# Book 1: Chapter 1 - About Performance Pipe

Performance Pipe is the successor to Plexco®[1] and Driscopipe®[2]. On July 1, 2000, Chevron Corporation and Phillips Petroleum Company announced the combination of their worldwide chemicals businesses into a new entity, Chevron Phillips Chemical Company LP. Performance Pipe, a division of Chevron Phillips Chemical Company LP, succeeds Plexco and Driscopipe as North America's largest producer of polyethylene piping products for gas industrial, municipal mining oilfield and utility applications.

Performance Pipe offers more than forty years of polyethylene piping system experience, with pipe and fitting manufacturing facilities throughout the United States and in Mexico.

To enhance the outstanding quality and performance of Performance Pipe polyethylene piping, Chevron Phillips Chemical Company LP further strengthens Performance Pipe with over four decades of quality polyolefin resin production.

## *The Polyethylene Pipe Advantage*

Performance Pipe polyethylene piping products have unique features that are ideal for many varied applications. DriscoPlex™ polyethylene pipes have excellent abrasion resistance, superb impact resistance, and extraordinary toughness. The smooth, non-wetting bore offers low resistance to the flow of water, wastewater, and water borne slurries. DriscoPlex™ polyethylene pipes are resistant to a broad range of corrosive chemicals, they do not support biological growth, and they resist the adherence of scale and deposits.

Performance Pipe polyethylene piping products are cost-effective solutions for a broad range of piping applications in gas, water, utility, municipal, industrial, marine, mining, and agricultural applications; in installations that are above ground, on the surface, buried, sliplined, trenchless, floating, and submerged. Fluids transported include water, wastewater, slurries, compressed gasses, odorous and corrosive gasses, chemicals, and hazardous wastes.

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[1] Plexco was formerly a Division of Chevron Chemical Company.

[2] Driscopipe was formerly a Division of Phillips Petroleum Company.

Some of the features of DriscoPlex™ polyethylene piping products include:

- Identification Stripes and Colors
- Handling
- Flexibility and Toughness
- Pressure Rating
- Service Temperatures
- Non-Contaminating
- Outstanding Chemical Resistance
- Sealed, Leak-Tight Heat Fusion Joints
- Excellent Hydraulics
- Surge and Liquid Velocity
- Abrasion Resistance
- Thermal Expansion

Lower Life Cycle Costs

## *Identification Stripes and Colors*

Color-coding has become the preferred way to identify differences among piping services, sizing systems, and to differentiate multiple DR's (pressure ratings) on the jobsite. For identification that is as permanent as the pipe, many DriscoPlex™ piping products have color stripes extruded into the pipe surface. Solid color pipes or a color shell extruded on the outside or inside of the pipe are also available.

### Colors to identify applications:

- Yellow for natural gas
- Blue for potable water
- Red for underground fire main
- Green for wastewater
- Purple for treated effluent
- Other stripe colors — white, orange, gray — to meet application requirements

### Color stripe patterns to identify sizing systems:

- IPS (iron pipe) sized pipe — four color stripes equally spaced around the pipe
- DIPS (ductile iron) sized pipe — three pairs of color stripes equally spaced around the pipe

### Color stripes to identify DR:

Single-striped pipe provides an easy, obvious, quick means to identify the pipe DR (dimension ratio) on a multiple DR project. Each permanent, co-extruded color designates a different DR — which determines pressure rating. Single-striped DriscoPlex™ pipe for mining, industrial and municipal applications makes installation and inspection more cost effective, and helps ensure that pipes with the correct pressure rating are installed in their proper location.

| *Color* | White | Red | Yellow | Gray | Orange | Blue | Purple | Green | Pink | Brown |
|---|---|---|---|---|---|---|---|---|---|---|
| *DR* | 7.3 | 9 | 11 | 13.5 | 15.5 | 17 | 21 | 26 | 32.5 | 41 |

### Solid Colors

Solid color pipe, duct and conduit are available. DriscoPlex™ 6500 PE 2406 medium density gas pipe is used world wide for gas distribution. DriscoPlex™ 4600 and DriscoPlex™ 4700 solid gray pipe facilitates video inspection in sewer applications. Red and black electrical conduit, and orange, black, gray, blue and white communications duct are available for single or parallel coil installation.

