

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

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Background

Polyethylene pipes and fittings are widely used for water supply pipelines and sewer rising mains (drains and sewers under pressure).

British Standards led the way in setting performance requirements but as new materials developed with better performance capabilities in the 1980s, the UK Water Industry introduced their own specifications to keep pace with innovation, mirroring in many aspects those being produced by the UK Gas Industry. Water Industry Specifications (WIS) offered the opportunity for product testing and third-party certification. As advances were made in materials, so the WISs were updated and extended and used to formulate the UK's input into drafting of European Standards (EN) adopted in the UK as British Standards (BS EN).

Where products or services are not covered by European or British Standards, such as the fusion jointing of polyethylene pressure pipeline systems and polyethylene barrier pipe for use in contaminated land, the UK Water Industry continues to develop and support Water Industry Specifications

The purpose of this short guide is to provide information on the specifications for polyethylene pipe and fittings for water supply and drains and sewers under pressure.

Readers of this guidance are reminded that when designing and installing new and replacement water supply pipelines and sewers rising mains (drains and sewers under pressure), national legislation applies. This includes, but is not limited to, suitability for contact with drinking water.

The British Plastics Federation (BPF) Pipes Group and its members strongly advise that compliance with the product standards listed in this guide is verified by a third-party certification scheme (for example, the BSI Kitemark or equivalent).

Product specifications

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

BS EN 12201 is a six-part publication which identifies the requirements for a piping system and its components when made from polyethylene (PE).

The scope covers piping systems intended to be used for water supply intended for human consumption, including the conveyance of raw water prior to treatment, drains and sewers under pressure, vacuum sewer systems, and water for other purposes.

All Parts have been revised and published in 2024. Additional information on the selection and installation of piping systems in the UK are given in the National Forewords to each Part.

Part 1: General specifies the overarching aspects of polyethylene (PE) pressure piping systems (mains and service pipes). It includes such items as definitions and characteristics of materials.

Requirements and test methods for components on the piping system are given in Parts 2–4. Characteristics for fitness for purpose of the system are covered in Part 5 and guidance for assessment of conformity in Part 7.

Part 2: Pipes specifies the requirements and test methods for pipe made from polyethylene (PE100, PE80 and PE40).

Three pipe types are identified in Part 2:

- PE pipes including identification stripes
- PE pipes with co-extruded layers
- PE pipes with a peelable, contiguous thermoplastics additional layer on the outside of the pipe.

Part 2 sets out the geometrical and dimensional characteristics of pipes in the diameter range 16 mm to 3000 mm. It also covers ten different SDR (Standard Dimensional Ratio, the ratio of the nominal outside diameter to the nominal wall thickness), from SDR 6 to 41.

The mechanical and physical properties of PE pipes are specified together with appearance and marking requirements.

Part 3: Fittings specifies the requirements and test methods for fittings made from polyethylene (PE100 and PE80). It sets out the mechanical properties of fittings including any non-PE components, together with geometrical and marking requirements.

Fitting types identified in Part 3 are listed on the following page.

Fitting types identified in Part 3:

- Fusion fittings
 - Electrofusion socket fittings and saddle fittings
 - Spigot end fittings (for butt fusion and electrofusion socket fusion)
 - Socket fusion fittings
- Mechanical fittings
 - Compression fittings
 - Flange adaptors
- Fabricated fittings

Part 4: Valves specifies the requirements and test methods for valves or valve bodies made from polyethylene. It sets out the mechanical properties of valves including any non-PE components, together with geometrical and marking requirements.

Part 5: Fitness for purpose of the system specifies the performance requirements for the assembled piping system (the pipe and fittings in combination). This includes such aspects as leaktightness of joints, resistance to pull out under longitudinal forces, and hydrostatic strength of the combined system.

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

BS 8588 identifies the requirements and test methods for a piping system and its components when made from polyethylene with an aluminium barrier layer. Two pipe construction types are:

- Type A: where one or more polymer layers for a core pipe designed to bear the stress associated with long term hydrostatic pressure. The aluminium layer would then be applied externally to the core pipe.
- Type B: Where one or more polymer layers and the aluminium layer together bear the stresses associated with the long-term hydrostatic pressure.

BS 8588 sets out the material and mechanical properties, performance tests, jointing and supply requirements. An important aspect of this specification is the ability of the material to resist permeation by petroleum-based contaminants.

NOTES:

Type B pipes are no longer manufactured in the UK.

