PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

PERFORMANCE PIPE
DriscoPlex® 6300 PE4710 Pipe
Oil, Gas Gathering & Oilfield Water Piping Systems

Oil and Gas Gathering

Produced Water

Brine Water Service

Crude Oil Collection and Transportation

Multiphase Oilfield Solutions

Hydraulic Fracturing Fluids

Sour Service CO_2 and H_2S

Liners

Raw Water Lines

DRISCOPLEX®
Polyethylene Pipe & Fittings

Performance Pipe

Performance Pipe's parent company, Phillips 66, first used polyethylene (PE) 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 of experience in the manufacturing of quality PE pipe, Performance Pipe is a name you can trust for your energy application piping.

It is the quality philosophy of Performance Pipe to meet customers' requirements the first time and every time. Our internal QA/QC requirements meet or exceed those required by industry standards. Each product line is continuously monitored throughout the manufacturing cycle to ensure that the product adheres to all internal quality control specifications and the manufacturing standard.

Performance Pipe has nine manufacturing facilities strategically located across the United States. All nine manufacturing facilities and our headquarters are certified in accordance with the latest edition of ISO 9001.

When selecting our DriscoPlex® PE pipe and fittings, in addition to receiving quality products, you also gain access to our team of experts for technical support, sales and assistance. Our territory sales teams are dedicated to the energy industry and are active members of the American Petroleum Institute, ASTM International, Plastics Pipe Institute and many other industry associations. As a company we provide technical expertise and service to these organizations on an ongoing basis.

The unmatched quality and performance of Performance Pipe's polyethylene piping products is further enhanced and strengthened by our being part of Chevron Phillips Chemical Company LP, a company with more than five decades of quality polyolefin plastic resin research and production.

Features and Benefits of DriscoPlex® 6300 Series PE Pipe

- Chemical and corrosion resistance
- Leak proof fusion joints
- Smooth, flow efficient ID
- Toughness and flexibility
- Lightweight
- UV resistance for above ground use

DriscoPlex® 6300 Series PE Pipe

Driscoplex® 6300 series PE pipe is for use in crude oil collection and transportation, non-regulated gas gathering and recovery applications, as well as brine and raw water and most all oilfield fluid applications.

Driscoplex® 6300 series PE pipe is produced to meet or exceed the manufacturing and material requirements of ASTM F2619 *Standard Specification for High-Density Polyethylene (PE) Line Pipe*. Driscoplex® 6300 series PE pipe also meets the requirements of API 15LE *Specification for Polyethylene Line Pipe (PE).*

Driscoplex® 6300 series PE pipe is manufactured in sizes ¾ inch through 54 inches IPS. The pipe is available in 40 or 50 foot lengths and coils are available through 6 inches IPS. Size and dimension

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data as well as packaging and loading information is available on our website at www.performancepipe.com under oil and gas gathering.

Fittings

Performance Pipe manufactures a full range of PE Fittings for butt, socket, and saddle fusion in sizes through 8 inches diameter. DriscoPlex® flange adapters are available through 18 inch diameter.

Material Properties

DriscoPlex® 6300 series PE pipe and fittings are produced from high performance PE4710 resins. These high density polyethylene (HDPE) materials are engineered for high density, high molecular weight, and broad molecular weight distribution to provide strength, flexibility, toughness and durability.

Cell Classification

The six PE material properties important for pipe applications are categorized per the cell classification system in ASTM D3350 *Standard Specification for Polyethylene Plastics Pipe and Fittings Materials*. DriscoPlex® 6300 series pipe cell classification and properties are listed in Table 1.

Corrosion and Chemical Resistance

DriscoPlex® 6300 series PE pipe has outstanding chemical resistance and will tolerate most downhole corrosion inhibitors, hot soils and sour gas. And, it does not corrode by electrolytic action or require cathodic protection. DriscoPlex® 6300 series PE pipe is suitable for use in crude oil service, low-pressure gas operations, acidic or alkaline water service, and brine service. Dry, gaseous hydrocarbons have no adverse effect on expected service life. Liquid hydrocarbons will permeate the wall and reduce hydrostatic strength, but do not degrade the material. Upon evaporation of the hydrocarbon, the pipe will regain its original physical properties. Pipelines designed to convey fluids containing notable quantities of liquid hydrocarbons such as crude oil pipelines typically have a 0.5 application factor applied to the pipe's standard pressure rating (See Table 3). A technical report of chemical resistance for thermoplastic pipes can be found at the Plastic Pipe Institute's website: TR-19/2007 "Chemical Resistance of Thermoplastics Piping Materials."

