

# Specifications for plastic pipes, chambers, manholes and covers for drainage and sewerage applications

## INTRODUCTION

Plastic pipes and inspection chambers for the construction of gravity drains and sewers have been widely used for many years in the UK.

British Standards, such as BS 4660 for unplasticized PVC underground drain pipe and fittings (first published 1971), have led the way in setting performance and installation principles. With the development of European Standards, British Standards were used to formulate the UK's input into drafting. European Standards (EN) are adopted in the UK directly as British Standards (BS EN).

The use of the correct standard for purchasing products which are suitable for their intended application ensures ease of installation and a long service life.

**The purpose of this short guide is to provide information on specifications applicable to plastic pipes, inspection chambers, manholes and covers for drainage and sewerage applications in both private and public applications. It is therefore suitable for work carried out to the Building Regulations (Part H), to Sewers for Adoption and their national equivalent documents.**

This guide has been updated (version 2) to reflect changes in the BS EN 13476 series and in BS EN 752.

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## DRAIN AND SEWER PIPES

To manage the removal of foul water from sanitary ware and appliances in a building, there are effectively three areas of application: above ground soil and waste systems within the building, private drainage and sewerage systems, and public sewerage systems. This guide covers the latter two applications.

### Terminology

For the purposes of this guide, the definitions given in Sewers for Adoption (7<sup>th</sup> Edition) are used; namely:

- Drain – a pipeline, usually underground, designed to carry foul sewage or surface water from buildings and paved areas associated with buildings within the same curtilage.
- Sewer – a pipeline, usually underground, designed to carry foul sewage or surface water from buildings and paved areas associated with buildings in more than one curtilage.

With a few exceptions, the ownership and responsibility for sewers are formally transferred to the Water Undertaker from the house developer, subject to meeting the relevant performance and construction standards set out in Sewers for Adoption, Sewers for Scotland or Sewers for Adoption (Northern Ireland). These sewers are subsequently maintained by the Water Undertaker. This is known as adoption or vesting (public sewer).

A drain from a single premises (a block of flats would constitute a single premises) remains the responsibility of the building owner. All work on drainage systems needs to comply with requirements of the Building Regulations or Building Standards (see Table 1: Key documents).

**Table 1: Key documents for construction of drains and sewers in the UK**

	<b>Drain</b>	<b>Public Sewer</b>
England	Building Regulations: Part H. Approved Document H	Sewers for Adoption (7 <sup>th</sup> edition), referred to as SFA7
Northern Ireland	Building Regulations: Part N	Sewers for Adoption – Northern Ireland (1 <sup>st</sup> edition), referred to as SFA-NI.
Scotland	Building Standards: Part M. Technical Handbook – Domestic: Environment Technical Handbook - Non-Domestic: Environment	Sewers for Scotland (3 <sup>rd</sup> edition), referred to as Sfs3
Wales	Building Regulations: Part H. Approved Document H	Sewers for Adoption (7 <sup>th</sup> Edition) , referred to as SFA7

### NOTES:

Sewers for Adoption and Sewers for Adoption – Northern Ireland can be purchased through WRc (<http://www.webookshop.com/>).

Sewers for Scotland is available to download free of charge from Scottish Water (<http://www.scottishwater.co.uk/business/connections/connecting-your-property/sewers-for-scotland-and-suds>).

The Technical Handbooks are available to download free of charge from the Scottish Government (<http://www.gov.scot/Topics/Built-Environment/Building/Building-standards>).

Approved Document H is available to download free of charge from GOV.UK (<https://www.gov.uk/government/collections/approved-documents>).

Sewers for Adoption 8<sup>th</sup> edition was published in June 2018 and will be implemented during 2019. It is available for download free of charge from Water UK (<https://www.water.org.uk/policy/improving-resilience/sustainable-drainage-systems>). The definitions and typical details for inspection chambers have been clarified; typical details for plastic manholes included and the selection diagram for chambers and manholes simplified. This BPF Pipes Group guide will be updated in 2019 to reflect changes from SFA7 to SFA8.

### Product Specifications

#### **BS EN 1401-1 Plastics piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinylchloride) (PVC-U): Specifications for pipes, fittings and the system**

This standard specifies the requirements for the solid wall pipes, fittings and the system for two fields of use:

- outside the building structure only (area code “U”);
- outside the building structure and buried in ground within the building structure (area code “UD”).

