALVE FOR KIS ONLY	15.0	8.0	11.4	3.5	2.50	8.9

*Larger sizes available upon request.

HDPE 360° Ball Valves



Description:

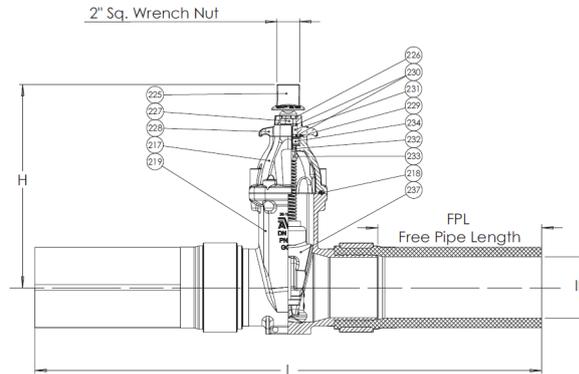
KIS 360° Ball Valves have a full port 360 degree gear turn to open and close. Fully operated from open to close by hand while under full-rate working pressure.

- Valve can be opened and closed by hand while under fully-rated working pressure
- Can be connected via butt fusion, socket fusion or electrofusion
- Protects swing joints and sprinklers by preventing lateral line water hammer
- Unique stem design eliminates over torquing and stem breakage
- Clear visual indicator shows the working positions: Open/Throttle/Close
- PE4710 & PE100 resin
- ANSI/NSF 61, ASME B16.40, AWWA C901 & C906
- Operating pressure of 200 PSI

Product No.	Description	Weight (lbs)
KIS02002	2" DR 11 IPS 360 KIS HDPE WATER BALL VALVE	4.19
KIS03002	3" DR 11 IPS 360 KIS HDPE WATER BALL VALVE	8.60

Part	Material
BODY	Polyethylene
END	Polyethylene
BALL	Polypropylene
BALL SEAT	Nitrile
P.G. OPERATOR	Acetal (POM)
STEM	Acetal (POM)
WEATHER SEAL	Nitrile
STEM SEAL	Nitrile
RETAINER	Polypropylene

Gate Valves



Description:

Lightweight and resilient seated gate valves feature a watertight design made exclusively for HDPE pipe systems. HDPE ends offer corrosion resistance and non-leaking properties.

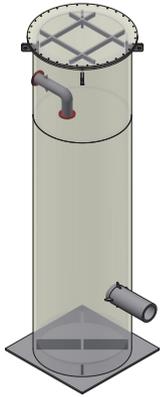
- Resilient seated design with AWWA 2" square operating nut. Stainless steel ASTM A582 stem.
- The valve-to-pipe joint is watertight and stronger than the pipe itself and meets AWWA C515 standards.
- Self-restrained, which eliminates the need for thrust blocking
- Available with HDPE ends, flanged, or mechanical joint connections upon request
- A unique serial number engraved on the stem. Serial number provides complete traceability to the date the valve was built, and every operation performed throughout the manufacturing process
- Meets American Made specifications

Product No.	Description	H	L	Free Pipe Length (FPL)	Turns to open	Weight (lbs.)
59021116	2" DR 11 IPS AVK PE GATE VALVE SERIES 66	10.50"	19.50"	5.10"	11	20
59031110	3" DR 11 IPS AVK PE GATE VALVE SERIES 66	12.09"	19.75"	5.20"	12	36
59041110	4" DR 11 IPS AVK PE GATE VALVE SERIES 66	13.50"	41.93"	14.92"	14	56
59061110	6" DR 11 IPS AVK PE GATE VALVE SERIES 66	17.50"	43.35"	14.00"	21	114
59081110	8" DR 11 IPS AVK PE GATE VALVE SERIES 66	21.50"	44.06"	13.04"	26	175
59101110	10" DR 11 IPS AVK PE GATE VALVE SERIES 66	24.75"	44.96"	11.25"	32	227
59121110	12" DR 11 IPS AVK PE GATE VALVE SERIES 66	27.63"	47.09"	11.14"	38	335

*Larger sizes available upon request.

*MJ xMJ, HYMAX x HYMAX, or FL x FL also available.

HDPE Wet Wells



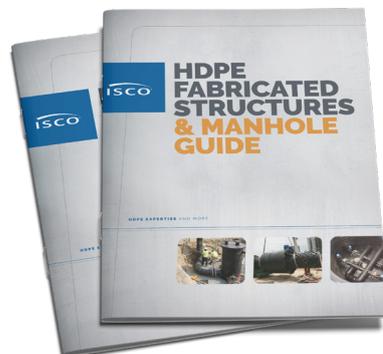
Description:

Fully customizable structures with 100 year design life, making it more efficient wet well material compared to conventional concrete options.

- Wet wells and other structures are available in a range of diameters spanning from under 18" to 120"
- Standard height up to 50'
- Prefabricated monolithic structures make installation easier and faster for contractors compared to concrete
- Resistant to corrosive acids and bases along with salts and seawater environments
- Unaffected by biologic attacks from bacteria and fungi
- With proper embedment materials, HDPE wet wells have sufficient strength for deep burial installations

*For more information and pricing on custom structures, please contact your ISCO representative.

Scan the qr code here to view the HDPE Fabricated Structures & Manholes Guide



HDPE Riser Spillways & Culvert Relining



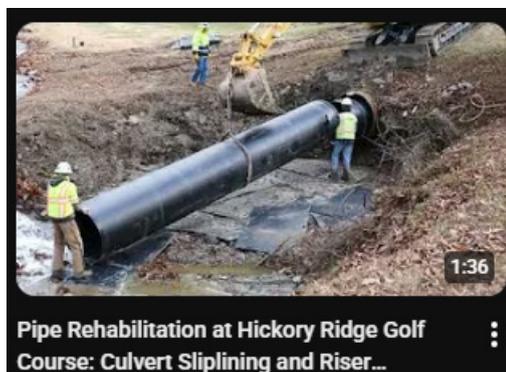
Description:

Using Snap-Tite to reline existing culverts & Spirolite pipe to rehabilitate riser spillway structures, there is a long lasting, simple solution to failing corrugated metal pipes (CMP).

