JCM INDUSTRIES, INC,
General Application Information
Fittings and Fabrications for High Density Polyethylene Pipe

JCM Products for repairing, connecting and tapping Polyethylene pipe have been tested and evaluated for their suitability and design capability. In each case JCM products have performed satisfactorily in respect to their design application. Test criteria range from short-term for special applications to long-term 1000 hour evaluations with the most common applications. Temperature and pressure cycles are also incorporated to fully address the pipe characteristics and full range of occurrences. Special monitoring equipment is utilized to produce accurate test data and for historical reference.

High Density Polyethylene Pipe (HDPE) has several unique characteristics which are taken into consideration in the following guidelines. The disregard of these guidelines and/or the installation instructions supplied with each fitting may cause unsatisfactory results and void the expressed product warranty.

HDPE Pipe considered for use must be manufactured to the recommendations set forth in the ANSI/AWWA Standard C906 and complies with criteria in reference to size.

HDPE has a high coefficient of thermal expansion and contraction along with a low modulus of elasticity. This sensitivity to pressure and temperature causes HDPE to expand and contract more than traditional water and sewer piping materials. The potential pipe expansion or contraction must be considered when assembling bolt on fittings.

HDPE will relax (“creep”) at lower stress levels than other piping materials. Due to these special characteristics, the following parameters should be adhered to when utilizing JCM products for HDPE (ANSI/AWWA C901, C906).

- HDPE and bolt-on fitting connections are vulnerable to forces experienced with expansion/contraction of the pipe and require special consideration. Restraint must be considered when joining plain end pipe to ensure against pipe pull out. HDPE is manufactured with a smooth pipe wall surface resulting in a low coefficient of friction that can enable fittings to slide, shift, move, rotate and/or travel on the pipe after installation. JCM products are limited in the tolerance of axial movement of the pipe.

- JCM products for HDPE are designed for underground pressurized fluid service and are pressure rated to match the pipe SDR pressure rating or with a maximum service rating of 150 PSI (Temperature 35^{o} - 75^{o} F/Maximum test pressure limited to rated pipe pressure or fitting, whichever is lower). For above ground applications, contact JCM Industries Technical Services.

- Pipe stiffeners must be used when joining, or connecting to, HDPE. Pipe systems must be engineered to prevent movement causing fittings to slide or rotate on the pipe. Cutting HDPE can cause the pipe to ovate or “neck” down and become egg shaped. This pipe movement can interfere with the assembly of bolt on fittings.

Thirty years of successful performance has been one of the most stringent proving grounds for JCM products and their application with Polyethylene Pipe. Generally speaking, most common potable water pressure applications utilize HDPE SDR 17 through 11. For applications on thinner wall pipe, special applications, higher pressure ratings and product usage recommendations, please contact JCM.

Note: JCM recommends fusion joints as a primary method of connection. When correctly implemented, fused joints are self-restraining and leak proof. In some instances conditions are not conducive to properly fuse the joint per manufacturers’ recommendations. Mechanical fittings to join or repair HDPE are a secondary and limiting choice. The information included on this page is provided to address the known factors when repairing, joining or tapping HDPE with mechanical fittings.

Effective 07/30/08

Applications of JCM ProductS on High Density Polyethylene Pipe
Frequently Asked Questions

Why does JCM not use Spring Washers?

"A Belleville washer, also known as a cupped spring washer, is a type of non-flat washer with a slight conical shape which gives the washer a spring characteristic." These washers are used both singularly and in multiple "stacks" for maintaining uniform tension load on a bolt. Basically, these metal curved disks are manufactured to a predetermined tension level that will accommodate thermal or pressure expansion and contractions. There are numerous formulas and design criteria to determine the material, size, curve, number and method of installation of these washers in various industries (industrial piping, automotive, electrical, construction, etc.), more data than space allows for here. A simple search on the internet provides a wealth of information on these items. **How they relate to installation on underground (buried) fittings is what JCM will address here.**

The theory behind the spring washer is that when installed, the "spring" in the washer will provide the uniform load on the fitting's bolting assembly should the pipe expand/contract – so as HDPE pipe shrinks and expands on the circumference, the spring washers will flex and absorb the expansion/contraction. That theory is applicable in above ground, vault or gallery piping installations in which the assembly has freedom of movement. It is JCM's opinion that when installed on a fitting that is buried underground, the ability of the washers to move or "flex" with the fitting is eliminated due to the site backfill embedment material. The spring washers perform no significant function in that environment. The space, voids and gaps around the assembly are filled with dirt, clay, mud, gravel and other soil matter that compacts around the fitting resulting in a solid, compressed environment (similar to concrete). The factors of compaction, debris between washers, rocks between fitting halves and various other backfill material fragments will encase the assembly in earthen "material" and prevent any chance of movement, no matter how slight.