Table 1: DriscoPlex® 6300 Series Cell Classification Properties

Property		Standard	Typical Value[1]
Material Designation		PPI TR-4	PE4710
Cell Classification		D3350	PE445574C
Cell Class Properties:			
4	Density	ASTM D1505	0.960 g/cm^3 (black)
4	Melt Index (190C/2.16kg)	ASTM D1238	0.08 g/10 minutes
5	Flexural Modulus	ASTM D790	>115,000 psi
5	Tensile Strength	ASTM D638	>3500 psi
7	Slow Crack Growth Resistance	ASTM F1473 (PENT)	>500 hrs
4	Hydrostatic Strength (HDB)	ASTM D2837	1600 psi
C	UV Stabilizer	ASTM D3350	Minimum 2% Carbon Black

[1]Resin values shown are evaluated at standardized conditions and used for classification purposes only. They do not represent engineering properties for pipe.

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Design Pressure Rating

A key pipe design consideration is ensuring the pipe's pressure rating is greater than or equal to the pipeline working pressure. Working pressure is the maximum sustained operating pressure applied to the pipe. The design pressure rating for DriscoPlex® 6300 series pipe is a function of numerous factors including the pipe thickness. A useful relationship is the pipe dimension ratio (DR) which is a ratio of the pipe outside diameter and wall thickness given by:

$$DR = \frac{OD}{t}$$

Additional factors include the application (fluid characteristics, etc.) and service temperature.

Tables 2 and 3 provide pressure ratings for some oil and gas gathering applications. Additional information may be available from Performance Pipe for conditions not addressed in Tables 2 and 3. A check should also be made to verify these pressures apply under the state and/or local codes governing the specific application.

Temperature

Operating service temperature range for DriscoPlex® 6300 series pipe is –40°F to 140°F; 6300 series PE pipe is not suitable for use at temperatures in excess of 140°F. As shown in Tables 2 and 3, the average system operating temperature will affect the allowable design pressure rating of the pipe. For temperatures below 73°F, use the design pressure ratings at 73°F.

Table 2: Design pressure ratings for water, brine and dry natural gas gathering service
(Class 1 locations and other non-federally regulated applications)

DriscoPlex® 6300 Series PE Pipe	Operating Temperature			
	73°F	100°F	120°F	140°F
DR				
6	400 psig	312 psig	252 psig	200 psig
7	333 psig	260 psig	210 psig	167 psig
9	250 psig	195 psig	158 psig	125 psig
11	200 psig	156 psig	126 psig	100 psig
17	125 psig	98 psig	79 psig	63 psig

Table 3: Design pressure ratings for crude oil, produced water with > 2% liquid hydrocarbons, wet natural gas and condensates
(Class 1 locations and other non-federally regulated applications)

DriscoPlex® 6300 Series PE Pipe	Operating Temperature			
	73°F	100°F	120°F	140°F
DR				
6	200psig	156 psig	126 psig	100psig
7	167 psig	130 psig	105 psig	83 psig
9	125 psig	98 psig	79 psig	63 psig
11	100 psig	78 psig	63 psig	50 psig
17	63 psig	49 psig	39 psig	31 psig

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Temperatures near or below freezing will affect polyethylene pipe by increasing stiffness, vulnerability to impact damage and sensitivity to suddenly applied stress, especially when cutting. Use additional care in handling the pipe in cold conditions. When temperatures are cold, avoid sharp impact such as dropping the pipe from moderate heights. PE pipe will be more difficult to uncoil or field bend in cold weather.

Pressure Surge Capacity for Water Applications

Pressure fluctuations resulting from flow velocity changes are commonly referred to as hydraulic transients. Other expressions include surge pressure, waterhammer and oilhammer depending on the fluid being conveyed. The designer will consider both working pressure and the total pressure (working pressure plus surge pressure) when determining an application DR. DriscoPlex® PE pipe can tolerate hydraulic transients above the pressure rating. Recurring hydraulic transients to 1.5 times the pipe's design pressure rating are well within the limits of the DriscoPlex® PE piping. Occasional hydraulic transients to twice the rated design pressure can be tolerated. The allowance for hydraulic transients should not be misinterpreted that working or steady state pressure is permissible above the pipe's rating.