The standard covers minimum diameters and wall thicknesses, types of fittings, mechanical and performance characteristics for PVC-U pipes up to 1000 mm.

#### **BS EN 13476: Plastic piping systems for non-pressure underground drainage and sewerage – Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE)**

BS EN 13476 is a three-part standard which identifies requirements for structured wall piping systems including pipes and jointing.

Part 1: General requirements and performance characteristics - This part specifies general aspects for both smooth wall and profiled pipes including definitions, material, geometrical characteristics and types of fittings.

Part 2: Specifications for pipes and fittings with smooth internal and external surface and the system, Type A - This part specifies the nominal dimensions, test methods, parameters and performance requirements for a product with smooth walls on both the inner and outer surface. It describes the types of wall construction as well as typical jointing methods for nominal pipe diameters up to 3000 mm.

Part 3: Specifications for pipes and fittings with smooth internal and profiled external surface and the system, Type B - This part specifies the nominal dimensions, test methods, parameters and performance requirements for a product with ribbed or corrugated walls on the outer surface. It describes the types of wall construction as well as typical jointing methods for nominal pipe diameters up to 3000 mm.

BS EN 13476-1: 2018, 13476-2: 2018 and 13476-3: 2018 contains a National Foreword which describes additional, allowable, requirements when specifying structured wall pipes for the UK market. It also clarifies the intended scope of the standard.

#### **WIS 4-35-01: Specification for thermoplastics structured wall pipe - supplementary test requirements**

This Water Industry Specification is called up by SFA7. The additional tests include resistance to water jetting for nominal diameters up to 300 mm, resistance to internal puncture and a maximum limit on longitudinal bending.

## **BS 4660: Thermoplastics ancillary fittings of nominal sizes 110 and 160 for below ground gravity drainage and sewerage**

BS 4660 contains UK specific ancillary products not covered by European Standards. This standard specifies the materials, dimensions and performance requirements for access fittings, rodding points (eyes), gullies and adaptors.

### **NOTES:**

Reference is made in the Building Regulations to BS EN 1852 for solid wall polypropylene (PP) pipes and BS EN 12666 for solid wall polyethylene (PE) pipes. Both can be, but are not commonly, used in the UK for gravity drains and sewers. All British Standards can be purchased through BSI (<http://shop.bsigroup.com/>).

WIS 4-35-01 can be downloaded free of charge from Water UK (<http://www.water.org.uk/publications/WIS-IGN/plastics-rubbers>).

### **Recommendations (drains and sewers)**

The product specifications allow for a wide range of product applications and design methodologies across Europe. Therefore, recommendations are given here to guide users in choosing suitable products for UK applications.

**Colour:** Preferred orange / brown or less commonly dusty grey.

**Pipe ring stiffness:** Stiffness is defined by “SN”, a numerical designation indicating the minimum required ring stiffness of a pipe or stiffness of a fitting to resist loading when installed. For structured walled pipes in adoptable sewer systems, a minimum ring stiffness of 8 kN/m<sup>2</sup> (SN8) is required for pipes up to 500mm. For pipes greater than 500mm, the required ring stiffness may be reduced to 2 kN/m<sup>2</sup> (SN2) subject to structural design load calculations for the specific project.

**Pipe jointing:** For both solid wall and structured wall pipes, socket and spigot joints and fittings are manufactured and supplied by BPF Pipe Group members as part of the overall plastic piping system. For pipes and joints to BS EN 1401-1, products are dimensionally compatible between manufacturers. For products to BS EN 13476, pipes and joints are designed as a single system and are not interchangeable. All pipes and joints should be installed in accordance with manufacturer’s recommendations.

To minimise impact on fluid flow along the pipe length, BS EN 476: 2011 “General requirements for components used in drains and sewers” recommends that the maximum step between pipe invert and a joint is 6 mm (for pipes up to DN/ID 300) and 0.02 x DN mm (for pipes greater than DN/ID 300) up to a limit of 30mm.

**Product certification:** 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).

**Marking:** Marking on a pipe is defined by the standard and demonstrates compliance with the standard and its scope of use.

For pipes to BS EN 1401-1, in addition to the manufacturer’s information, materials, dimensions and any third party certification, each product is marked with the area code U or D. The area code indicates the application: U, outside the building structure and D, both buried in ground within the building structure and outside the building.