JCM Industries has worked closely with HDPE manufacturers and contractors to engineer fittings that are specifically designed to accommodate the unique characteristics of HDPE – the thermal expansion and contraction is one of the major features of the pipe. The design criteria that makes JCM fittings extremely successful on HDPE is the gasket and the machined groove. JCM implements a unique gasket design in all of our products that are especially recommended for use on HDPE pipe. This thick cross section of gasket, of a specific profile, is where the pipe expansion/contraction finds accommodation. The special gasket is compressed during installation of the fitting with specified bolt torque. As the bolts are tightened, the bolt torque is directly transferred through the bolting system and into the gasket, compressing and storing "flexing" the appropriate amount of energy between the pipe and fitting. The ability to accommodate the expansion/contraction is housed in the gasket itself, thus eliminating the need to try transferring the expansion/contraction energy through the exterior of the fitting by washers.

Therefore, based on this mechanical philosophy, JCM does not furnish spring washers – the energy stored in the gasket which is in direct contact with the pipe wall is a more effective and efficient application.

Compression of the gasket and a true "bolt torque" reading at the completion of the fitting installation is critical. As HDPE goes through the varying changes of the thermal dynamics, the secure seal of the gasket on the pipe is the key to the watertight connection.

Frequently Asked Questions (Continued)

Are ALL JCM products suitable for HDPE?

No. JCM recommends particular products to be installed in applications on HDPE because of certain distinctive design features that make them most suitable for HDPE characteristics. HDPE's high coefficient of thermal expansion/contraction and the low modulus of elasticity present two important working traits to consider when selecting bolt on pipe fittings. Generally, products that provide a broad footprint on the pipe wall with extensive gasket to pipe contact and a wide cross section gasket with enough volume to store compression energy are most desirable for HDPE. The gasket should be of hardness (durometer) which will flex with pipe pressure fluctuations. Outlet seals should have a mechanical sealing lip that utilizes line pressure to increase the seal. Outlet gaskets, such as on tapping sleeves and service saddles, should be externally and internally confined in a groove. Fittings should be sized and formed to fit the HDPE pipe outside diameter to ensure the sleeve or body conforms to the HDPE pipe and prevents undue stress. A wide stance design provides pipe wall support and spreads the "load" to prevent point loading or deformation of the pipe.

Why do bolt on pipe fitting manufacturers insist on the use of "stiffeners" in a connection application?

Under pressure, HDPE will move or "creep" (cold flow of material) away from the point of pressure, a trait that works against the typical bolted coupling design. As pressure is applied by the tightening of the bolts, HDPE will relax and move away from the pressure, preventing the bolt torque from fully compressing the gasket and complete a water tight, long term installation. The use of an internal pipe stiffener will block the "creep" or movement and provide a stable base for the bolt torque energy.

Another associated issue is commonly known as "toe-in." This is when a plain end of HDPE will "neck down" or ovate after cutting. If left uncorrected, the ovation (egging, necking down) of the pipe will hinder the bolt on fitting gasket from making proper 360^{o} contact and in some cases prevent the fitting from being installed. The internal stainless steel stiffener used in the pipe ends will provide a durable support for the bolted fitting and the bolt torque to fully compress the gasket for a watertight, long term seal.

Are restraint devices or anchorage systems really necessary when using bolt-on clamps or couplings with HDPE?

Yes, they are really necessary. Without incorporating a physics lesson, simply put, the HDPE pipe surface is smooth and without texture (unlike asbestos cement or cast iron pipe), thus the surface produces a "low coefficient of friction." The coefficient of friction is the relative amount of force required to make two surface materials slide past each other. A low number reflects low resistance and smooth action (i.e. lubricated bearings, Teflon finishes, etc.). So with the lower coefficient of friction, the HDPE can more easily slide in various soils and out of bolt-on fittings if the pipe is not restrained to prevent axial (linear) movement that causes pipe movement, pull out from the bolted fitting can occur. HDPE fused joints are "self-restraining" and according to HDPE manufacturers, do not require external restraint methods – as long as the fusion procedure was done correctly.
Refer to the PPI (Plastic Pipe Institute). PPI provides a complete Handbook of PE Pipe that specifically addresses designing and installing PE piping systems and methods of restraint.

