

Chapter 15

General Guidelines for Repairing Buried PE Potable Water Pressure Pipes

Introduction

Traditional piping systems have gasket-sealed bell and spigot joints every 20 feet, which can be a potential maintenance and repair point at each connection. Metallic pipes are subject to corrosion which can require constant maintenance over the life of the pipes. A heat fused high density polyethylene (PE) pipeline is not only corrosion and chemical resistant but the leak free joints at 40 to 50 foot intervals are as strong as the pipe itself which provides a maintenance free system except for infrequent unforeseen third party damage. If PE is damaged by a third party, repair methods may be required to bring the piping system back into service as soon as possible. This document will provide general guidelines for repairing PE. They should be useful in establishing procedures and/or specifications for various repair methods to PE piping systems.

For above ground repairs, when the pipe can be moved, the damage can be cut out and replacement pipe can be butt fused or electro-fused into the system.



Figure 1 Above Ground Repair with Fusion Machine

However constrained installations, such as buried pipes, may not allow such movement. Permanent repairs of constrained pipes may require techniques and fittings that do not require longitudinal movement such as spool or flanged assemblies, mechanical or electrofusion couplings, etc.

Caution: Be sure to follow OSHA safety guidelines when uncovering and repairing buried pipelines.

Natural Gas Polyethylene Piping Systems

In this application, only those persons qualified pursuant to a gas company's Operator Qualification program shall make repairs.

Plastic piping systems may be damaged during installation or through third party damage by others once in service. The repair or replacement must be made in accordance with requirements of DOT 49 CFR 192.311. All imperfections or damaged sites that would impair the serviceability of the plastic pipe (significant scratches, gouges or flaws) must be removed or repaired.

Mechanical or electrofusion couplings appropriate for plastic gas piping systems are frequently used for economical and convenient replacement of damaged plastic pipe segments. The gas flow is stopped; the damaged section cut out and replaced with a mechanical repair fitting or a new segment using either two couplings or a fusion joint and a coupling. Joints fabricated from mechanical fittings used in replacement must be designed to restrain the pipe against pullout forces and, if metallic fittings are utilized, be protected against corrosion.

Full encirclement type band clamps have been successfully used with plastic pipe to make repairs. ASTM F 1025 "Standard Guide for Selection and Use of Full Encirclement Type band clamps for Reinforcement or Repairs of Punctures or Holes in Polyethylene Gas Pressure Pipe" provides guidance regarding use of this fitting for repair and reinforcement of polyethylene pipe. The important consideration is that the clamp permanently exerts limited unit-bearing pressure on the plastic pipe since it is not possible to install metal stiffeners inside the plastic pipe in this application. A soft gasket formulation with waffle-type inner surface would generally be preferred for this application. In all cases, the method used should follow procedures that have been established and qualified by test.

Full encirclement type band clamps in compliance with the guidelines of ASTM F 1025 are acceptable for temporary repairs of polyethylene pipe.

Before placing in service, test segments of plastic pipe that are installed to replace damaged sections of mains and services according to the operator's procedures. Leak

test all tie-in joints and the squeeze-off areas at system pressure after the repair is complete. If recommended by the manufacturer, any anti-static fluid should be rinsed from the piping using water. If, in a dig-in situation or a plastic service other than a low pressure service, it appears that the pipe or casing was pulled or moved, and that damage could have occurred at locations along the service other than those inspected or repaired, leak-test the entire service at 100 psig for a minimum of 5 minutes per the operator's procedures. Leak- test low –pressure services at 10 psig for a minimum of 5 minutes per the operator's procedures. If additional damage is found, replace the service.

Municipal and Other Polyethylene Piping Systems

Temporary Field Repairs with Full Circle Band Clamp

Many system operators will have full circle band clamps in their specifications as a repair option. In general these types of repair clamps have proven to be a great method of temporary repair, especially in emergency situations.

Some general design considerations for the successful use of full circle band clamps are as follows:

- Full Circle Band Clamps are recommended for repairs only where the pipe is able to maintain its structural integrity. Consider repairs only to a clean-cut round hole or deep scratches or gouges of maximum dimension, less than the nominal diameter of the pipe divided by three. Do not use band clamps when the pipe has cracks, jagged punctures, long tears, or deep scratches or gouges which could propagate outside the clamp under anticipated field loads.
- Do not exceed the manufacturer's recommended maximum operating parameters such as temperature and pressure.
- The installer should always follow the clamp manufacturer's recommend installation guidelines. Whenever possible, use a product that has been specifically designed for use with polyethylene pipe.
- The manufacturer should always be consulted on the use of their product on polyethylene pipe if the clamp was not manufactured specifically for use with polyethylene pipe.
- Pipe movement due to thermal expansion, thermal contraction and creep, as well as, surge events must be considered when repairing polyethylene pipe with a full circle band clamp.
- Generally, full circle band clamps are intended for use in underground applications. If your application is of a different nature, contact the manufacturer of the band clamp.

If the band clamp is to be used as a permanent repair, contact the fitting manufacturer for the suitability of use as a permanent repair.

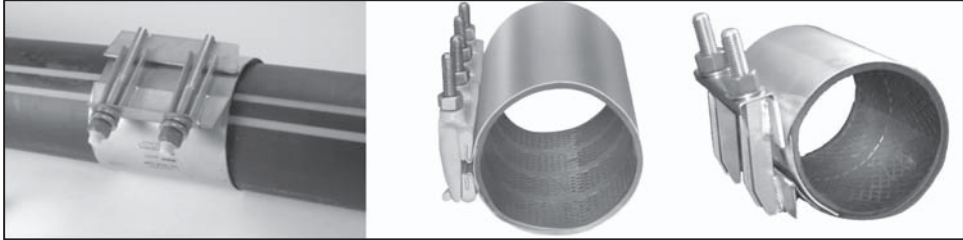


Figure 2 Full Circle Band Clamps

Permanent Field Repairs

Small Field Repairs

Saddle Fusion Repair

If the size of the puncture damage is very small (1inch or smaller puncture on one pipe wall), a capped off Tapping Tee or High Volume Tapping Tee or patch can be saddle fused to the main over the damaged area, provided the water flow can be stopped and the repair area kept dry during the repair process. Before adding the patch or fitting, drill a small hole at each end of the damage to prevent the crack from propagating further.

