Performance Pipe

DRISCOPLEX® 4000/4100 Pipe

Water and Wastewater Piping Systems

- Corrosion Resistant
- Leak Proof Fused Joints
- Ideal for Trenchless Applications
- Flexible
- Hydraulically Efficient
- Will Not Tuberculate
- Reduces Surge Pressure
- Outstanding Resistance to Fatigue
- Excellent Impact Strength
- Thrust Blocks Not Needed
- Resistant to Sewer Gas
- Less Maintenance
- Mechanical Fittings for Transitions and Repairs
- Environmentally Friendly

DriscoPlex®

Polyethylene Pipe & Fittings

Performance Pipe, a division of Chevron Phillips Chemical Company LP, manufactures polyethylene (PE) piping and fittings for a variety of applications. Performance Pipe's parent company, Phillips 66, invented high density polyethylene (HDPE) as well as the butt fusion joining process. They first used HDPE pipe in the 1950's to take advantage of the pipe's features and benefits for water, brine, crude oil and gas gathering. With over 50 years experience in the manufacturing of quality PE pipe and seven plants across the U.S. utilizing state-of-the-art extrusion technology, Performance Pipe is a name you can trust for your water and wastewater piping.

Attributes of HDPE Pipe

- Does not rust, rot, tuberculate, or support biological growth
- Heat fused, fully restrained, zero-leak joints
- Flexibility, toughness and durability
- Smooth interior; high flow factor
- High tolerance for surge pressure
- Can be installed with Trenchless Technology
- Easily incorporated into existing systems
- Over 50 years of proven performance

Why Use HDPE Pipe for Water?

The EPA has identified the two biggest problems facing America's infrastructure as corrosion and leakage. According to the American Society of Civil Engineers (ASCE) 2017 infrastructure report, there is an estimated 240,000 water main breaks per year in the United States, wasting over two trillion gallons of treated drinking water. DriscoPlex® HDPE pipes offer a solution. HDPE pipes do not rust and are suited for installation in aggressive soils. DriscoPlex® HDPE pipes are joined by heat fusion which forms a continuous pipe without gasket joints to leak.

DriscoPlex® 4000/4100 Series HDPE Pipe

DriscoPlex® 4000/4100 series pipe serves multiple markets, including municipal potable water, raw water, process water, sewer, and industrial applications. DriscoPlex® 4100 Series is based on iron pipe size (IPS) OD's and DriscoPlex® 4000 Series is based on ductile iron pipe size (DIPS) OD's. Common sizes, dimension ratios (DR), and dimensions are found in Table 2. For a full range of available sizes and DR's, see PP152 (IPS) and PP153 (DIPS), size and dimension sheets. 4000/4100 piping meets or exceeds the manufacturing and material requirements of ASTM D3035/AWWA C901 for sizes ≤ 3", ASTM F714/AWWA C906 for sizes ≥ 4" and are evaluated to the toxicological requirements of NSF/ANSI 61.

Table 1 DriscoPlex® 4000 DIPS and 4100 IPS HDPE Piping

DriscoPlex® HDPE Piping for Municipal Water and Wastewater				
DriscoPlex® HDPE Piping Series	Appearance[1]	Size Range	Material Designation Code	ASTM D3350 Cell Classification
4000 (DIPS)	Black with blue stripes is standard	4" through 42" DIPS	PE4710	445574C
4100 (IPS)	Black pipe is standard	2" through 54" IPS	PE4710	445574C

1. Available options include solid black and black pipe with blue, green or purple stripes. IPS striping pattern is four equally spaced single stripes and DIPS striping pattern is three equally spaced sets of dual stripes.

Performance Pipe also designs and produces a molded fitting portfolio that is comprised of flange adapters, MJ adapters, elbows, tees, reducers, caps, couplings, branch and service saddles, and tapping tees. Contact a sales representative to discuss your specific requirements.

