Who We Are

The mission of the Alliance for PE Pipe, Inc. is to promote smooth-wall polyethylene pipe and fittings as the material of choice for municipal water and sewer piping applications. HDPE is the responsible choice for piping systems: Environmentally-responsible due to its leak-free properties, Fiscally- responsible due to its lower life-cycle, installation and maintenance costs, Socially-responsible due to trenchless installation resulting in less disruption to traffic flow and commerce. Help your city to make the responsible choice today. Choose HDPE for water and sewer piping.

Polyethylene Pipe Offers:

November 2013 Issue

The Proof is in the Bead

The butt fusion bead is one of those things in the HDPE industry that gets a lot of attention. You see it on all fused pipe, you look at beads to make sure the joint is connected properly and it is a topic of conversation in every seminar and roadshow that we conduct.

Where would we be without the bead? First off, we would not have the monolithic pipe system that everyone talks about. We would not have the proof that fusion has worked and we would not have our primary point of differentiation from other products. The fact that once the fusion process takes place, there is no joint. Thus, nothing to break, come apart over time or leak its cargo. The bead is the key indicator of a successful fusion and contributes to our understanding of the process and fusion operator performance. About that point of differentiation.... When two HDPE pipes fuse together, a monolithic pipe structure is formed where there are no leaks, no joints and no failures. So, water can make it from A to B intact and with no leakage throughout its 100 + year service life.

You will also notice below in column one a CALL TO ACTION in support of common sense legislation for municipal infrastructure finance. We also took the opportunity to briefly discuss the merits of the 4710 resin which makes up today's PE pipe and fittings. This is a remarkable resin, designed specifically for the way we use it. Also, if you happen to have some time next year, come by one of our roadshow. These popular roadshows are for engineers and municipal operators of water and sewer systems. We would enjoy meeting you and learning about your system and its challenges. See you on the road!

Peter Dyke
Executive Director

The Beauty and the Bead

By Peter Dyke, Alliance for PE Pipe Executive Director

Before we talk about the product of fusion , we need to understand the

- Trenchless installation
- Lowest failure rate for water mains
- Lowest life cycle costs
- Resistance to galvanic corrosion
- No gaskets to leak
- Outstanding flexibility
- Resistant to ground movement
- Excellent flow characteristics
- Low maintenance costs
- Easily repaired

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PE 4710 Performance

The article on the right talks at length about the butt fusion bead. Stepping back a bit we see that the bead and the pipe are made of HDPE material. HDPE piping materials have served international and domestic utilities for at least half a century. In fact, Europe and Australia lead the world in their use of HDPE piping on a percentage basis.

HDPE piping is designed to exhibit the properties that make it so popular. Since the introduction of polyethylene piping materials in the 1950's, polyethylene piping manufacturers have continually improved the materials. International standards

fusion set up and how we arrive at the product of fusion, aka the 'bead.' On the jobsite, the operator brings two lengths of pipe together at a fusion machine and aligns the ends. He or she cleans the pipe ends, removes the outer layer of pipe in an act called "facing" to expose fresh pipe. The heating process can now begin with a "heater plate" that is warmed to 450 degrees. When the pipe comes in contact with the heater plate, the HDPE melts.

Your local distributor rents and sells McElroy fusion machines Above, a city of Houston staff member tries his hand at fusing two pieces of 6" DR 17 pipe on a McElroy "Pit Bull 26" while Hal Smith from ISCO Industries provides a few tips. (Image: Alliance)

The heater plate is then removed and the molten HDPE pipe ends are pushed together under "fusion pressure." This forms the "bead" on the outside and inside of the joint. The bead rolls back over the unmelted pipe ends when fusion pressure is applied.

Interestingly enough, the outer bead is formed from the melted resin along the outer third of the pipe wall. The fusion joint interface is formed from the center third of the pipe wall and the inner bead is formed from the inner third of the pipe wall.

I bet you are saying "this is way too much information." You know what, I kind of agree, but if you are even close to getting serious about using HDPE, you will soon find out the importance of the bead and why regular users of the product are well acquainted with making and reading about that all important bead. The Alliance strongly encourages HDPE users to require operators that are properly trained and carry a qualification card that is less than two years old while on the job.

Reading the Bead

Pipe manufacturers like WL Plastics and Performance Pipe provide clear

recognized higher performing HDPE materials in mid-1990. Higher-performing polyethylene pipe materials were recognized and incorporated into domestic ASTM and AWWA standards in mid-2000. The material designation code for higher-performing HDPE piping is PE4710.