- Eliminate the need to excavate and replace old piping.
- Minimize disruption of golf course play.
- Available in diameters up to 120", Spirolite competes with reinforced concrete, fiberglass, and steel and wins on overall installation cost.
- Bell-and-spigot or welded joint options, Spirolite delivers leak-free performance for 100 years of service life.

*For more information please contact your ISCO representative.

Scan the qr code here to view more information about Riser Spillways and Culvert Relining



McElroy 2LC Fusion Machine

FUSION RANGE: 1/2" CTS - 2" IPS

Product No.	Machine Type	Input requirement	Plug Type
A217201	Manual	100V-120V, 50/60Hz, 800 Watt, 1 Ph	A
A217202	Manual	200V-240V, 50/60Hz, 800 Watt, 1 Ph	C

* Includes fusion machine, heater, facer, insulated heater/facer stand and screwdriver kit



McElroy Pit Bull® 14 Fusion Machine

FUSION RANGE: 1" IPS - 4" IPS

Product No.	Input requirement	Min. Power Req.	Plug Type
A430101	100V-120V, 50/60Hz, 800 Watt, 1 Ph	3 KVA, 2.5 KW	A
A430102	200V-240V, 50/60Hz, 800 Watt, 1 Ph	3 KVA, 2.5 KW	C

*Includes fusion machine, heater, facer, insulated heater stand, 4" IPS/DIPS master inserts, and screwdriver kit



McElroy Pit Bull® 26 Fusion Machine

FUSION RANGE: 2" IPS - 6" IPS

Product No.	Machine Size	Input requirement	Min. Power Req.	Plug Type
A708502	6" IPS	100V-120V, 50/60Hz, 800 Watt, 1 Ph	3 KVA, 2.5 KW	A
A708505	6" DIPS	200V-240V, 50/60Hz, 800 Watt, 1 Ph	3 KVA, 2.5 KW	C
A708504	180mm	200V-240V, 50/60Hz, 800 Watt, 1 Ph	3 KVA, 2.5 KW	C

*Includes fusion machine, heater, facer, insulated heater stand, facer stand, 6" IPS/DIPS master inserts, and screwdriver kit



McElroy Rolling 28 Fusion Machine

FUSION RANGE: 2" IPS - 8" DIPS

Product No.	Cylinder Force	Input requirement	Min. Power Req.	Plug Type
A860805	High	120V, 60Hz, 1 Ph	3.4 KVA, 3.2 KW	A
A860810	Low	120V, 60Hz, 1 Ph	3 KVA, 2.5 KW	A
A897601 - HAND PUMP	Low	120V, 60Hz, 1 Ph	3.28 KVA, 3 KW	A

* Includes fusion machine, 8" IPS master inserts, facer, heater, and insulated heater stand



McElroy TracStar 28 Fusion Machine

FUSION RANGE: 2" IPS - 8" DIPS

Product No.	Cylinder Force	Input requirement	Min. Power Req.
AT08P1011795	High	On-board Generator	Gasoline powered
AT08P1011799	Low	On-board Generator	Gasoline powered

* Includes fusion machine, 8" IPS inserts, facer, heater, insulated heater stand, and lifting assembly



McElroy Rolling 412 Fusion Machine

FUSION RANGE: 4" IPS - 12" DIPS

Product No.	Cylinder Force	Input requirement	Min. Power Req.
A12P1011865	High	3,000 Watt, 60 Hz, 1 Ph	Gasoline powered
A12P1011871	Med.	3,000 Watt, 60 Hz, 1 Ph	Gasoline powered
A12P1011875	Low	3,000 Watt, 60 Hz, 1 Ph	Gasoline powered

* Includes fusion machine, facer, heater, 12" IPS/DIPS master inserts and lifting sling



McElroy Sidewinder® Chain Clamp

FUSION RANGE: SADDLES UP TO 4"

Product No.	Gauge Range
ASW00110	1500 PSI
ASW00111	1000 PSI
ASW00112	600 PSI
ASW00113	300 PSI



*Includes fusion machine, 3" pivot master, and screwdriver kit. Heaters and Adapters sold separately
 *Contact your ISCO sales representative for more information on accessories needed based on outlet and mainline size
 *Compact chain and jaw clamp sidewinders are also available upon request

McElroy Socket Tooling Kit

FUSION RANGE: SADDLES UP TO 4"



Product No.	Socket Tooling	Multi-Mc Heater		
		Size	Voltage Requirements	Plug Type
ASW19101	¾" - 2" IPS	2"	100V-120V, 50/60Hz, 800 Watt, 1 Ph	A
ASW19102	¾" - 2" IPS	2"	200V-240V, 50/60Hz, 800 Watt, 1 Ph	C
ASW19301	3" & 4" IPS	4"	100V-120V, 50/60Hz, 800 Watt, 1 Ph	A
ASW19302	3" & 4" IPS	4"	200V-240V, 50/60Hz, 800 Watt, 1 Ph	C

¾" - 2" IPS:

2" heater, 2" IPS Socket Fitting Holder, 1.7" and 2.4" OD Shears/Cutters, ¾" IPS - 2" IPS heater adapters, chamfer tools, heater bag, cold ring tools, and storage box

3" & 4" IPS:

4" heater, 3" and 4" IPS Socket Fitting Holder, 4" Plastic Pipe Cutters, 3" IPS and 4" IPS heater adapters, chamfer tools, heater bag, and cold ring tools

McElroy iSeries Fusion Machines

Description:

The TracStar iSeries technology is available for medium diameter pipe sizes. This includes the FusionGuide(TM) Control System giving operators the choice of three levels of control during fusion process. Each level has varying degrees of assistance, from manual control to fully automatic fusion. Hydraulic clamping options are also available upon request.