For moderate flow velocity (i.e. 5 ft/sec or less), it is generally unnecessary to adjust PE pipe's pressure rating for additional allowance for hydraulic transients. For lines operating at higher velocities, the working pressure may need to be reduced so the maximum peak pressures during a surge event are within material limits. This topic is covered in further detail in the Plastics Pipe Institute's (PPI) *Handbook of Polyethylene Pipe* available at www.plasticpipe.org.

Vacuum or Suction Pipelines

In some cases, the external pressure exerted on pipe may exceed the internal pressure. Examples include pipes operating under vacuum as well as some submerged, gravity flow and downhill siphon pipelines. When DriscoPlex® 6300 series PE pipe is used in vacuum applications or where external pressure exceeds the internal pressure, a sufficiently heavy wall pipe must be selected to resist the buckling forces. The vacuum capabilities of the pipeline vary with the pipe DR, temperature and the time of exposure to the vacuum. Vacuum Ratings for Performance Pipe HDPE pipes are in Table 14 of Performance Pipe's Field Handbook. Appendix B of API *15LE Specification for Polyethylene Line Pipe (PE)* and the PPI *Handbook of Polyethylene Pipe* also provide detailed information on designing PE pipe to withstand vacuum.

Unloading, Handling and Storage

Although PE pipe is not as heavy as some other piping products, significant weight may be involved. Improper handling or abuse may cause damage to piping or cause personal injury. Unloading equipment must be appropriate for handling PE pipe and have sufficient lifting capacity. Equipment such as an appropriately sized forklift, crane, side boom tractor, or an extension boom crane can be used for unloading. Refer to Performance Pipe's Field Handbook for additional information.

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The unloading and storage area should be level and of sufficient size to accommodate piping components and handling equipment. The storage area should be free of large stones, debris or other material that could damage the pipe. Performance Pipe's Field Handbook provides additional information including maximum recommended stacking heights for jobsite loose storage of PE pipe.

Heat Fusion Joining

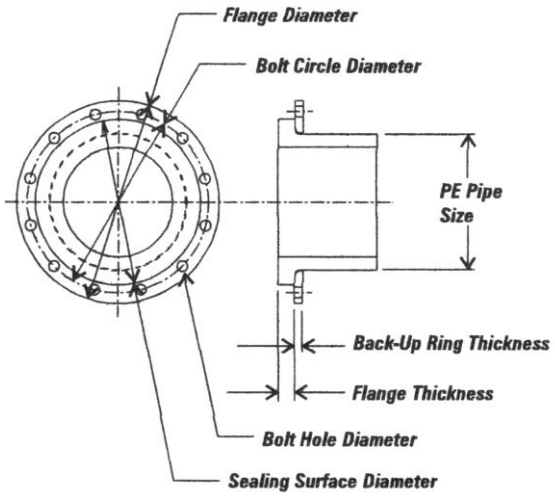
A key benefit of PE pipe is the fusion joint which when correctly made, is leak-tight and as strong in tension as the pipe itself. DriscoPlex® 6300 series PE pipe and fittings may be heat fusion joined per Performance Pipe's Bulletin PP-750 *Heat Fusion Joining Procedures and Qualification Guide* as well as ASTM F2620 *Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.* During the heat fusion process, equipment and products can

reach temperatures in excess of 450°F (231°C). Caution should be taken to prevent burns. Also, do not bend pipes into alignment against open butt fusion machine clamps. The pipe may spring out and cause injury or damage.

PE piping that has been in service conveying liquid hydrocarbons or wet natural gas requires additional joining considerations. Liquid hydrocarbons can permeate PE pipe and heat fusion joining of liquid hydrocarbon permeated pipes may result in a low strength joint. Liquid hydrocarbon permeation may be indicated by a rough, bubbly or pockmarked surface when the heater iron is removed or by a rough, pockmarked fusion bead when fusion joined. When indicated, fusion joining should be stopped and these pipes should be joined using suitable mechanical connections.

Flanged Connections

Flanged joints are made using a DriscoPlex® flange adapter that is butt fused to the pipe. A metal back-up ring is fitted behind the flange adapter sealing surface and bolted to the mating flange. The bolt circle, bolt hole number and diameter of standard back-up rings conform to ANSI/ASME B16.5 Class 150 dimensional patterns. Additional information including bolt torque recommendations and bolt tightening patterns are provided in Performance Pipe's Technical note PP811-TN PE Flange Connections.



Mechanical Connections

DriscoPlex® 6300 series PE pipe may also be joined using suitable mechanical connections. Mechanical

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connections must be adequately restrained to undergo. Some mechanical couplings incorporate restraint in the fitting design. Others may require the addition of compression restraining rings used in combination with the mechanical coupling. When using OD compression methods to join and restrain PE pipe, a metal stiffener inserted into the PE pipe ID may be required to provide the necessary long-term rigidity to withstand the compression load; consult with the mechanical fitting manufacturer for further guidance.