## *Handling*

Made from materials much, much lighter than ductile iron and reinforced concrete, tough, lightweight DriscoPlex™ polyethylene pipes do not require the heavy handling and laying equipment commonly required for ductile iron and concrete pipe. Rather than handling short, heavy pipe sections, longer lengths of comparably sized polyethylene pipes typically weigh less than a fifth as much. Some smaller sizes can even be carried by hand.

## *Flexibility and Toughness*

Polyethylene pipe is flexible, allowing it to follow rolling terrain contours and reducing the need for fittings.

*Caution — Protect polyethylene piping against excessive bending and shear loads where pipes emerge from structures such as walls or casings; and at rigid connections such as flanges and mechanical joints.*

Protect small pipes at connections to plastic or metal tapping tees or service or branch outlets (protective sleeves should be used).

Protect connections to much larger pipes, tanks, manholes, etc.

During installation, protect fabricated PE fittings against bending.

- *At a minimum, areas that are subject to bending or shear loads must be carefully installed and properly supported to minimize undue loads that could result in premature failure.*

DriscoPlex™ polyethylene pipes retain working flexibility even in harsh climates and under adverse conditions. Water within the pipe may freeze solid without damage to the pipe;

however, ice blockages must be thawed before pumping is resumed. Unstable soils and seasonal freeze/thaw conditions have little effect on this flexible, elastic piping system.

Polyethylene pipe is becoming the material of choice for directional drilling. It's flexibility and toughness facilitate installation and reduces costs.

## *Pressure Rating*

Pressure rating is based on long-term sustained pressure tests and analysis that are designed to replicate the long-term behavior of polyethylene. Long-term performance of polyethylene materials under stress is characterized by the Hydrostatic Design Basis (HDB), which is determined using ASTM D 2837. Pressure rating is calculated using the HDB, the pipe diameter and wall thickness, and appropriate design (safety) factors for temperature and the environment inside and outside the pipe.

Quick burst is not used to determine pressure rating. Quick bursts are an indication of short-term strength and ductility, but tests show that long-term performance is dependent on long-term resistance to applied stress, temperature, fatigue and chemical effects. Short-term properties such as tensile strength and ductility do not provide an indication of service life.

Quick burst pressures for DriscoPlex™ polyethylene pipes are determined by testing under ASTM D 1599. Typically, quick burst pressures exceed four times the pipe's long term pressure rating.

## *Service Temperatures*

Sub-freezing temperatures are well tolerated by DriscoPlex™ polyethylene pipes. Operating service temperatures may be from -50° F (-45° C) or lower, up to 140° F (60° C) for pressure applications, or up to 180° F (82° C) for non-pressure applications. Pressurized fluids must be in a flowable liquid or gaseous state.

As with all thermoplastic piping products, service pressure ratings, mechanical design properties and in some cases, service life expectations are reduced at elevated temperatures.

## *Non-contaminating*

The purity of the fluids being conveyed is safeguarded by the absence of easily extractable substances. Polyethylene piping materials for potable water applications have been evaluated and certified by the National Sanitation Foundation to NSF Standard 61. Potable water products meet the requirements of standards such as AWWA C901 or AWWA C906.

## *Outstanding Chemical Resistance*

Few materials offer better over-all resistance to corrosive acids, bases and salts. In addition, polyethylene is unaffected by bacteria, fungi or even aggressive naturally occurring soils. It has good resistance to many organic substances, such as solvents and fuels.

Polyethylene piping does not rust, rot, corrode, or tuberculate like traditional metal or concrete piping. It is not subject to galvanic or hydrogen sulfide corrosion.