Pressure and Temperature Capabilities:

- Dimension Ratios from DR 7 to DR 32.5
- Pressure ratings from 63 psi to 333 psi at 73°F
- Temperature range from -40°F to 140°F for pressure pipe and to 180°F for non-pressurized pipe (e.g. gravity flow)

For service temperatures above 80°F, a Temperature Design Factor from Table 5 of our Field Handbook is applied to the pressure class (PC) from Table 2 to obtain the applicable pressure rating for a pipe at a specific service temperature. For pressure pipe applications above 140°F, see PP533, *"PlatinumStripe™ 1800 Series PE-RT HDPE Pipe Product Flyer."*

Performance Pipe

DriscoPlex®
Polyethylene Pipe & Fittings

Table 2 DriscoPlex® 4000 DIPS and 4100 IPS Pipe Sizing Systems

Common Dimension Ratios* for DriscoPlex® 4000 DIPS Pipe										
DIPS		DR 17 PC = 125 psi			DR 13.5 PC = 160 psi			DR 11 PC = 200 psi		
Pipe Size, in.	OD, in.	Min. Wall, in.	Avg. ID, in.	Weight lbs/ft	Min. Wall, in.	Avg. ID, in.	Weight lbs/ft	Min. Wall, in.	Avg. ID, in.	Weight lbs/ft
4	4.80	0.282	4.201	1.76	0.356	4.046	2.18	0.436	3.876	2.62
6	6.90	0.406	6.040	3.64	0.511	5.816	4.50	0.627	5.571	5.42
8	9.05	0.532	7.921	6.26	0.670	7.629	7.75	0.823	7.305	9.33
10	11.10	0.653	9.716	9.42	0.822	9.357	11.66	1.009	8.961	14.03
12	13.20	0.776	11.554	13.32	0.978	11.127	16.48	1.200	10.656	19.84
14	15.30	0.900	13.392	17.89	1.133	12.897	22.15	1.391	12.351	26.65
16	17.40	1.024	15.230	23.14	1.289	14.668	28.64	1.582	14.046	34.47
18	19.50	1.147	17.068	29.07	1.444	16.438	35.97	1.773	15.741	43.30
20	21.60	1.271	18.906	35.66	1.600	18.208	44.14	1.964	17.436	53.13
24	25.80	1.518	22.583	50.88	1.911	21.748	62.97	2.345	20.829	75.77
30	32.00	1.882	28.009	78.28	2.370	26.975	96.87	2.909	25.833	116.58
36	38.30	2.253	33.524	112.13	2.837	32.285	138.77	3.482	30.918	167.02
42	44.50	2.618	38.951	151.37	3.296	37.512	187.33			

Common Dimension Ratios* for DriscoPlex® 4100 IPS Pipe										
IPS		DR 17 PC = 125 psi			DR 13.5 PC = 160 psi			DR 11 PC = 200 psi		
Pipe Size, in.	OD, in.	Min. Wall, in.	Avg. ID, in.	Weight lbs/ft	Min. Wall, in.	Avg. ID, in.	Weight lbs/ft	Min. Wall, in.	Avg. ID, in.	Weight lbs/ft
2	2.375	0.140	2.078	0.43	0.176	2.002	0.53	0.216	1.917	0.64
3	3.50	0.206	3.063	0.94	0.259	2.951	1.16	0.318	2.826	1.39
4	4.50	0.265	3.938	1.55	0.333	3.794	1.92	0.409	3.633	2.31
6	6.625	0.390	5.798	3.36	0.491	5.584	4.15	0.602	5.349	5.00
8	8.625	0.507	7.550	5.69	0.639	7.270	7.04	0.784	6.963	8.47
10	10.75	0.632	9.410	8.83	0.796	9.062	10.93	0.977	8.679	13.16
12	12.75	0.750	11.160	12.43	0.944	10.749	15.38	1.159	10.293	18.51
14	14.00	0.824	12.253	14.98	1.037	11.802	18.54	1.273	11.301	22.32
16	16.00	0.941	14.005	19.57	1.185	13.488	24.22	1.455	12.915	29.15
18	18.00	1.059	15.755	24.77	1.333	15.174	30.65	1.636	14.532	36.89
20	20.00	1.176	17.507	30.58	1.481	16.860	37.84	1.818	16.146	45.54
22	22.00	1.294	19.257	37.00	1.630	18.544	45.79	2.000	17.760	55.10
24	24.00	1.412	21.007	44.03	1.778	20.231	54.49	2.182	19.374	65.58
26	26.00	1.529	22.759	51.67	1.926	21.917	63.95	2.364	20.988	76.96
28	28.00	1.647	24.508	59.93	2.074	23.603	74.17	2.545	22.605	89.26
30	30.00	1.765	26.258	68.80	2.222	25.289	85.14	2.727	24.219	102.47
32	32.00	1.882	28.010	78.28	2.370	26.976	96.87	2.909	25.833	116.58
34	34.00	2.000	29.760	88.37	2.519	28.660	109.36	3.091	27.447	131.61