McElroy TracStar® 412i Fusion Machine

FUSION RANGE: 4" IPS - 12" IPS



Product No.	Cylinder Force	Input requirement
AT12P1011815	High	3,000 Watts, 50 / 60 Hz, 1 Ph
AT12P1011819	Medium	3,000 Watts, 50 / 60 Hz, 1 Ph
AT12P1011823	Low	3,000 Watts, 50 / 60 Hz, 1 Ph

*Machine Package includes fusion machine, facer, heater, datalogger tablet, 12" IPS/DIPS master inserts and lifting harness

McElroy TracStar® 618i Fusion Machine

FUSION RANGE: 6" IPS - 18" IPS



Product No.	Cylinder Force	Input requirement
AT18P1011839	High	4,300 Watts, 50 / 60 Hz, 1 Ph
AT18P1011843	Medium	4,300 Watts, 50 / 60 Hz, 1 Ph
AT18P1011847	Low	4,300 Watts, 50 / 60 Hz, 1 Ph

*Machine Package includes fusion machine, facer, heater, datalogger tablet, 12" IPS/DIPS master inserts and lifting harness

McElroy Lynqs



Description:

The McElroy Lynqs enables a single operator to quickly and reliably install outlet fittings on 2" IPS mains. The machine automatically aligns both the pipe and the fitting, while its jaws snap into place with a simple squeeze of the handle. A compact footprint and angled heater design reduce the amount of excavation required to perform the fusion. A visual force indicator clearly shows when proper fusion force has been achieved, ensuring consistent, repeatable results with every fusion.

- Installs KIS Swing Joint Saddle fittings using ASTM F2620 fusion procedure.
- Includes a caddy for the machine and heater for quick and easy transport
- Designed to fuse 1½" IPS fittings
- Quick grip handle to snap the machine directly on to the pipe

DATALOGGER 7



Description:

The need for better record keeping and increased accountability is growing among those who build and manage pipeline infrastructures. New standards, including ASTM F3124, have been implemented to govern the collection of data from plastic pipe fusions. The new DataLogger® 7 from McElroy meets these requirements by capturing the most important information related to fusion operations. It is now easier than ever before to add improved traceability and a higher level of assurance that pipelines were fused properly before they go into service.

- Record and document key parameters of the fusion process
- Upload data from the field via wireless network to the DataLogger Vault™
- Intuitive user interface with large touch screen buttons
- Tablet powered by Android features integrated camera, bar code scanner and GPS
- Multi-language support

SUPERCELL



Description:

The Supercell is a lithium-ion battery powered processor designed to work all day, everyday. With industry leading capacity, the average operator can get up to two weeks of work on a single charge. The Supercell comes standard with GPS, is ASTM F2897 traceability compliant, and equipped for use with mobile applications.

- Reliably fuse up to 200 1" IPS 200 Couplings¹ on a single charge. Supercell will also handle up to 12" IPS couplings.
- 98% reduction in carbon emissions versus traditional generator powered fusion. 0db operation also reduces noise pollution by 100% all in a 32lb package.
- 60 Minutes to recharge. From flat to full when using the included faster charger. Achieve enough energy to fuse a 4" coupling¹ in just 25 minutes.
- Fuse 4.0mm or 4.7mm fitting terminals with universal fusion tips.
- Wireless and rechargeable barcode scanner.
- Rugged case for protection and storage.

VORTEX



Description:

ISCO's Highland VORTEX electrofusion machine is a small processor with big power. VORTEX features an active cooling system which allows for a decrease in overall size and weight of the unit. The powerful fan keeps the processor cool while a positive pressure configuration helps keep out dust and debris. VORTEX comes standard with GPS and is ready to meet your ASTM F2897 traceability needs.

- Fuse up to 12" fittings with active cooling for maximum performance
- Features an IP54 rating to weather the elements
- Upgradeable software and mobile application compatible
- Fuse 4.0mm or 4.7mm fitting terminals with universal fusion tips
- Wireless and rechargeable barcode scanner
- Rugged case for protection and storage

HIGHLAND MODEL 630 V2



Description

Engineered for versatility and reliability, this electrofusion processor delivers precise, traceable fusions across HDPE, MDPE, PP, and Polypropylene systems. Built for field durability and ease of use, it combines rugged design with smart data management—ensuring consistent performance in any environment.

- Operates in both manual input and barcode scanning modes for flexible jobsite use
- Rugged waterproof case with wheels and retractable handle for easy transport
- Detachable leads connect directly to 4.0 and 4.7 mm pins—no adapters required
- Stores up to 2,048 fusion records with upgradeable software via USB
- CE approved and ISO compliant
- 2-year warranty

SWEETWATER METAL PRODUCTS



Sweetwater Model CT2710C-LT-SL

Width	Length	Height	Max Weight	Capacity	Empty Weight
8'	27'	8' 4"	9,850 lbs	3,200 lbs	6,300 lbs

Coil Sizes	Max Outside Diameter	Min. Inside Diameter	Max Width
	125"	48"	66"



Sweetwater Model CT1143TT

Width	Length	Height	Max Weight	Capacity	Empty Weight
8'	12' 9"	7' 4"	5,080 lbs	2,660 lbs	1,640 lbs

Coil Sizes	Max Outside Diameter	Min. Inside Diameter	Max Width
	96"	43.5"	50"



Sweetwater Model CT2786C-LT

Width	Length	Height	Max Weight	Capacity	Empty Weight
8'	27'	8' 4"	9,850 lbs	4,550 lbs	5,300 lbs

Coil Sizes	Max Outside Diameter	Min. Inside Diameter	Max Width
	125"	48"	66"

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This specification covers the material (pipe and fittings), joining methods and general installation practice for high density polyethylene pipe (HDPE) piping systems for use as indicated on the Drawings.