Direct Burial

The toughness and flexibility of PE piping make it ideal for underground construction. Since PE pipe can be fused above ground in long lengths, narrow trench widths can be used to save on installation costs. DriscoPlex® 6300 series PE pipe should be installed in accordance with ASTM D2774 *Standard Practice for Underground Installation of Thermoplastic Pressure Piping* and Performance Pipe's Field Handbook. Because of the interaction of PE pipe with the surrounding soil, the nature of the embedment materials and the quality of their placement are important especially for deeper burial and thin walled (high DR) PE pipe. In general, coarse, angular sands and gravels are preferred, but other materials may be used under the direction of the design engineer. Native soils may be acceptable for some shallow cover non-traffic applications provided the particle sizes do not exceed the below guidance. To avoid excessive stress concentrations in the pipe, the maximum particle size for the embedment soils should be limited to ½ inch for pipes to 4 inches diameter, ¾ inch for pipes 6 inches to 8 inches diameter, 1 inch for pipes 10 inches to 16 inches diameter and 1 ½ inches for larger pipes.

withstand the axial movement that the PE pipe could

Locating

Most polyethylene materials are not detectable with standard magnetic locating equipment. When installing PE piping, a method or methods for future pipeline detection should be considered. Underground locating agencies should always be contacted before the start of any underground installation work such as excavation, trenching, and directional drilling.

Above Ground Service and UV Protection

DriscoPlex® 6300 series PE piping products are defined as Code C materials in accordance with ASTM D3350. The products are protected against outdoor exposure through the addition of a minimum of 2-3 percent carbon black. The dispersed carbon black particles help to prevent UV degradation by blocking UV energy penetration. DriscoPlex® 6300 series PE piping is suitable for extended outdoor service. Surface and above grade applications must be properly supported and must take thermal expansion and contraction into account. Additional information on this topic can be found in Performance Pipe's Technical note PP814-TN Thermal Effects.

Field Bending Radius

The flexibility of PE pipe allows it to follow a tortuous course with minimal need of fittings for changes in direction. The allowable field bending radius for DriscoPlex® PE pipe is dependent upon the pipe OD, DR and the presence of fittings in the bend. See Performance Pipe's Technical note PP819-TN Field Bending of DriscoPlex® Pipe. Table 4 provides the minimum long-term field bend radius for DriscoPlex® PE pipe.

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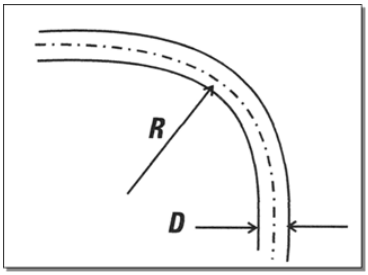
Table 4: Allowable Field Bending Radius for DriscoPlex® PE Pipe	
Pipe Dimension Ratio	**Allowable Field Bending Radius (R)**
9 or less	20 times the pipe OD
>9 to 13.5	25 times the pipe OD
13.5 to 21	27 times the pipe OD
Fitting or flange present in the bend	**100 times the pipe OD**



Leak Testing

Polyethylene pipe may be hydrostatically tested or pneumatically tested to determine system integrity for leaks. When testing is required, observe all safety measures, especially if using pressurized gas as the test medium. Consideration must be given to restraining the pipe against movement in the event of catastrophic failure, observing limitations of temperature, test pressure, test duration, and procedures for making repairs. Performance Pipe's hydrostatic leak testing procedure is discussed in Technical note PP-802 Leak Testing of Polyethylene Pipe available on the website under Engineering Information. ASTM F2786 *Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Gaseous Media under Pressure (Pneumatic Leak Testing)* provides guidance on air testing.

Cautions

Polyethylene piping has been safely used in many applications. However, there are general precautions that should be observed when using the product. Performance Pipe recommends the following reading for a more detailed list of cautions and safety features.