For pipes to BS EN 13476-2, marking includes manufacturer's information, materials, dimensions, ring stiffness and application (area) code. The area codes are designated as U and UD to BS EN 13476-2, description as BS EN 1401-1.

**Photograph 1: Example of marking of pipes (smooth outer wall)**



**Photograph 2: Example of marking of pipes (structured outer wall)**



**Photograph 3: Example of marking of pipes to BS EN 13476-3**



**CE marking:** Under the Construction Products Regulations (CPR), construction products placed on the market in the UK will need to carry CE marking. It is currently not possible or legal to apply CE marking to plastics pipework systems. The BPF Pipes Group statement (<http://www.plasticpipesgroup.com/support-downloads/position-statements/ce-marking/ce-marking/>) provides further explanation.

## **INSPECTION CHAMBERS**

Access is required to drain and sewer systems for testing, inspection, maintenance and removal of debris. In line with the Confined Spaces Regulations 1997, operations should be carried out, where practicable, without entering the confined space. The National Annex to BS EN 752: 2017 “Drain and Sewer Systems outside Buildings” states a strong preference for working at ground level i.e. non-man-entry wherever possible. Inspection chambers provides a means of access compatible with this aim.

### **Terminology**

The term used by European Standards for the manufacture of plastic inspection chambers is:

- Chamber with a removable cover constructed in a drain or sewer that permits the introduction of cleaning and inspection equipment from surface level, but does not provide access for personnel and which terminates at ground level with a riser shaft of 200 mm minimum outer diameter and an inner diameter of less than 800 mm.

This has been simplified, but broadly similar, in other key reference documents.

The intended use and local preferences leads a number of other terms which specifiers will encounter:

- Demarcation chamber / Disconnecting chamber (Sewers for Scotland 3<sup>rd</sup> edition, 2015) – an inspection chamber placed near the boundary of the property on the lateral drain. The demarcation chamber is placed at the change from private drain to public sewer. It has no specific operational requirements but it is recommended that consideration be given to designing the systems such that the demarcation chamber may also be used for testing, inspection, maintenance and removal of debris.
- Disconnecting inspecting chamber (Scottish Technical Standards, 2016) – meaning the same as demarcation chamber.
- Non-man access chambers (Sewers for Scotland 3<sup>rd</sup> edition, 2015 and Sewers for adoption Northern Ireland 1<sup>st</sup> edition) - meaning the same as inspection chambers.
- Shared disconnecting chamber (Scottish Technical Standards, 2016) – an inspection chamber to accommodate the lateral drains from more than one property where it is not possible to provide a chamber for individual houses.
- Type 3 inspection chamber (Sewers for Adoption 7<sup>th</sup> edition, 2012) – an inspection chamber of less than 3 m depth and accommodating the lateral drains from more than 3 properties.
- Type 4 inspection chamber (Sewers for Adoption 7<sup>th</sup> edition, 2012) – an inspection chamber of less than 2 m depth and accommodating the lateral drains from less than 3 properties.

Plastic inspection chambers for each and all of these applications should be designed and tested to the product specifications described in the next section.

### **Product Specifications**

**BS EN 13598 Plastics piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE). Specifications for manholes, inspection chambers and ancillary fittings.**

BS EN 13598 is a two part specification which identifies the requirements for plastic inspection chambers, together with sealed access fittings, mechanical saddles, rodding points and manholes.

Part 1: Specification for ancillary fittings and shallow chambers. This part is intended for chambers up to 1.25m deep in non-trafficked applications. It specifies materials and geometrical characteristics, and performance requirements.

Part 2: Specification for manholes and inspection chambers in traffic areas and deep underground installations. It specifies materials and geometrical characteristics, and performance requirements.

*This standard is currently under revision and the scope of each part may change.*

### **BS 7158 Plastics inspection chambers for drains and sewers. Specification**

BS 7158 has largely been superseded by BS EN 13598 and was withdrawn from general sale by BSI in 2013. However, this standard is quoted in Approved Document H to the Building Regulations. As such, the Department of Communities and Local Government has confirmed that it is still possible to install product to BS 7158 under the Building Regulations.