BS 8588: 2017 calls up WIS 4-32-11 for fittings up to DN 63 and BS 8561 for fittings up to DN 630. Section 2 of BS 8561: 2021 identifies the requirements and test methods for mechanical fittings for use with PE barrier pipe to BS 8588.

Pipeline performance

BS EN 12201 sets out the performance requirements for a polyethylene piping system as designed by the manufacturer. For installation and commissioning of pipelines, the National Foreword to BS EN 12201-1: 2024 directs readers to WIS 4-32-08 and WIS 4-01-03.

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

This document specifies the equipment and jointing procedures for fusion welding of PE pipes to BS EN 12201-2 and fittings to BS EN 12201-3.

WIS 4-01-03: Specification for hydrostatic pressure testing of polyethylene and polyethylene barrier water supply pipelines and sewer rising mains

This document specifies the UK test procedure for hydrostatic testing of below ground pressure pipelines constructed from polyethylene or polyethylene barrier pipes.

NOTES:

BS EN 12201 (all parts), BS 8588 and BS 8561 can be purchased through BSI (<http://shop.bsigroup.com/>).

WIS 4-01-03, WIS 4-32-08 and WIS 4-32-11 are available to download from Water UK's website (<http://standards-board.water.org.uk>).

WIS 4-01-03: 2024 replaces IGN 4-01-03: 2015.

Appendix A: Commonly used terms

PE 80	<p>PE resin for manufacture of pipes and fittings with long-term strength, known as the minimum required strength (MRS), of 8 MPa. Typically used for pipes up to a maximum of 180mm diameter.</p> <p>Note: Prior to the adoption of international standards, PE pipe materials were designated by their density, so PE80 might be referred to as Medium Density Polyethylene or MDPE pipe. These terms are not recognised in the product standard.</p>
PE 100	<p>PE resin for manufacture of pipes and fittings with long-term strength, known as the minimum required strength (MRS), of 10 MPa.</p> <p>Note: PE100 might be referred to as High Density Polyethylene, HDPE or HPPE, High Performance Polyethylene pipe. These terms are not recognised in the product standard.</p>
Barrier pipe	<p>PE pressure pipe with an aluminium barrier layer. The pipe is used as part of a system of compatible pipes and fittings used to convey or retain drinking water for buried use in contaminated land.</p> <p>Note: PE / Al / PE pipe may be referred to as a 'composite' pipe, meaning a multi-layer pipe construction. This is not to be confused with fibre-reinforced composite pipe.</p>
Co-extruded pipe	<p>PE pressure pipe manufactured using a co-extrusion technique, as part of the extrusion process. The black inner and outer polyethylene materials are homogeneously bonded together under high temperature and pressure resulting in a single layer pipe wall construction. The colour of the outer layer is application specific. The outer layer is NOT removed during preparation for electrofusion jointing and should not be a 'scrape to depth' or damage indicator.</p>
Peelable pipe	<p>PE pressure pipe with a peelable thermoplastic layer on the outside of the pipe. The additional external layer (skin) is applied during the manufacturing process and protects the pipe during handling, transportation, installation, and reinstatement. A short section is removed using the manufacturer's recommended tool to provide a clean surface for fusion jointing.</p> <p>Note: Peelable pipe might be referred to as 'skinned' pipe. Peelable pipe might incorrectly be referred to as 'coated pipe' - this term should not be used.</p>
Factory sealed pipe	<p>Coiled PE pressure pipe that is sealed on both ends, as part of the manufacturing process without the use of chemical sterilisation. The seal safeguards the bore of the pipe from contamination during storage, transportation and installation, up to the point of connection. Factory sealed pipes are intended to overcome the requirement for pre-chlorination and only require the final chlorination process before they are put into service. The internal bore of the factory sealed pipe remains factory clean for 12 months, after which time it should be treated as a conventional pipe.</p>
Fusion jointing	<p>Technique to join pipes and / or fittings until the PE material reaches fusion temperature causing the pipe and fitting surfaces to fuse.</p>
Butt fusion	<p>Fusion jointing technique to join ends of pipes or spigot end fittings by holding the surfaces them against a flat heating plate until the PE material reaches fusion temperature, removing the heating plate quickly and pushing the two softened ends against one another.</p>
Electrofusion	<p>Fusion jointing technique using the Joule effect of the heating element incorporated at the jointing surface of an electrofusion fittings, causing the material adjacent to the fitting to melt and the pipe and fitting surfaces to fuse.</p>