## *Sealed Joints*

DriscoPlex™ outside-diameter controlled polyethylene pipes can be joined into long, continuous lengths by heat fusion, a joining technique that provides leak-free joints that are as strong and chemically resistant as the pipe itself.

Inside-diameter controlled DriscoPlex™ 2000 SPIROLITE® pipes are joined using push-on type, gasketed-spigot-and-bell joints. The DriscoPlex™ 2000 SPIROLITE® joint meets or exceeds ASTM D 3212 deflected joint leak tightness requirements.

## *Excellent Hydraulics*

Polyethylene pipe behaves as an "ideally smooth conduit," offering extremely low resistance to the flow of fluids. Superior chemical resistance and a non-wetting (wax-like) surface combine to virtually eliminate scaling and pitting, and to preserve excellent hydraulic characteristics throughout the pipe's service life.

## *Surge and Liquid Velocity*

Unlike traditional piping which may require a working pressure reduction to cope with surge events, DriscoPlex™ polyethylene pipe is resilient, and can withstand surge-induced pressures that exceed the pipe's pressure rating (pressure class). When joined using properly made butt fusion joints, fully restrained mechanical connections, and flanged connections, the allowable water hammer surge pressure may be up to 50% above the pipe pressure rating (pressure class) when surges are frequent, or up to 100% above the pipe pressure rating (pressure class) when surges are infrequent. Surge pressure allowance may be restricted when there are many fittings, and where other appurtenances such as valves or hydrants limit surge pressures. Because polyethylene is resilient and has a lower elastic modulus, surge pressures in polyethylene pipe are 80% lower than in ductile iron, and 50% less than in PVC.

Acceptable fluid flow velocity is dependent on the application and on system design. For example, pressure water system flow velocities as high as 14 fps may be acceptable where uncontrolled surge is infrequent, and where surge pressures are controlled, velocities higher than 20 fps may be acceptable.

## *Abrasion Resistance*

Because of its high impact strength, resilience, high molecular weight, and corrosion resistance, DriscoPlex™ PE 3408 HDPE pipe is used successfully for transporting liquid slurries in power plants, mining, dredging and similar applications. Polyethylene piping frequently outwears harder piping materials when conveying many types of abrasive solids in liquid slurries. In slurry applications, polyethylene's behavior is similar to elastomer-lined pipe where particles in suspension bounce off the pipe wall. Extra-high molecular weight DriscoPlex™ PE 3408 HDPE

pipe resists impact and cutting abrasion from sharp particles when properly designed. Particle size and fluid velocity are important considerations for slurry piping design.

***WARNING — Do not use polyethylene pipe for dry pneumatic slurry or dry sliding applications. Dry particles sliding on dry polyethylene will cause an electrostatic charge to build up on the pipe surface, sometimes thousands of volts. A sudden electrostatic discharge can be hazardous.***

Polyethylene pipe is not electrically conductive and cannot be grounded by attaching grounding wires to the pipe. Dry sliding applications also generate heat from sliding friction that may reduce pipe structural integrity, or even melt the surface.

## *Thermal Expansion*

Non-buried pipelines, such as surface or suspended pipelines, or pipelines within above grade casings, will expand or contract in diameter and length with changing temperature. An approximate length change allowance is “one – ten – one-hundred”, that is about 1" for a 10° F temperature change for each 100’ of pipe.

System designs should accommodate thermal length change effects when they apply. Thermal expansion and contraction length change can be much greater compared to non-PE piping systems, but loads on anchors and supports are usually much lower. Hanging the pipe from supports that allow lateral movement, expansion loops, snaking the pipe in the right-of-way, and various anchoring techniques may be employed. *Expansion joints should not be considered unless they are designed specifically for PE pipe.*

## *Additional Information*

For additional information on use, design and installation considerations, see the *Performance Pipe Engineering Manual Book 2: System Design* and the *Performance Pipe Engineering Manual Book 3: System Installation.*