British Plastics Federation
PIPES GROUP

Altering, diverting or repairing polyethylene water pipelines

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Introduction

The purpose of this guide is to provide guidance when planning alterations, diversions or repairs to existing polyethylene water pipelines. In all of these scenarios, welded solutions can be used.

This guide draws attention to some simple aspects such as fittings selection, re-rounding and managing water trickle, which if anticipated at the planning stage, can lead to trouble free implementation.

Thrust loads—product selection

Polyethylene pipes installed with butt fusion and electrofusion welded connections are able to resolve thrust loads without the need for thrust blocks to be installed. Thrust arising from thermal loads, or from water pressure acting on the pipe, fittings and valves, are resolved by the material. By using polyethylene of equivalent specification with welded fittings in a repair for example, the design philosophy for the pipeline is maintained. That is important to those managing long term assets.

Where mechanical fittings are selected for repair, typically compression fittings or flanged fittings, then attention is drawn to IGN 4-01-02 published by Water UK Standards Board library. Particular attention is drawn to the need to specify fittings that are either Type 1, or Type 2, according to that guidance note, otherwise thrust blocks must be installed.

Where alternative pipe materials are used, for example in a repair, then the requirements for end load assessment apply to both the polyethylene and also to the in-fill pipe section. Polyethylene pipes themselves impart end loads due to thermal effects additional to pressure, which need to be considered, thus the fittings must demonstrate comparable resistance to pull off on the alternate material as they do on polyethylene to be considered suitable. In addition, the inserted pipe section must also be suitable for the expected loads.

There are product specifications available that inform sensible choices for materials. Useful examples include:

- BS EN 12201-2 *Plastics piping systems for water supply, and for drains and sewers under pressure. Polyethylene (PE). Pipes* (inserted new pipe sections).
- BS EN 12201-3 *Plastics piping systems for water supply, and for drains and sewers under pressure. Polyethylene (PE). Fittings.*
- IGN 4-01-02 *The determination of end-loads for the performance testing of fittings for polyethylene pipe.*

- BS 8561 *Specification for mechanical fittings for use in the repair, connection and renovation of pressurized water supply pipelines. Requirements and test methods* (this national standard also covers mechanical fittings and specifically the context of retrospective repair or connection to pipelines).

In order to demonstrate compatibility of the component products as a system, the supplier should provide evidence of fitness for purpose, in line with BS EN 12201-5 *Plastics piping systems for water supply, and for drains and sewers under pressure. Polyethylene (PE). Fitness for purpose of the system.*

Anticipating a viscoelastic response

A big word, lots of science and a simple consequence. Polyethylene pipes can change their dimensions once installed. Usually this means the diameter of the pipe increases if not constrained by the soil embedment. The rate at which it changes is affected by temperature, this is the viscoelastic response, and also by the internal pressure in the pipe itself.

Pipeline engineers often like a rule of thumb, and this is one area where such a rule is practical. Polyethylene pipes can increase their diameter by up to 3% from their original specified diameter in UK networks. So worked examples of what that means could be:

- A 125mm nominal diameter pipe, could be up to 129mm, or
- A 250mm nominal diameter pipe, could be up to 258mm

The change in diameter is a natural and expected response for the pipe material. Loss of roundness of the pipe may also occur. These changes are more likely to occur in pipes that have been slip lined inside old, abandoned pipes or ducts, and less likely in pipes directly buried with high stiffness self compacting backfill. And there is a simple remedy. There are simple tools that we can take to the construction site that can reverse the changes and allow standard fittings to be used. A variety of re-rounding clamps are available for this purpose.

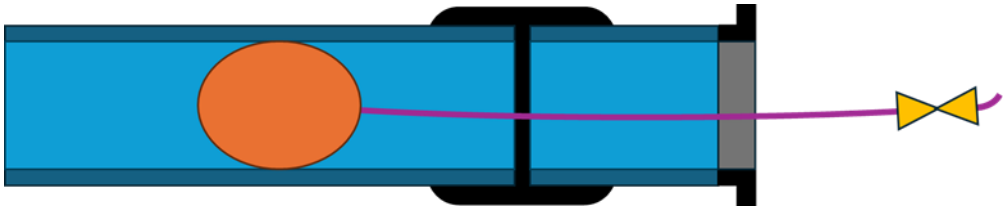
Anticipating Water Trickle

In practice, it is possible to still have a trickle of water flowing along the invert of a water pipelines following closure of an upstream valve (for example). If this is not addressed, it will compromise a welded joint. It is often cited as the reason why welded joints are not used but it is easily mitigated with a little preparation.