1.02 SUBMITTALS

- A. Submit product data to the Engineer for review in accordance with the Section XXXXX for all pipe, fittings, and appurtenances.
- B. Contractor shall also submit the following to the Engineer for approval:
1. Certified dimensional as-built drawings/profile of all installed pipe, specials and fittings.
 2. Details of fittings and specials such as elbows, tees, outlets, connections, test bulkheads, nozzles or other special items where shown on the Construction Drawings. All connections to jointed gasketed pipe materials, valves or fire hydrants must be restrained and supported independently to withstand the pressure transients, soil settlement, and external loading conditions.
 3. The Supplier of the material shall submit, through the Contractor, a Certificate of Compliance that the HDPE pipe and fittings furnished for this project meet or exceed the standards set forth in this specification. The Contractor shall submit these certificates to the Engineer prior to installation of the pipe materials.
 4. Provide a certification that personnel responsible for fusing the pipe have been trained and qualified per ASTM F3190
- C. For items that do not meet all of the requirements of this specification, the bid/submittal shall include a written description of the deviations, along with data that show the magnitude and the justification for the deviation from the specification. The decision to accept material deviating from this specification shall be the responsibility of the specifying engineer and must be approved in writing.

1.03 REFERENCE DOCUMENTS AND STANDARDS

The standards and documents listed below may apply to the materials and practices in this specification. In the event of a conflict, the requirements of this specification prevail. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the project bid date.

ANSI/AWWA

- ANSI/AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, 3/4 in. (19 mm) Through 3 In. (76 mm) for Water Service
- ANSI/AWWA C906 Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 65 in. (100 mm Through 1,650 mm) for Waterworks
- ANSI/AWWA C651 Standard for Disinfecting Water Mains
- AWWA M55 Manual of Water Supply Practices, PE Pipe–Design and Installation

PLASTICS PIPE INSTITUTE, PPI

- PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)
- PPI Municipal Advisory Board (MAB) MAB-01 Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe
- PPI Material Handling Guide for HDPE Pipe and Fittings
- PPI TR-4 PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe
- PPI TR-33 Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
- PPI TR-34 Disinfection of Newly Constructed Polyethylene Water Mains
- PPI TN-38 Polyethylene Flanged Joints
- PPI TR-41 Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping
- PPI TR-46 Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe

ASTM

- ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- ASTM D2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter- Controlled Polyethylene Pipe and Tubing
- ASTM D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
- ASTM F2880 Standard Specification for Lap-Joint Type Flange Adapters for Polyethylene Pressure Pipe in Nominal Pipe Sizes 3/4 in. to 65 in.
- ASTM D3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
- ASTM D3139 Standard Specification for Joints for Plastic Pressure pipes Using Flexible Elastomeric Seals
- ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- ASTM F585 Standard Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers
- ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
- ASTM F1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
- ASTM F1417 Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air
- ASTM F1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings
- ASTM F2164 Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
- ASTM F2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE)

- ASTM F2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
- ASTM F3124 Standard Practice for Data Recording the Procedure Used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings
- ASTM F3183 Standard Practice for Guided Side Bend Evaluation of Polyethylene Pipe Butt Fusion Joint
- ASTM F3190 Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings
- ASTM F1804 Standard Practice for Determining Allowable Tensile Load for Polyethylene (PE) Gas Pipe During Pull-In Installation
- ASTM B843 Standard Specification for Magnesium Alloy Anodes for Cathodic Protection

PART 2 – PRODUCTS

2.01 HIGH DENSITY POLYETHYLENE MATERIALS

A. RESIN AND MATERIAL REQUIREMENTS

1. All material shall be manufactured from a PE 4710 resin listed within PPI TR-4. The resin material shall meet the specifications of ASTM D3350 with a minimum cell classification of 445574C. HDPE pipe and fittings shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

B. HDPE PIPE

1. Pipe shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01.A. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black of not less than 2 percent. The manufacturer of the HDPE resin shall certify the cell classification indicated.
2. Pipe sizes 3" DIPS/4" IPS and larger shall have a manufacturing standard of ASTM F714, while IPS pipe 3" and smaller shall be manufactured to the dimensional requirements listed in ASTM D3035. Dimension Ratio (DR) and Outside Diameter (IPS/DIPS) shall be as specified on plans.
3. Pipe shall be manufactured by an ISO 9001 certified manufacturer. The pipe manufacturer shall have an ongoing Quality Control program for incoming and outgoing materials, and shall assure that the pipe will meet the material requirements of this specification. HDPE resins for manufacturing of pipe shall be checked for density, melt flow rate, and contamination. For potable water systems the facility shall have the necessary testing equipment to verify that pipe meets the AWWA and NSF standards. Pipe shall be checked for outside diameter, wall thickness, length, and surface finish on the inside and outside. The Manufacturer's production facilities shall be open for inspection by the Owner or Engineer.
4. All pipe may be color coded for the intended service. When required, the color coding shall be permanently co-extruded stripes on the pipe outside surface as part of the pipe's manufacturing process. Painting HDPE pipe to accomplish color coding is not permitted.