How much of a consideration is thermal expansion and contraction?

HDPE has a high thermal coefficient of expansion/contraction. When subjected to a temperature change, unrestrained, above and below grade, polyethylene pipe will experience expansion and contraction. As a rule of thumb, a change of 1" per 100' of pipe per 10°F change in temperature. This is especially important in installations in which the HDPE is laid along the trench site. Forces encountered due to thermal expansion and contraction can be significant. Properly designed systems that account for the potential expansion/contraction will be required.

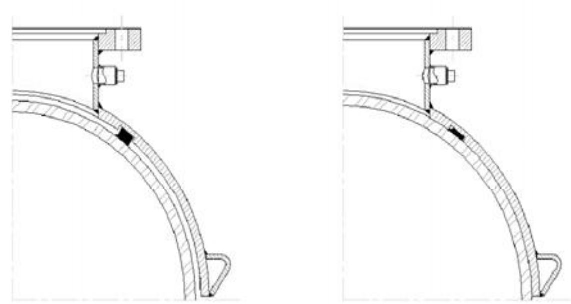
Frequently Asked Questions (Continued)

What factors should be taken into account before tapping HDPE Pipe?
An important factor for consideration is the SDR (Standard Dimension Ratio) of the pipe to be tapped. HDPE pipe with an SDR number greater than 17 (SDR 19, 21, 26, 32.5) have a lesser wall thickness and can be subject to flexing. This limits the type and size of branch that can be provided.

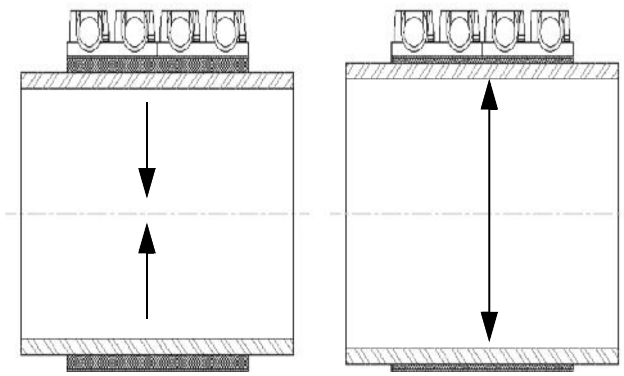
Conversely, other factors must be considered with increased wall thickness. Calculations should be completed prior to the branching procedure that include the wall thickness of the pipe, travel distance of the tapping machine and the size of the tapping machine cutter. In some instances a size on size branch with a full opening may not be possible due to the wall thickness and the inability of the cutter to make a clean cut through the "shoulder" of the pipe wall. This can be overcome by reducing the size of the cutter (reducing the size of the cut opening in the pipe). JCM provides various sleeve types and designs that provide an array of options that can overcome critical size-on-size requirements.

These factors should be included with the standard branching considerations such as size of pipe, size of branch outlet, working/test pressure requirements, line content and any environmental factors such as hot or acidic soils.

What is Unique about JCM gaskets performance on HDPE?
JCM gasket design was conceived based on the working characteristics of HDPE and the distinctive fluctuations that transform the pipe through thermal dynamics. Within the JCM Tapping Sleeves and Service Saddles, the gasket durometer (hardness of the gasket material) formulation is pliable enough to accommodate compression and storage of energy with thermal changes in pipe diameter, yet hard enough to withstand high working pressures – the working features of the gasket durometer, the broad, hydromechanical lip design and the confinement in a recessed groove around the outlet join together to provide a secure, active watertight seal at the pipe/gasket interface. The drawing right demonstrates the system of the gasket storing and releasing energy as the pipe contracts and expands.



JCM Universal Clamp Couplings share the same gasket compression "stored energy" theory. This working energy is the reason JCM does not use "spring washers" to store energy. (Once backfilled and buried, the ability of the spring washer to perform as designed can be limited.) JCM uses a 1/4", or thicker in some cases, gasket for Universal Clamp Coupling (thickest in the industry). This thick gasket stores the energy as the pipe diameter increases and releases the energy back as the diameter decreases. The image right reflects the compression and release of the stored energy along the body of the clamp.



As pipe contracts, gasket expands and releases stored energy.

As pipe expands, gasket compresses and stores energy.