Dimensions for DriscoPlex® 4100 IPS Series Pipe Sized < 4in†				
IPS		DR 9 PC=250		
Pipe Size, in.	OD, in.	Min Wall, in.	Avg. ID, in.	Weight lbs/ft
2	2.375	0.264	1.816	0.77
3	3.50	0.389	2.676	1.66

* Additional sizes and DR's are available (IPS & DIPS). Contact Performance Pipe.

† AWWA piping sized under 4in only permitted in DR9 per AWWA C901-20 update

Average ID is calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flow. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimensions and tolerances in the applicable pipe manufacturing specification. Pressure class (PC) is the working pressure ratings to 80°F for applications flowing water and aqueous solutions of salt, acids, and bases. Some applications may require additional design factors

Design for Hydraulic Transients (Surge Pressure)

Too frequently, the comparison between HDPE pipe and other materials is made primarily on pressure class (PC). However, during operation, flow velocity variations result in the total pressure exceeding the steady state working pressure (WP). These hydraulic transients result in millions of cycles of hoop stress variation over the pipe's service life. Thus, the pipe's surge allowance and fatigue strength are key engineering considerations.

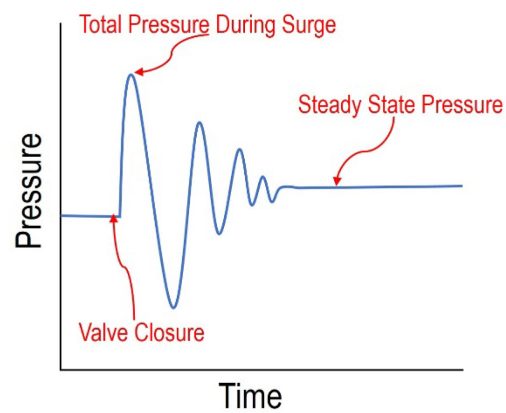


Figure 1: Illustration of Pressure Fluctuation due to Sudden Valve Closure

Hydraulic Transient Design Checks:

1. $PC \cdot F_T \geq WP$
2. Allowable Total Pressure during Occasional Surge ≥ $WP + P_{OS}$
3. Allowable Total Pressure during Recurring Surge ≥ $WP + P_{RS}$
4. Minimum Safety Factor Against Fatigue of 2.0

In lieu of specific hydraulic transient analysis, typical operating conditions warrant using a minimum 8 ft/sec flow velocity change for occasional surge pressure (P_{OS}) events and a minimum 4 ft/sec flow velocity change for recurring surge pressure (P_{RS}) events with a minimum safety factor against fatigue of 2.0. See Table 3 below, which illustrates that high performance PE4710 pipes greatly exceed these requirements. Additional information is available in Performance Pipe Technical Note PP 841-TN.

Benefits of HDPE Pipe for Surge Pressures

- For the same flow velocity change in a water pipeline, surge pressure in HDPE pipe is significantly lower.
- Surge pressures are allowed above HDPE pipe's pressure rating - per AWWA C906, recurring surges to 1.5PC and occasional surges to 2.0PC.
- HDPE pipe is capable of withstanding well over 7 million surge cycles to 1.5PC resulting in high fatigue safety factors.

Table 3 DriscoPlex® 4000/4100 Surge and Fatigue Resistance

Surge Capability Comparison of HDPE and PVC Pipe									
Working Pressure	Material	DR	PC	Total Pressure During Occasional Surge	Allowable Total Pressure Occasional Surge	Total Pressure During Recurring Surge	Allowable Total Pressure Recurring Surge	Cycles to Failure (N) $f(WP, P_{RS})$	Fatigue SF
125 psi	PE4710	17	125	215 psi	250 psi	170 psi	188 psi	1.9 X 10^7	9.5
	PVC	18	235	264 psi	376 psi	195 psi	235 psi	1.9 X10^6	0.9
160 psi	PE4710	13.5	160	262 psi	320 psi	211 psi	240 psi	2.6 X 10^7	13.0
	PVC	14	305	319 psi	488 psi	239 psi	305 psi	3.2 x 10^6	1.6
200 psi	PE4710	11	200	315 psi	400 psi	258 psi	300 psi	3.3 x 10^7	16.4
	PVC	14	305	359 psi	488 psi	279 psi	305 psi	2.8 x 10^6	1.4

