

Joining of polyethylene pressure pipes for below ground water applications

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Background

Polyethylene pressure pipes for water and gas applications can be joined by one of three methods: electrofusion, butt fusion or mechanical fittings (including flanges).



Electrofusion



Butt fusion



Mechanical fitting

The advantages of an integrated, end-load resistant system are best achieved by fusion welding carried out by skilled operatives. However, there are some circumstances where mechanical joining is more suitable.

The BPF Pipes Group has prepared this short guide to identify the preferred method of joining for a range of applications, together with the reasoning for that recommendation and any suitable alternatives.

Electrofusion

Electrofusion fittings for use with polyethylene pipe (to BS EN 12201-1) in water supply and drains and sewers under pressure are manufactured to BS EN 12201-3. They have sockets that incorporate electrical heating wires which, when connected to the appropriate power source, fuse the fittings into the pipe without the need for additional heating equipment. Made correctly, electrofusion joints provide a fully end-load resistant system.

Butt fusion

Polyethylene pipes and fittings can be joined using electrically heated plates to fuse the surfaces together. To ensure reliable welds, butt fusion should only be used to join pipes of the same diameter / thickness and polyethylene grade. Made correctly, butt fusion joints provide a fully end-load resistant system.

WIS 4 -32-08: Issue 4 specifies the equipment and jointing procedures for fusion welding of PE pipes and fittings. It is strongly recommended that WIS 4 -32-08 is used for all fusion jointing to provide consistent and good quality workmanship.

Mechanical fittings

Mechanical fittings can be used to join polyethylene to polyethylene, or polyethylene to other pipe materials. Compression of the fitting onto the pipes is normally achieved by mechanical tightening of bolts or compression rings and sealing against water pressure is accomplished by elastomeric seals or gaskets.

Mechanical fittings for use with polyethylene pipe (to BS EN 12201-1) are manufactured to BS EN 12201-3. Mechanical fittings for use with polyethylene barrier pipe (to BS 8588) are manufactured to WIS 4 -32-11 for fittings up to DN 63 and BS 8561 for fittings up to DN 630.

Fittings for connection to ductile iron pipe need to meet the requirements of BS 8561 or BS EN 14525. Most mechanical fittings for polyethylene pipe are designed such that the end load which can be resisted by the joint is greater than that maximum axial forces assumed to be acting on the joint in service (i.e. Type 2 as defined by IGN 4-01-02). A fully end load resistant system can be offered by flanges or specialist products (i.e. Type 1 as defined by IGN 4-01-02).

Selection of joints

Each of the three jointing methods can provide long-term, leak tight, solutions. The tables below highlight the best solution for any given condition. Guidance can be sought from members of the BPF Pipes Group for specific situations.

Pipe: New pipe manufactured to BS EN 12201-2 (PE100 to PE 100 or PE80 to PE80)			
Installation: Open cut trench			
Pipe size (Nominal diameter)	Preferred method of joining	Reason for preference	Acceptable alternatives
20 - 63	Electrofusion	Long term reliability of joint and speed of assembly	Mechanical
75 - 180	Electrofusion	Long term reliability of joint and speed of assembly	Mechanical Butt Fusion
180 - 315	Electrofusion	Long term reliability of joint and speed of assembly	Mechanical Butt Fusion
355 - 630	Electrofusion Butt Fusion	Long term reliability of joint	Mechanical
630 - 1200	Butt Fusion	Better where pipe ovality is large	Electrofusion

Pipe: New pipe manufactured to BS 8588 for laying in contaminated land			
Installation: Open cut trench			
Pipe size (Nominal diameter)	Preferred method of joining	Reason for preference	Acceptable alternatives
20 - 63	Mechanical	Speed of assembly on service sizes, barrier maintained	Electrofusion
75 - 180	Electrofusion Mechanical	Reliability and barrier maintained	-
180 - 315	Electrofusion	Reliability and barrier maintained	-
355 - 630	Electrofusion	Reliability and barrier maintained	-

Pipe: New pipe manufactured to BS EN 12201-2 (PE100 to PE 100 or PE80 to PE80)			
Installation: Trenchless (pull-through)			
Pipe size (Nominal diameter)	Preferred method of joining	Reason for preference	Acceptable alternatives
Up to 180	Coiled pipe (no joints)	Integrity of pipe maintained and no obstruction to pull-through	Butt fusion
Above 180	Butt Fusion	Strength of joint and no obstruction to pull-through	-

Note: Joining at excavation pits / end of coils as open cut recommendations

When connecting polyethylene pipe to ductile iron, PVC-U or steel, in any nominal diameter, the only viable solution is mechanical jointing.

Complementary guidance from the BPF Pipes Group

Specifications for polyethylene pipe and fittings for water supply, drainage and sewerage under pressure.

Joining of polyethylene pressure pipes for below ground gas applications.

BPF Pipes Group guidance is available from <https://bpfpipesgroup.com/technical-information/specification-guidance/>.

References

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

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

BS EN 12201: Plastic piping systems for water supply and drains and sewers under pressure – Polyethylene (PE).

- Part 1: General
- Part 2: Pipes
- Part 3: Fittings
- Part 4: Valves
- Part 5: Fitness for purpose

BS 8561: Specification for mechanical fittings for use in the repair, connection and renovation of pressurized water supply pipelines. Requirements and test methods.

BS EN 14525: Ductile iron and steel wide tolerance couplings and flange adaptors for use with pipes of different materials: ductile iron, grey iron, steel, PVC-U, PVC-O, PE, fibre-cement.

BS 8588: Polyethylene pressure pipe with an aluminium barrier layer and associated fittings for potable water supply in contaminated land. Size 20 mm to 630 mm

WISs and IGNs are available from Water UK's website (<http://standards-board.water.org.uk/>).

British Standards can be purchased through BSI (<http://shop.bsigroup.com/>).