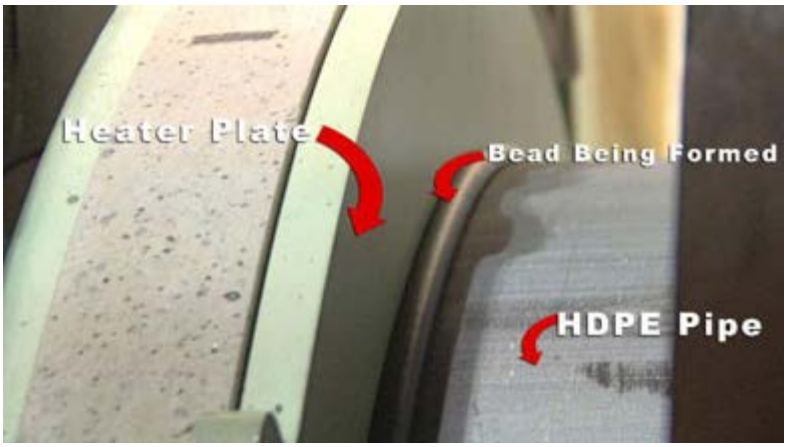
Compared to earlier HDPE piping materials, PE4710 has increased density, higher tensile strength and superior toughness. These enhanced properties provide PE4710 pipe that meets higher performance requirements for HDPE piping that have been added to North American material and piping standards. These higher performance requirements provide pressure-class rated PE4710 pipe that features:

- Lower cost per foot
- Higher flow capacity
- Greater integrity, reliability and service life
- Lower maintenance and operating costs
- Superior toughness and resilience for dynamic and emergency conditions

Improved PE4710 piping materials have superior resistance to static and dynamic pressures compared to traditional municipal piping materials. PE4710 piping assures system integrity in unstable soils, offers unique, cost-effective infrastructure rehabilitation alternatives, and provides superior economics for the municipal dollar. PE4710 piping has the lowest life-cycle cost when compared to "traditional"

direction on fusion bead requirements. The bead is read twice during the fusion process, once to determine if the proper melt has been achieved, and next to determine that correct procedure has been observed. In both circumstances, bead size depends on pipe diameter and, to a lesser extent, on the thickness of the pipe wall (DR). For larger pipes, the bead is larger.

When the pipe ends are moved against the heater, a melt bead develops. Polyethylene swells when melted and shrinks as it solidifies. The correct melt bead size shows that the pipe ends are properly melted for fusion joining. For example, on a 6" pipe the melt bead should be just ¼" to 3/8". At this point the operator removes the heater plate, moves the melted pipe ends together, and applies a "joining force" that is held against the pipe ends for a prescribed cooling time. A double rollback bead forms as the joining force is applied.



A good fusion process starts with the heat soak where the resin melt occurs slowly against the heater plate. Once the plate is removed, the bead is formed by the joined melted resin from both pipe ends. (Image: Alliance)

Once the fused pipe is cooled, the trained operator checks for uniform double roll-back bead shape and dimensions around the circumference of the pipe. The operator checks the "V" groove depth between the rollback beads. The "V" groove should not be deeper than ½ the height of the bead off the pipe. A V-groove that is too deep can indicate excessive joining pressure, inadequate heating or improper pressure during heating.

The "V" is not the only point of information found in the bead. The bead shape also speaks to the operator. An overly large bead can suggest pressure during the heat soak. Inconsistent size around the pipe can show uneven heating (possibly from a defective heater plate) or misalignment and even excessive fusion machine wear. Beads not rolled over to the pipe OD surface can indicate inadequate fusing pressure.

municipal piping materials, and can provide new system performance for service lifetimes exceeding 100 years.

Attention: Pipeline Readers

Support the Water Infrastructure Finance and Innovation Act (WIFIA)

WIFIA is now closer than ever to becoming law, so the time is right to take action in support of it!

WIFIA is an innovative federal loan program that will help meet the nation's water infrastructure needs with a minimum budgetary impact. WIFIA would make direct loans for larger projects, defined as $20 million for cities with more than 25,000 people or $5 million for cities with fewer than 25,000 people. In addition, WIFIA would offer direct loans to states that wish to aggregate a number of smaller projects to reach the $20 million (or $5 million) threshold.

The Alliance for PE Pipe asks that you contact the representatives below and voice support for Rep. Bob Gibbs and his work on WIFIA.

Urge that WIFIA be included in the eventual conference between the House and Senate in the water resources legislation.

Rep. Bill Shuster, Penn., Chair of the T&I Committee

Follow the colored lines to see where they end up after fusion. The outer bead is formed from the outer third of the pipe wall, the fusion joint interface is formed from the center third and the inner bead is formed from the inner third of the pipe wall. (Image courtesy Harvey Svetlik, GF Central)

A small, thin bead may indicate the heat soak did not last long enough, but a uniform bead size, shape and V-groove depth all the way around the circumference is ideal. In actual fact, the strongest point in the pipe system is at those joints because the HDPE pipe is thicker at that point. Any double rollback bead irregularities can be cause for cutting out and refusing the two pieces of pipe.