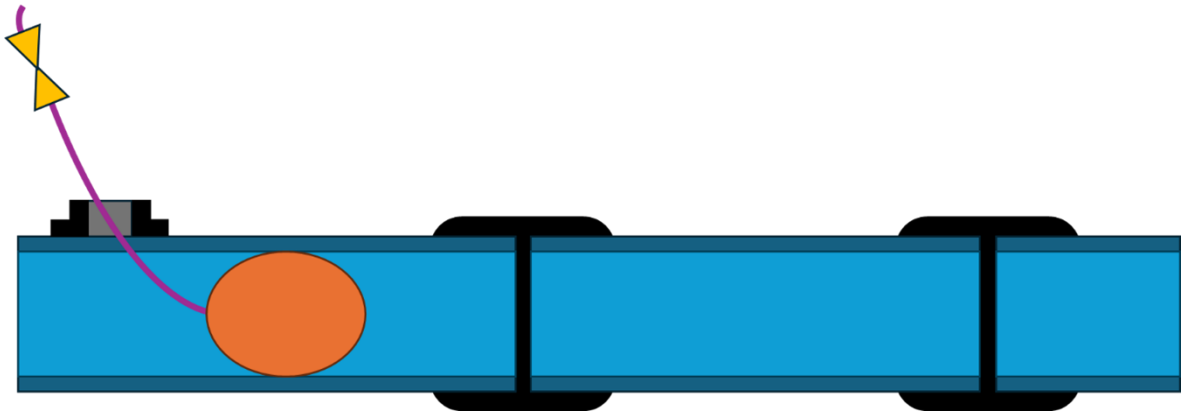
Inflatable stoppers, appropriately disinfected before use, can be placed in the pipeline in one of two ways to provide a high integrity seal adjacent the work area.

Bag stoppers can be introduced in one of two ways depending on the type of connection being made to the pipeline. Conceptually this would be into the open end of the pipe where a flange connection is to be welded for example, the stopper withdrawn afterwards through the flange. Or they might be introduced through a saddle connection that can also function as a washout point if needed, where an electrofusion coupler(s) is to be used for a tie-in connection.

Stopper introduced through flange which has been electrofusion welded to the pipe end



Stopper introduced through a small diameter electrofusion saddle for a repair tie-in



Diagrams are for illustrative purposes only.

Using re-rounding tools

The pipe diameter can be brought back to, and will remain in, a controlled diameter range with the tooling that has been described. Which will then allow fittings to be placed over the pipe end, once it has been scraped if welding, without the need for forceful persuasion (a health and safety consideration for construction workers). The manufacturers instructions on scraping pipe ends should be followed.

To re-round a pipe end, the main advice is to take your time. A slow rate compression of the pipe end allows the pipe to change its size without damaging the material but more importantly it will reward you by resisting less, that means the loads to compress it will be lower. If you try to rapidly compress it the loads will be very high in comparison. To gently wind the jack screw or the pump to close the clamp. Then leave it at the stop position for 20-30 minutes before removing and proceeding with the jointing activity.

The 20-30 minutes in the locked position is the key, this enables the material to creep and resolve the applied load so that it holds its revised shape for the time needed to scrape, assemble the electrofusion socket and make the weld. If you cut corners here on time you are more likely to see elastic recovery back to the higher diameter which will interfere with the joint.

Fittings - fusion jointing method

Methods for butt and electrofusion welding in the UK water industry are given in WIS 4-32-08 *Specification for the fusion jointing of polyethylene pressure pipeline systems using PE80 and PE100 materials.* Using WIS 4-32-08 and the guidance in this document, summarised in the steps below, will help support risk assessed method statements (RAMS) when considering alteration, diversion or repair of polyethylene pipes.

- **Step 1:** Ensure through product selection that aspects relating to thrust loads have been mitigated and a compatible solution is being built
- **Step 2;** Be prepared to correct the diameter of the pipe end so that it can be easily assembled with whichever fitting system is employed
- **Step 3:** Be prepared to stop trickle flows on the invert of the pipe which compromise welding by using temporary inflatable stoppers

And if these additional planning steps are followed, the industry standard method for welding to polyethylene pipes, WIS 4-32-08 *Specification for the fusion jointing of polyethylene pressure pipeline systems using PE80 and PE100 materials*, can be followed to make reliable connections, matching the design intent of the pipeline, having long term predictable asset behaviour.

Further information:

BPF Pipes Group supporting documents that give further detail are available on our website:

Specifications for polyethylene pipe and fittings for water supply, and drains and sewers under pressure v4

Dealing with longitudinal forces in a polyethylene pipeline under pressure

The following documents can be found in the Water UK Standards Board library

IGN 4-01-02 The determination of end-loads for the performance testing of fittings for polyethylene pipe.

WIS 4-32-08 Specification for the fusion jointing of polyethylene pressure pipeline systems using PE80 and PE100 materials.