1. The Plastic Pipe Institute Handbook of Polyethylene Pipe, Chapter 2, "Inspection, Tests and Safety Considerations".
2. Performance Pipe Manual PP-750 *Heat Fusion Joining Procedures and Qualification Guide*.
3. Static Electricity
   High static electricity charges can develop on polyethylene piping products, especially during squeeze-off, when repairing a leak, purging, or making a connection. See Performance Pipe Technical note *Polyethylene Pipe Squeeze-Off PP 801-TN* as well as Manual PP-750.
4. Coils
   Coiled PE pipe is restrained with strapping to contain the spring-like energy retained within the coil. Cutting or breaking strapping can result in an uncontrolled release. Take all necessary safety precautions and use appropriate equipment. Observe the safe handling instructions provided by the delivery driver and available through the manuals noted above. See PP 807-TN *Large Diameter Coiled Pipe*.

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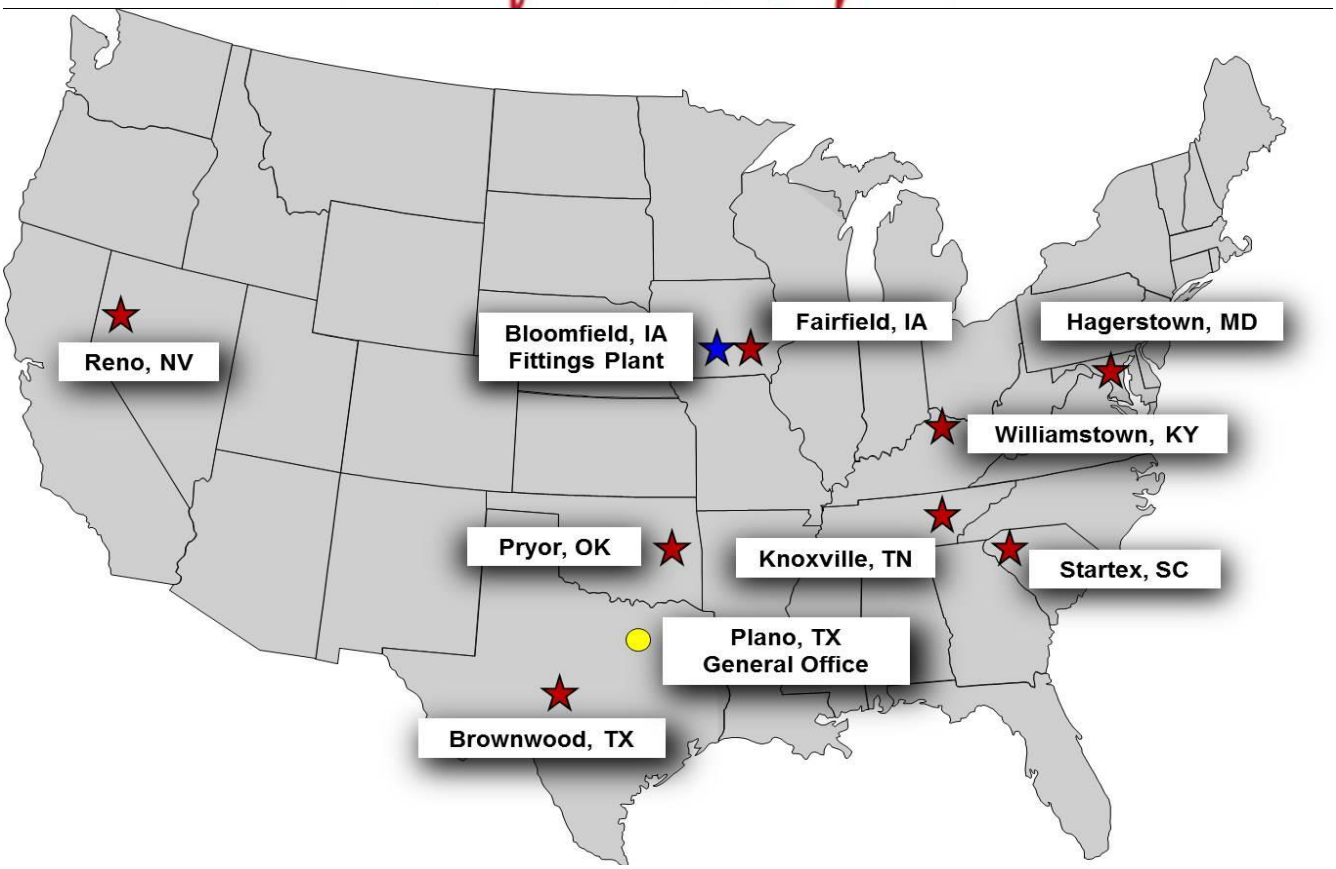
When Performance Matters Rely on Performance Pipe



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DRISCOPLEX® POLYETHYLENE PIPE & FITTINGS

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