C. HDPE FITTINGS

1. **Butt Fusion Fittings** - Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01.A. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans or accepted by owner/engineer.
 - a. Molded fittings shall comply with the requirements of ASTM D3261.
 - b. All fabricated elbows, tees, reducing tees and end caps shall be produced and meet the requirements of ASTM F2206, as manufactured by ISCO Industries, Inc or other approved manufacturer holding an ISO 9001 quality system certificate. Each fitting will be marked per ASTM F2206 section 10 including the nominal size and fitting EDR, which will meet or exceed the pipe DR identified for the project. Fabricated fittings shall be manufactured using a data recording device to record fusion pressure and temperature, and shall be stamped with unique joint number that corresponds to the joint report. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained for a minimum of 5 years as part of the quality control and will be available upon request of owner. Test results to validate ASTM F2206 section 7.3 and 9 shall be provided to owner or owner's representative upon request.
2. **Socket Fusion Fittings** - Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01.A. Socket Fusion Fittings shall have a manufacturing standard of ASTM D2683. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans or accepted by owner/engineer.
3. **Electrofusion Fittings** - Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01.A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans.
4. **Saddle Fusion Fittings** - Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01.A. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans.
5. **Bolted Connections** - Flanged and Mechanical Joint Adapters can be made to ASTM D3261. Flange adapters, if machined, may also meet the requirements of ASTM F2880. Flanges and MJ Adapters shall be fused onto the pipe and have a minimum pressure rating equal to or greater than the pipe unless otherwise specified on the plans.
 - a. Metallic back-up rings (Van-Stone style lap joint flanges), shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class D (or B or E), ASME/ANSI B 16.5 Class 150, ASME/ANSI B 16.1 Class 125, or ASME/ANSI B16.47cSeries A.
 - b. Flange assemblies shall be assembled and torqued according to PPI TN-38,
 - c. Where shown on the drawings, 4" and larger transitions to mechanical joint fittings and valves shall be accomplished using a MJ Adapter with kit. The D.I./HDPE mechanical joint adaptor shall consist of:
 - i. A molded or fabricated HDPE mechanical joint transition fitting.
 - ii. A rubber gasket.
 - iii. A mechanical joint backup drive ring.
 - iv. Corten mechanical joint tee bolts.

6. Swing Joint Adapter Fittings – Connections to PVC swing joints, for installation of sprinkler heads, shall be HDPE fusion fittings or mechanical saddle-type fittings, unless otherwise approved by the owner or engineer prior to installation. HDPE fittings shall meet a minimum designation code of PE 4710 with a minimum Cell Classification as noted in 2.01.A. HDPE fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are jointed unless otherwise specified on the plans.
- a. Saddle Fusion Fittings used to connect to PVC swing joints shall be KIS Swing Joint Saddles, as manufactured by ISCO Industries, Inc. or other approved manufacturer holding an ISO 9001 quality system certificate. The fitting shall be tested in accordance with the requirements of ASTM D3261 and ASTM D3139. The Saddle Fusion Fittings shall consist of:
 - i. A molded HDPE branch saddle with reinforced base fusible to 2" IPS DR 9-13.5.
 - ii. Double O-ring seal with FKM O-rings.
 - iii. 1-1/2" Buttress Thread
 - iv. Permanently marked manufacturing date for traceability.
 - b. Butt Fusion Fittings used to connect to PVC swing joints shall be KIS End of Line Fitting, as manufactured by ISCO Industries, Inc. or other approved manufacturer holding an ISO 9001 quality system certificate. The fitting shall be tested in accordance with the requirements of ASTM D3261 and ASTM D3139. The Butt Fusion Fittings shall consist of:
 - i. A molded HDPE reducer fitting fusible to 2" IPS DR 9-13.5.
 - ii. Double O-ring seal with FKM O-rings.
 - iii. 1-1/2" Buttress Thread
 - iv. Permanently marked manufacturing date for traceability.
 - c. Mechanical Saddles used to connect to PVC swing joints shall be PLASSADDLE, as manufactured by Plasson USA. or other approved manufacturer holding an ISO 9001 quality system certificate. The Mechanical Saddle shall consist of:
 - i. Glass reinforced polypropylene body.
 - ii. Glass reinforced polyamide retaining nut.
 - iii. Polypropylene threaded insert with 1", 1-1/4", and 1-1/2" ACME threads.
 - iv. Permanently marked manufacturing date for traceability.
7. **Mechanical Fittings:** The use of mechanical coupling and saddles shall be approved by the owner or engineer prior to installation. Mechanical Fittings shall be designed for use and compatible with HDPE pipe. Mechanical fittings shall have a pressure rating equal to or greater than the pipe.
- a. Couplings without self-restraining capabilities (integrated serrated teeth or grippers) shall include a plan for external restraint or isolation from pipeline generated forces.
 - b. No U-bolts shall be allowed.
 - c. When required by mechanical coupling manufacturer, pipe stiffeners shall be employed to support the interior wall of the HDPE. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed of 304 or 316 stainless steel, with a wedged style design to fit the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE.

D. FUSION EQUIPMENT REQUIREMENTS

1. All Fusion Equipment, whether new or used, rented or owned, shall comply with the requirements of ISO 12176-1 "Equipment for Fusion Jointing Polyethylene Systems".
2. Butt fusion equipment must be in satisfactory working order and the hydraulic system must be leak free. Heater plates shall be free from scrapes, gouges, and have a consistent clean coated surface. The pressure gauge and thermometer should be properly calibrated. When requested by the owner, records showing a maintenance service/inspection within 3 months prior to use for this project shall be provided.
3. Rental Butt Fusion Equipment must be maintained by a McElroy Authorized Service and Repair Center with at least one McElroy Certified Master Mechanic on staff. When requested by owner or his authority, an inspection report detailing the components inspected within 3 months prior to arrival at jobsite will be provided.
4. For 16" and larger pipe sizes, the butt fusion machine shall be capable of autonomously calculating the drag pressure and perform the shift sequence autonomously.
5. Electrofusion Processors shall be maintained and calibrated per manufacturer's requirements and recommendations.

E. APPROVED SUPPLIERS

1. All Pipe, Fittings, and Fusion Equipment shall be provided by one supplier. Approved suppliers are ISCO Industries, Inc. or approved equal.

2.02 PIPELINE LOCATING MATERIALS

- A. **Detectable Marker Tape** - Plastic marker tape shall be 5 mil minimum thickness with a solid aluminum core of .35mil minimum thickness and a minimum width of 2". The background of the tape shall be colored based on pipe service with black lettering continuously printed. Marker tape shall have a minimum 35 lbs./inch tensile strength. The installation of the tape shall be at 18 inches below finish grade.
- B. **Tracer Wire** - All HDPE pipe 4" and greater shall be installed with an extra high-strength, copper clad steel tracer wire including 45 mil HDPE jacket that has a minimum average break load of at least 1150 lbs. The jacket shall be colored based on pipe service, with blue for potable water or green for sewer. Tracer wire gauge shall be 12 AWG, 10 AWG, or 8 AWG depending upon application and installation procedure. This wire shall to be continuous and brought up in the valve boxes at the ends of each line segment with splices made only by methods per the equipment manufacturer's recommendation. All miscellaneous splicing components shall be furnished and installed by the Contractor.