1. Ratings shown are for 73°F service temperature
2. Values for PVC pipe are evaluated per guidance in AWWA C900-07 including N values in Appendix B.
3. Occasional and recurring surge pressures calculated based on 8ft/s and 4ft/s flow velocity change respectively.
4. Fatigue Safety Factor (SF) is based on 100-year service at 55 surge cycles per day (~2 million cycles).

Flow

By utilizing HDPE pipe with its smoother surface, the pipeline ID can be smaller but may deliver comparable flows. Hydraulic studies show a Hazen Williams pipe flow coefficient (C) of 150 and a roughness (ε) of 7×10^{-5} ft (includes ID fusion bead effects) are applicable for pressure flow calculations. For gravity flow calculations, Manning roughness coefficient (n) of 0.009 for clear water and 0.010 for sanitary sewer are typically used. As HDPE pipe's ID does not tuberculate or rust, the pipe's flow capabilities are maintained over the design life for long-term hydraulic efficiency.

Resistance to Potable Water Disinfectants

HDPE pipes are well suited for potable water applications as they contain additives which protect the pipe from the oxidizing effects of disinfectants. For specific analysis, the Plastics Pipe Institute (PPI) has published TN-44 for pipe sizes 4" and larger and TN-49 for pipe sizes 3" and smaller. These tools (available at www.plasticpipe.org) enable design engineers to assess HDPE pipe's long-term resistance to potable water disinfectants in specific operating conditions. For typical conditions, the methodology in TN-44 and TN-49 can be used to demonstrate that current high performance HDPE pipes offered by Performance Pipe have a resistance to disinfectants of at least 100 years for potable water applications.

Leak-Proof Joints

DriscoPlex® 4000 and 4100 piping systems are joined by heat fusion. Heat fusion utilizes controlled temperature and pressure to create joints that are stronger than the pipe itself. A fused HDPE system is fundamentally a monolithic piping system without joints eliminating potential leak points. Refer to our Fusion page for links to videos on butt, socket, and saddle fusion and our PP750 - Heat Fusion Joining Procedures and Qualification Guide.

Alternative Polyethylene Joining Methods

In addition to the conventional heat fusion methods, HDPE pipe may be connected by alternate means including electrofusion and mechanical methods such as flanges, MJ adapters, compression couplings or other qualified types of manufactured transition fittings. When selecting non-Performance Pipe products for use with DriscoPlex® HDPE piping systems, ensure the manufacturer recommends the particular product for use on HDPE pipe.

Advantages of Heat Fusion Joining

- Creates fully-restrained joints that have the same hydrostatic strength, tensile strength, and toughness as the pipe itself.
- Eliminates possible leak points.
- Does not require thrust blocks or restraints.
- Standardized procedure published in ASTM F2620.

Easy Transition to Non-Polyethylene Pipes

DriscoPlex® 4000/4100 pipe can be conveniently connected to metallic valves, hydrants, pumps and other pipe materials. For these transitions to non-polyethylene pipe, Performance Pipe manufacturers flanges adapters and mechanical joint (MJ) adapters. For flange adapter assembly and bolt torque information, see PPI TN-38 at www.plasticpipe.org. For MJ adapter installation guidance, see PP 812-TN on our website. Other options for transitioning to non-polyethylene pipe include mechanical couplers with restraint and stab transition fittings. When transitioning to unrestrained bell/spigot joined pipe, the system should be properly restrained to counter contraction forces of HDPE pipe from pressurization, etc. See PP813-TN Poisson Effects.

Tapping

Saddle fused and saddle electrofused tapping tees, service saddles and branch saddles can all be used to add a service connection or lateral main. Additionally, mechanical service and tapping sleeves may be used provided they are designed and recommended for HDPE pipe by the fitting manufacturer. Direct threading of HDPE pipe is not recommended.