### **Recommendations**

**Design and Layout:** The National Annex to BS EN 752 “Drain and Sewer Systems outside Buildings” has been recently updated and provides useful guidance on a number of aspects including:

- minimum clear opening (cover size) to provide for the introduction of equipment;
- recommended restriction to opening size on chambers greater than one metre deep to prevent unauthorised access;
- recommended maximum spacing between inspection chambers and other access points in the system to allow for cleaning of the whole drain / sewer;
- guidance on bends and branches;
- a reminder that access to a drain / sewer system may comprise both non-man entry and man entry points to minimise risk to operatives by above ground working.

**Product certification:** The British Plastics Federation (BPF) Pipes Group and its members strongly advise that compliance with BS EN 13598 is verified by a third party certification scheme (for example, the BSI Kitemark or BBA certification). It is recognised that Approved Document H to the Building Regulations permits the installation products to BS 7158 and where manufactured, products to BS 7158 should also be verified by a third party certification scheme.

**CE marking:** Under the Construction Products Regulations (CPR), construction products placed on the market in the UK will need to carry CE marking. It is currently not possible or legal to apply CE marking to plastics pipework systems. The BPF Pipes Group statement (<http://www.plasticpipesgroup.com/support-downloads/position-statements/ce-marking/ce-marking/>) provides further explanation.

## MANHOLES

### Terminology

The term used by European Standards for the manufacture of plastic manholes is:

- Chamber with a removable cover constructed in a drain or sewer to permit entry by personnel and which terminates at ground level with a riser shaft of 800mm minimum inner diameter..

### Product Specifications

**BS EN 13598 Plastics piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE). Specifications for manholes, inspection chambers and ancillary fittings.**

BS EN 13598 is a two part specification which identifies the requirements for plastic inspection chambers, together with sealed access fittings, mechanical saddles, rodding points and manholes.

Part 2: Specification for manholes and inspection chambers in traffic areas and deep underground installations. It specifies materials and geometrical characteristics, and performance requirements.

*This standard is currently under revision and the scope of Part 2 may change.*

### Recommendations

The preference is for above ground working wherever possible to minimise risk to operatives.

**Design and Layout:** The National Annex to BS EN 752: 2017 “Drain and Sewer Systems outside Buildings” provides useful guidance on a number of aspects including:

- The minimum clear opening size for a manhole is 600 mm x 600 mm for safe access / egress;
- manholes should not generally be used at depths less than 1.5 m, but where they are provided the minimum clear opening size is larger than the minimum above to allow for crouching / standing during working;
- the recommended maximum spacing between manholes and other access points in the system to allow for cleaning of the whole drain / sewer;
- manholes should be designed to be watertight, durable and designed to minimise the risk of blockages; and
- manholes should be designed to withstand ground loading, lateral loadings, and flotation.

## COVERS FOR INSPECTION CHAMBERS AND MANHOLES

Approved Document H to the Building Regulations calls for covers for inspection chambers and manholes to be removable, non-ventilating, made from a durable material and be of suitable strength. Therefore, plastic covers for inspection chambers have been widely used for many years for use in drainage systems. Until 2015, there was no dedicated product standard for thermoplastic covers and manufacturers have used BS 7158 as a basis for their product evaluation.

For sewers, and more recently lateral drains, Sewers for Adoption specifies compliance to BS EN 124. BS EN 124:1994 restricted materials of construction to cast iron, steel or reinforced concrete. With the publication of BS EN 124, Part 6: 2015, thermoplastic covers have been included in the EN 124 suite and for some applications, the use of thermoplastic covers on chambers and manholes in public drain and sewer systems is now possible.

## Product Specifications

### **BS EN 124 Part 6: Gully tops and manhole tops made of polypropylene (PP), polyethylene (PE) or unplasticized poly(vinyl chloride) (PVC-U)**

This standard specifies the requirements for thermoplastic covers for covering gullies, manholes and inspection chambers for installation within areas subjected to pedestrian and/or vehicular traffic.

It is applicable to manhole tops and gully tops for use in:

- areas which can only be used by pedestrians and pedal cyclists (class A 15); and
- pedestrian areas and comparable areas, car parks or car parking decks (class B 125).

Part 6 specifies materials specific requirements for materials, performance and certification.