PART 3 – EXECUTION**3.01 GENERAL**

- A. All HDPE pipe and fittings shall be cut, joined, and installed in accordance with the manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe systems.

3.02 TRANSPORTATION, UNLOADING, AND STORAGE

- A. The manufacturer shall package product in a manner designed to deliver the pipe and fittings to the project neatly, intact and without physical damage. During transportation each pipe shall rest on suitable pads, strips, skids, or blocks securely wedged or tied in place.
- B. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. The handling of the pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.
- C. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2. All pipe and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid.
- D. Materials, if stored, shall be kept safe from damage and shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources. The contractor shall be responsible for all security, damage and loss of pipe, excluding Acts of God.
- E. The interior of the pipe as well as all sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or foreign matter at all times. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent insects, animals, or foreign material from entering the pipe line or pipe section. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted. Use waterproof nightcaps to prevent the entrance of any type of natural precipitation into the carrier or containment pipe and secure to the pipe in such a manner that the wind cannot blow them loose. Where possible, the pipe shall be raised and supported at a suitable distance from the open end such that the open end will be below the level of the pipe at the point of support.

3.03 RECEIPT INSPECTION

- A. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are installed or lowered into the trench to be laid. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10% or more are not acceptable and must be removed and discarded. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor.

3.04 FUSION AND JOINING

A. FUSION JOINING REQUIREMENTS:

1. All HDPE pipe shall be joined to by the heat fusion process which produces homogeneous, sealed, leak-tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.
2. **Butt Fusion:** The pipe shall be joined by the butt fusion procedure outlined in ASTM F2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per ASTM F3190. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F2620. Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the owner/engineer. The use of a controlled cooling cycle procedure to reduce cooling time is acceptable only as part of a controlled cooling cycle procedure where testing demonstrates that acceptable joints are produced using the controlled cooling cycle procedure.

3. **Saddle Fusion:** Joints shall follow the saddle fusion procedure outlined in ASTM F2620 or PPI TR-41. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per ASTM F3190. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F2620. Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the owner/engineer.
4. **Socket Fusion:** Joints shall follow the socket fusion procedure outlined in ASTM F2620. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per ASTM F3190. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F2620. Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the owner/engineer.
5. **Electrofusion:** Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are PPI TN 34 and PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe. The process of electrofusion requires an electric source, commonly called an electrofusion processor that has wire leads and a method to read electronically (by laser) or otherwise input the barcode of the fitting. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence electrofusion training within the past year on the equipment to be utilized for this project.

B. FUSION OPERATORS:

1. The employer of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual. The employer is responsible for documenting all training and qualification records for that individual, including compliance to any code requirements for fusion/bonder operators.
2. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.
3. For Projects with at least 5,000 feet or with pipe larger than 24 inches, operators or their supervisor must have a current McElroy Fusion Training Certificate for the equipment to be used on the project.
4. When the fusion machine operator is employed by the HDPE pipe and fusion machine supplier, the supplier shall maintain an ISO 9001 Certified Quality Management System.

C. FUSION EQUIPMENT:

1. All HDPE fusion equipment shall be capable of performing joints according to ASTM F2620
2. For 6" and larger pipe sizes, the pipe butt fusion machine shall be a self-contained hydraulic fusion machine capable of butt fusing HDPE pipe. The carriage must be removable from the chassis for in-ditch use. The machine must be compatible with an electronic data recording device. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord of appropriate gauge (25' minimum), and hydraulic extension hoses (minimum of four). The butt fusion machine will be McElroy, or approved equivalent.
3. For 16" and larger pipe sizes, the butt fusion machine shall be capable of autonomously calculating the drag pressure and perform the shift sequence autonomously.
4. In areas where there may be insufficient space for layout of the entire length of fused pipe to be pulled-back, the Contractor shall utilize a continuous HDPE pipe fusion equipment such as a PolyHorse by McElroy or other means in order to fuse the length of pipe necessary for the installation.

D. FUSION DATA RECORDING:

1. For 6" and larger pipe sizes, McElroy DataLogger or equivalent fusion data recorder shall be used to record all fusion welds on hydraulically operated fusion machines. The device shall be capable of meeting the requirements of ASTM F3124, "Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings". The device, or combination of devices, shall record the following variables of each fused joint:
 - i. Heater surface temperature- immediately before inserting the heater plate, measure with a pyrometer and manually enter into the weld record.
 - ii. Gauge pressure during the initial heat cycle
 - iii. Gauge pressure and elapsed time during the heat-soak cycle
 - iv. Heater removal (dwell) time
 - v. Gauge pressure and elapsed time during the fusing/cool cycle
 - vi. Drag pressure
 - vii. Pipe diameter and wall thickness
 - viii. Type of HDPE material (Specification and Classification) and manufacturer
 - ix. Fusion Machine Identification
2. The device shall record the operator name and a unique operator ID number, along with the date and time of each weld.
3. Records showing the device is up to date on all required calibration should be available for presentation when requested.
4. All fusion welds should be traceable to the report (via operator and weld ID) with an indentation weld stamp or by permanent paint marker/pen next to fusion weld.
5. A weld location map may be requested, prior to commencement of work, by the owner or owner's representative.