The bead performs a diagnostic role during the fusion process, to check the melt during heating, and to check the joint after fusing. But after the pipe is fused together, the bead has little function other than to show where the joint used to be.

To Debead or not to Debead? That is the Question (for some)

For some users of HDPE pipe, there is a concern that the bead impedes flow. A very popular question we receive is "Can I take the bead off?"

Rep. Nick Jo Rahall, W.V., Ranking Member of the committee

Rep. Bob Gibbs, Ohio, Chair of the T&I Subcommittee on Water Resources and Environment:

Rep. Timothy Bishop, New York, Ranking Member of the Subcommittee:

Several types of tools can be used to debead fused pipe. The one shown below is an internal debeading arm that can extend inside a pipe the full 50 feet if necessary. Note the operator is holding the cut, internal bead in his left hand. The pipe shown is grey, HDPE sanitary sewer pipe. (Image: Alliance)

To which most veteran insiders say, "Why would you want to do that?" In a word, we say "NO." The flow characteristics of HDPE pipe are such that the pipe retains its Hazen Williams factor of 150 both with the bead and without it. In water applications where pressure is constant in the system, the bead has zero practical effect. In sewer force main systems the bead also has no effect. And, in gravity flow sewer applications where the grade is 1% or more, the bead has very little influence.

However, an internal bead may slightly impede flow in gravity sewer situations where the grade is shallow, less than 1%, and flow is low. But, when flow picks up, the residual material will be pushed along. As Bob Gajeske (Gajeske, Inc, in Houston) said when asked about this situation, "I have been doing this for over 20 years, I have never seen a shallow grade flow issue caused by the bead."

In trenchless sliplining where a smaller liner pipe is pulled inside a deteriorated host pipe, removing the exterior bead may increase OD-ID clearance in tight situations. Some contractors will debead in that situation, but with normal sliplining clearance, the external bead makes no difference. Most debeading occurs because designers and owners are unsure of what to do. So unnecessary cost is added to the project by calling for the contractor to remove the bead. When in doubt, send us an email.

Ambient Temperature Recommended

Manufacturers do recognize owner or designer preference and need may call for bead removal even though the process adds expense.

Manufacturer guidelines call for debeading to occur *only after the pipe has cooled.*

Some contractors don't pay attention to that recommendation because it is easier to remove the bead while it is warm and soft. The problem is that polyethylene shrinks as it cools and solidifies, and when the bead is removed when warm, the hot PE at the joint continues to shrink and creates a notch at the joint. Having a notch at the joint makes it susceptible to premature failure. Always wait until the joint is completely cooled before removing the bead.

External beads are removed with run-around cutting tools which are forced into the bead and then drawn around the pipe. Internal beads may be removed with remote control cutters or length by length with a cutter fitted to a long pole. Manual or power tools such as chisels or planers may also be used, but care must be taken not to cut into the pipe surface.

Happy Fusing.

Sources:

Adams, Bill, Senior Engineer, WL Plastics, Fort Worth TX, technical emails and telephone conversations, September, 2013

ASME, *An Assessment of Industry Data Related to Essential Variables for Fusing HDPE Pipe*, 3002000598, Draft Report, April 2013,

ASME, *QF ASME Fusion*, Final Draft 2013.

Casteel, Heath, Technical Service Specialist, Performance Pipe, Plano TX, technical email, September, 2013

Fletcher, Bryan, Regional Sales Manager, ISCO Industries, technical emails and telephone conversations, September, 2013.

McElroy Manufacturing, *2013 Fusion Catalog,* MMI, Tulsa Oklahoma, 2013.

Performance Pipe, Plano Texas, PP-901, *The Performance Pipe Field Handbook*, 2009.

Performance Pipe, Plano Texas, *Technical Note, PP-750-TN-05 Butt Fusion Joining* Procedures, September, 2012.

Plastic Pipe Institute, Handbook of PE Pipe, second edition, Ch. 9, pg 329, February, 2012.

Svetlik, Harvey, Director of Engineering, Georg Fischer Central Plastics, LLC, Dallas Texas, technical emails, September, 2013

Svetlik, Harvey, Director of Engineering, Georg Fischer Central Plastics, LLC, Dallas Texas, *Authesion HDPE Fusion Joints*, not dated.

WL Plastics, Fort Worth, TX, WL Technical Document *WL-101 Joining and Field Procedures,* 2013

WL Plastics, Fort Worth, TX, WL Technical Document *WL123 High Performance 4710,* April, 2012.

If you are interested in bringing the Alliance's roadshow to your town, please contact the Alliance for more information.