All covers to EN 124 are required to meet the relevant performance requirements specified in BS EN 124: Part 1: 2015 together with material specific requirements set out in the relevant Part. This means that the performance test methods are set out in Part 1 and a table of showing which design, performance and testing requirements are appropriate is given in Part 6.

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

## Recommendations

Wherever possible, thermoplastic covers should be selected as they offer benefits over traditional metal or reinforced concrete products:

- Lightweight – meaning transport to site is less costly and manual handling during installation less onerous.
- Integral locking mechanism – this can be provided without compromising the weight of the product, preventing easy removal by vandalism.
- Improved safety – the requirements of BS EN 124: Part 6: 2015 prevents “dishing” of the cover to convex and puddling of water which could produce a slippery ice patch in winter.
- Suitable for use with inspection equipment – thermoplastic covers are non-magnetic nature meaning no interference with radio detection equipment.

Covers for use with inspection chambers on drains where there will be no vehicular access (i.e. no wheeled loading), products manufactured and tested to Class A15 are suitable. This will be applicable for most drains where design and construction is carried out to Approved Document H to the Building Regulations or equivalent (see Table 1).

For sewers and laterals drains including demarcation / disconnecting chambers on the property boundary, where there will be no vehicular access (i.e. no wheeled loading), products manufactured and tested to Class B125 are specified by Sewers for Adoption or equivalent (see Table 1).

Installers need to ensure that they select products of the correct loading class and that they follow the manufacturers' instructions to ensure the locking of the frame to the riser upstand and the cover to the frame.

**Product certification:** The British Plastics Federation (BPF) Pipes Group and its members strongly advise that compliance with BS EN 124 is verified by a third party certification scheme (for example, the BSI Kitemark or BBA certification).

**CE marking:** Under the Construction Products Regulations (CPR), construction products placed on the market in the UK will need to carry CE marking. It is currently not possible or legal to apply CE marking to products manufactured to EN 124 (any parts) as these standards have not yet been cited as harmonised standards in the Official Journal of the European Union.

## PROVING THE INTEGRITY OF THE WASTEWATER SYSTEM

### Pipes and joints

Sewers for Adoption (SFA7), Sewers for Scotland and Sewers for Adoption (Northern Ireland) require that sewers are tested before backfilling to demonstrate watertightness against infiltration and exfiltration.

The leaktightness of pipes and joints can be tested using either air or water pressure. The water pressure test is set out in BS 8000-14 “Workmanship on building sites. Code of Practice for below ground drainage”. In summary, the section of pipeline to be tested is sealed with stoppers with a tube to a water container placed at the highest point on the section. The pipe section is filled with water to a height of 1.5 m in the container and the water topped up to maintain the level over a 30-minute test period.

To ensure that testing is consistent and reliable it is recommended that:

- test equipment is calibrated and checked before use; and
- testing is not carried out in conditions where the temperature of the pipeline could fluctuate during the test (e.g. strong sunlight).

Part H of the Building Regulations includes a 1-hour conditioning period before the start of the test. This allows for equalising of the temperature of the pipe and water, settling of the pipe under the weight of water and the release of air bubbles which could confuse the results.

SFA7 and BS 8000-14:1989 include a 2-hour conditioning period (and BS EN 1610: 2015 “Construction and testing of drains and sewers” a 1-hour conditioning period) to allow for absorption of water into a porous pipe surface. This is not required for plastic pipes and therefore time could be saved in carrying out the on-site pressure test.

The table below provides a quick look-up for maximum water loss over the 30-minute test period for the most common diameters of plastic pipes. These values can be multiplied up for the actual section length.

<u>Nominal Size (DN)</u>	<u>Maximum water loss (litres) per metre test section</u>
110	0.05
150/160	0.08
200	0.09
225	0.11
250	0.12
315	0.15
400	0.19
500	0.24
600	0.28
For sizes not shown in the table, see E7.7 of SFA7 or BS EN 1610.	

## Chambers

The leaktightness against both infiltration and exfiltration of inspection chambers to BS EN 13598 is part of the compliance testing to the standard. Sewers for Adoption, Sewers for Scotland and Sewers for Adoption (Northern Ireland) therefore do not require additional testing of water tightness, once constructed, beyond visual inspection.

The final performance of the system is dependent on the quality of construction work - it is important to follow the manufacturer's installation guidance and take special care during jointing to pipework to ensure a good seal is made.