E. FUSION EXAMINATION AND TESTING:

1. Examinations
 - i. **Visual:** For butt fusion, saddle fusion, and socket fusion sections, examine the full exterior circumference for bead uniformity before cutting. All beads should have visually acceptable bead formation as shown in ASTM F2620. In addition, the following characteristics are expected:
 1. There shall be no evidence of cracks or incomplete fusing.
 2. There shall be no evidence of captured objects (e.g., pipe shavings, facer ribbons) between bonded surfaces.
 3. Variations in bead heights on opposite sides of butt fusion beads and around the circumference of fused pipe joints are acceptable.
 4. The v-groove between beads of butt fusion joints shall remain above the base material surface.
 5. Fused joints shall not display visible angular misalignment, and outside diameter mismatch shall be less than 10% of the nominal wall thickness for butt fusions.
 6. Fusion data record review that meet criteria of section 3.04.E.1.ii can be used as additional verification of visual indicators.

ii. Fusion Data Record Review

The fusion data record for each fused joint shall be compared to the approved fusion procedure. The reviewer shall verify the following:

1. That all data required by section 3.04.D.1 was recorded
 2. Interfacial pressure was within the acceptable range
 3. Heater surface temperature was within the acceptable range
 4. Butt fusion pressure applied during the fusing/cool cycle was correctly calculated to include drag pressure, fell within the acceptable range for the applicable size and agrees with the recorded hydraulic fusing pressure.
 5. Butt fusing pressure was reduced to a value less than or equal to drag pressure at the beginning of the heat soak cycle.
 6. Fusing machine was opened at the end of the heat soak cycle, the heater was removed, and the end were brought together at the fusion pressure with the acceptable time range
 7. Cooling time at butt fusing pressure met the minimum time specified
- iii. If the recorded data in section 3.04.D.1 is outside the limits of the acceptable range, the joint is unacceptable, and must be removed and replaced.
 - iv. Frequency. Records for test fusion joints should be reviewed immediately after the joint is completed. Fusion joints for jobsite fusions should be reviewed daily or before being covered with backfill.

2. Mechanical Tests

- i. Contractor shall mechanically test the first fusion of each operator and each machine used on the project. Installation shall not continue until a fusion test has passed the test. Additional mechanical test are not required as long as the fusion are reviewed with the frequency specified in section 3.04.E.1.iv. Testing of fusion joints with no fusion data record review shall be at a frequency specified by the Owner or Engineer.
 - ii. The fusion shall be allowed to cool completely, then fusion test straps shall be cut out.
 - iii. All samples shall be labeled with operator information. Testing must be done at 73 degrees F plus or minus 5 degrees. The test temperature and sample size are critical to testing. Testing performed at cold or elevated temperatures may not give similar results to tests performed at ambient temperatures.
 - iv. Each pipe sample weld shall be subjected to testing at two locations 180 degrees apart from each other in the joint weld. All specimens shall be tested by one of the following methods:
 1. Reverse Bend Test are allowed for pipe sizes 4" IPS or smaller. The specimens shall be prepared and tested in accordance with ASTM F2620, Appendix X4.
 2. Guided Side Bend Test are allowed for all wall thicknesses of 1" or greater. The specimens shall be removed and tested in accordance with ASTM F3183.
3. Hydrostatic Burst Test is allowed for pipe sizes 2"-24". The specimen length should measure 6 times pipe diameter with the butt fusion joint in the center of the specimen. The specimen should be tested in a tank filled with water, and testing conditions monitored and recorded with computerized equipment. The specimen will be tested at 4 times pipe rated pressure for 5 minutes with no failure of joint allowed.
- v. Results of any mechanical test should be documented. Information on the weld and operator should be transferred from the sample to the testing record.

3.05 INSTALLATION

A. DIRECT BURIAL

1. Buried HDPE pipe and fittings shall be installed per engineering drawings and ASTM D2774, ASTM D2321 and AWWA Manual of Water Supply Practices M55 Chapter 8. The Design Window identified in AWWA M55 Chapter 5 (page 65 of 2006 version) shall be considered acceptable design and installation conditions.
2. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be re-compacted to provide uniform side support for the pipe.
3. Pipe embedment - Embedment material should be Class I, Class II, or Class III materials as defined by ASTM D-2321 Section 6. The use of Class IV or Class V materials is not recommended, however, they may be used only with the evaluation and approval of the engineer at a demonstrated achievable compaction
4. Bedding: Pipe bedding shall be in conformance with ASTM D2321 Section 8. Compaction rates should be as specified in ASTM D2321. Deviations shall be approved by the engineer.
5. Haunching and backfill shall be as specified in ASTM D2321 Section 9 with Class I, II, or III materials. Compaction shall be in excess of 85% Proctor, providing a minimum modulus of 1000 psi or greater.

B. PULL-IN INSTALLATION

1. Per ASTM F1804 and/or www.HDPEapp.com, the contractor shall determine and document the maximum proposed pull-in length and pull-in force for the pressure class and pipe diameter to be pulled into an open trench. Pull-in lengths will not exceed the maximum lengths for the class and diameter pipe. A commercially available load limiter (weak link) approved by the Engineer shall be used between the puller and the pipe.
2. Prior to pulling the pipeline, contractor shall place rollers or other approved devices beneath the pipe to avoid unnecessary damage and to reduce pipe drag.
3. Trenchless installations:
 - i. For Horizontal Directional Drilling (HDD), refer to ASTM F1962, PPI TR-46, PPI PE Handbook (Chapter 12) and www.PPIBoreAid.com
 - ii. For sliplining, refer to ASTM F585, PPI PE Handbook (Chapter 11) and www.HDPEapp.com
 - iii. For pipe bursting, refer to PPI PE Handbook (Chapter 16)

C. APPURTENANCES

1. All appurtenances (tees, elbows, services, valves, air relief valves, fire hydrants, etc.), must be independently supported and shall not rely on the pipeline and its connections for this support. Excessive stresses may be encountered when appurtenances are inadequately supported.
2. Hydrant Assemblies shall be installed and field tested according to the requirements of AWWA M17.
3. Installation of Tracer Wire. When tracer wire is required, the Contractor shall install along the entire section of pipeline and along all service connections as listed below. The tracer wire shall be installed simultaneously with the polyethylene piping system. Tracer wire shall be installed by the Contractor once backfill has been placed and compacted to at least 12 inches above the top of the pipe and not more than 18 inches above the top of the pipe. Tracer wire shall be properly spliced at each end connection and each service connection. Care should be taken to adequately wrap and protect wire at all splice locations. No bare tracer wire shall be accepted. Provide Magnesium alloy anode for cathodic protection that conforms to the requirements of ASTM B843. Install tracer wire per local and manufacturer's requirements.