Burial in Open-Cut Trenching

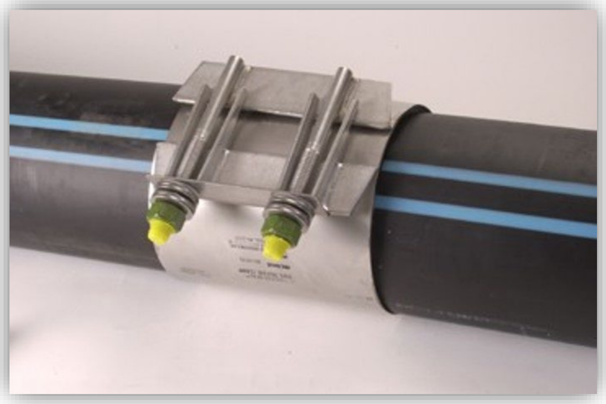
The toughness and flexibility of HDPE piping makes it ideal for underground construction. HDPE pipes can deform and deflect without cracking or failing to the extent that that the soil surrounding the pipe will provide the necessary support. HDPE pipe has been placed in landfills with cover depths well in excess of 100 ft. However, most municipal applications are significantly shallower. The PPI *Polyethylene Systems Field Manual for Municipal Water* gives simplified installation guidelines applicable to a burial depth from 2 feet (3 feet with traffic loading) to 16 feet. Additional resources include Performance Pipe's Field Handbook, the PPI Handbook of PE Pipe, ASTM D2774, "*Standard Practice for Underground Installation of Thermoplastic Pressure Piping"*, or AWWA M-55, *PE Pipe – Design and Installation*.

Exceptional for Trenchless Installations

DriscoPlex® HDPE piping is unmatched for trenchless installation including horizontal directional drilling (HDD), sliplining and pipe bursting. The pipe's flexibility, tensile strength as well as the strength of the fusion joint are key features for pull-in trenchless techniques. Many HDD installations exceeding 4000 ft. in a single pull have been successfully installed.

HDPE pipe's tight allowable bend radius (e.g. 25 times OD for DR 11 pipe) enables it to be strung around corners and other obstacles and installed using shorter insertions pits, resulting in less disruption to the surrounding environment and lower construction costs.

DriscoPlex® HDPE piping is an excellent choice for rehabilitating deteriorated pipelines. Trenchless rehabilitating options include sliplining a smaller HDPE pipe into an existing pipe and pipe bursting, which involves expanding or breaking an existing pipe into the surrounding soil while simultaneously pulling in the new HDPE pipe. See Chapters 11 and 16 of the PPI Handbook of PE pipe for additional information.



Repair and Maintenance

Polyethylene pipe has an excellent field record; its corrosion resistance, toughness and fully restrained heat fusion joints reduces the need for repairs and minimizes maintenance costs. However, circumstances may arise where repairs are necessary. Mechanical repair clamps, capped off saddle-fused tapping tees, saddle heat fusion and electrofusion patches can be used to repair small puncture damage. If a section of HDPE pipe needs to be removed, a new pup piece can be inserted using electrofusion couplings, proper mechanical compression fittings, MJ adapters and solid sleeves, or flange adapters. Refer to Chapter 15 of the PPI *Handbook of PE Polyethylene Pipe* available at www.plasticpipe.org for additional details.

Technical Information

The Performance Pipe Field Handbook, technical notes on engineering topics, model specifications, and additional helpful information can be found on www.performancepipe.com to assist in the selection and use of our products. In addition, the Plastic Pipe Institute's website, www.plasticpipe.org, has a pdf version of the Handbook of PE Pipe, along with many technical notes and reports, to further assist in the design of HDPE piping systems.

PlexCalc™

The premier and original calculator for HDPE piping applications, PlexCalc™ allows users to perform a number of HDPE pipe calculations for Performance Pipe's DriscoPlex® products. Pressure ratings, fluid flow rates, reactions to burial and traffic loading, thermal effects, deflection between above grade supports, safe pulling strength, allowable bend radius, and many more important calculations can be made using PlexCalc™. It's found on our website at www.performancepipe.com, as well as an app in the Apple App Store, and on Google Play for Android devices.

PLEXCALC™
By Performance Pipe

SEARCH FOR PERFORMANCE PIPE,
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When Performance Matters Rely on

Performance Pipe

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