Then, butt fuse a cap on the service outlet of the Tapping Tee selected for the repair. Turn off the water and prepare the surface area around the damage for the saddle fusion process (see PPI Generic Saddle Fusion Procedure TR-41). Saddle fuse the fitting over the damaged area using the Generic Procedure and allow the joint to cool. Wait 30 minutes, turn the water back on.



Figure 3 Saddle Fusion Repair

Electrofusion Patch Repair

An electrofusion patch can also be used to repair small puncture damage in the pipe (3 inches or smaller puncture in one wall of the pipe) as long as the water flow can be stopped and the repair area kept dry during the repair process. Use the manufacturer's recommended electrofusion procedure and equipment for saddle fusion.

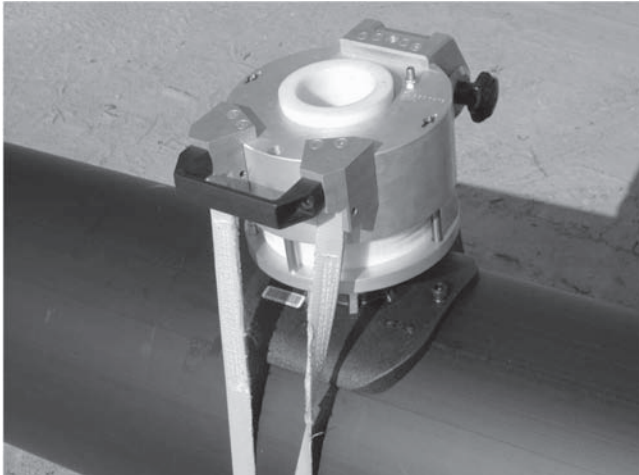


Figure 4 Electrofusion Patch Repair

Mechanical Fitting Repair

In some cases where the damage is slight but has severed the pipe, the line can be shut off and a small section of the pipe cut out to install a mechanical coupling in the damaged area (see Figures 5, 6, & 7). Contact the coupling manufacturer for the size of damage that can be repaired. A certain amount of the piping system will need to be exposed to allow the pipe to be bent for the installation of the coupling.

Some couplings are self restrained and others are not. Some require a stainless steel stiffener inside the PE pipe and some do not.

For damage to small diameter water service lines (2 inches and smaller), mechanical compression fittings appropriate for PE pipe or tubing are commonly used for the repair. Water flow is stopped, generally using a pinch off tool, and the damaged area evaluated. If it is a small cut or hole, the pipe can be cut in the damaged area and a compression fitting installed between the pipe ends. As required for larger pipe sizes, this method may require a certain amount of the piping system be exposed to allow the pipe to be bent for the installation of the coupling. If the damage is more extensive, a section of pipe is cut out and replaced with a replacement piece of pipe and two compression fittings.

It is recommended that all couplings used with PE should have a stiffener installed to increase the sealing capability of the coupling by minimizing the effects of creep and dimensional changes due to temperature variations (see “Stiffener Installation Guidelines” section in this chapter). It is also recommended that, if the coupling does not provide its own restraint, then external restraints should be utilized on each side of the fitting to prevent pullout due to the thermal expansion or the Poisson effect of the pipe (see “Restraint Methods” section in this chapter). Mechanical fittings have different design advantages and accommodate different sizes. Contact the mechanical fitting manufacturer for more information. Several manufacturers make mechanical fittings specifically for use with PE, including Mueller, Elster Perfection, Victaulic, Dresser, JCM, Ford, Romac, Cascade Water Works and Smith-Blair.

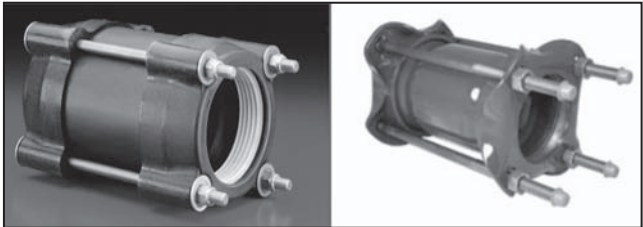


Figure 5 Mechanical Couplings

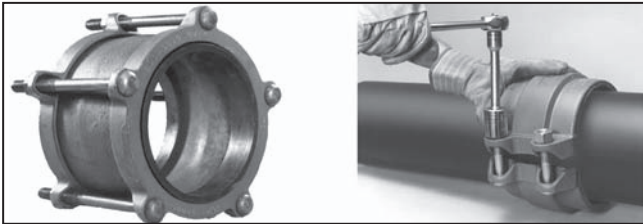


Figure 6 Mechanical Couplings

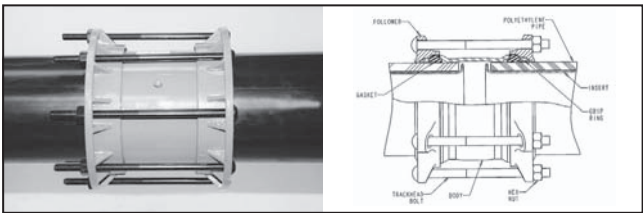


Figure 7 Mechanical Couplings