3.06 PIGGING, FLUSHING, CLEANING, AND DISINFECTING

- A. All mains shall be pigged, cleaned and flushed to remove all dirt, sand, debris and other foreign matter. The Contractor shall be responsible for developing a pigging and flushing plan to be submitted to the Engineer for approval prior to pigging and flushing.
- B. Disinfection:
 - 1. Cleaning and disinfecting of potable water systems shall be in accordance with AWWA C651 and AWWA M55 Chapter 10, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition).
 - 2. The liquid disinfection chemical solution should be limited to less than 12% active chlorine. The time-duration of the disinfection should not exceed 24 hours. Chlorine tablets or powders are not permitted.
 - 3. Upon completion, the system should be thoroughly flushed with fresh water, and retested to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water tubing and branch lateral pipes

3.07 TESTING AND LEAKAGE

- A. The contractor shall ensure testing can be accomplished in a safe manner, including protection of personnel, equipment, and public in the event of a failure during testing. The contractor shall restrain pipe, components, and test equipment as required. All pumps, valves, temporary connections, meters, gauges and other measuring devices shall be furnished, installed and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Owner's Engineer.
- B. The pressure gauges or data recorders should be calibrated and sufficiently sized to provide mid-range data that result in easy reading, interpretation. Gauges shall be accurate to within 2% of full scale
- C. The test pressure may be up to 1.5 times the system design pressure, based on the lowest point in elevation in the test section. The contractor shall ensure that the designated test pressure does not exceed the maximum allowable test pressure specified by the manufacturer for any component in the test section.
- D. Test pressures require consideration of thermal conditions. Polyethylene piping materials are typically pressure rated at 73°F (23°C) and PE piping at temperatures greater than 80°F (26°C) require reduced test pressures. (Note that higher pipe temperatures should consider both ambient temperatures and radiant solar heating of exposed black HDPE pipe) Guidance for elevated temperatures can be found in the appendix of Chapter 3 (Material Properties) of the PPI Handbook of PE Pipe.
- E. Gravity Pipelines-The Contractor shall perform a low-pressure air test for gravity flow pipelines to the requirements and specifications of ASTM F1417. Warning: All pneumatic test, regardless of pressure, can be dangerous and safety procedures shall be identified, documented, approved by the owner and engineer, and followed.
- F. Pressure Pipelines-Pressure testing shall be conducted in accordance with requirements and recommendations of ASTM F2164 (Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure), AWWA M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.
 - 1. The section of pipe to be tested shall be filled with potable or generally clean water (uncontaminated river/lake water) approved by the Owner/Engineer. While the system is being filled with water, air shall be carefully and completely exhausted.
 - 2. The test procedure for HDPE pipe consists of two steps: 1) the initial phase or expansion phase and 2) the test phase. During the initial/expansion phase, sufficient make-up water shall be added hourly for 3 hours to return to the test pressure. During the test phase, the expansion phase pressure is reduced by 10 psi to test phase pressure and monitored for at least one hour (3 hours maximum).
 - 3. Under no circumstances shall the total time under test exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason, depressurize the test section and permit the system to "relax" for eight (8) hours prior to the next testing sequence.

4. In accordance with section 9.8 of ASTM F2164, the pipe shall pass if the final pressure is within 5% of the test phase pressure for the testing period (3 hours maximum). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.
- G. All pressure and leakage testing shall be done in the presence of a representative of the Owner and Engineer.

END OF SECTION



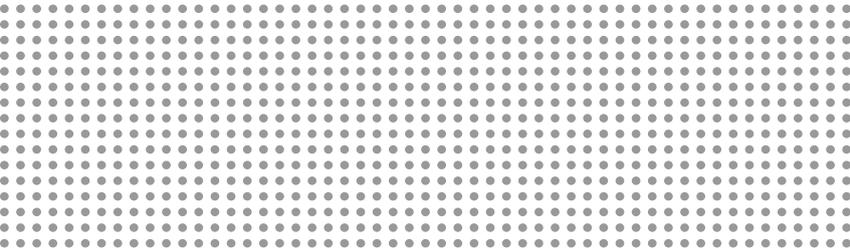
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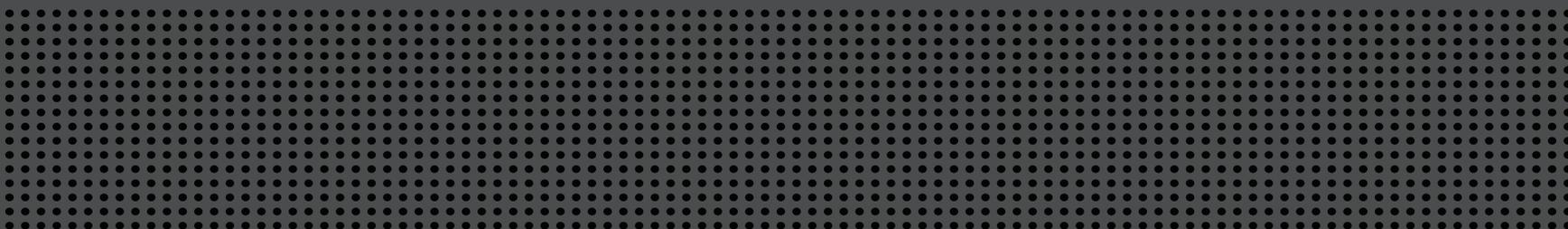
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ISCO Industries, Inc.
100 Witherspoon St.
Louisville, KY 40202

T (800) 345 ISCO
E sales@isco-pipe.com
isco-pipe.com

