BS EN 13598-2:2016

BSI Standards Publication

Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE)

Part 2: Specifications for manholes and inspection chambers

bsi.

National foreword

This British Standard is the UK implementation of EN 13598-2:2016. It supersedes BS EN 13598-2:2009 which is withdrawn.

BSI, as a member of CEN, is obliged to publish EN 13598-2:2016 as a British Standard. However, attention is drawn to the fact that during the development of this European Standard, the UK committee voted against its approval as a European Standard.

There are a number of fundamental errors in this document which could a) have an effect on product performance and b) be a source of confusion when consideration is given to products manufactured in accordance with part 1 of this standard. A revision is being prepared by CEN / TC 155 to address these errors. EN 13598-1 is also being revised and will align with the corrected Part 2. The UK committee strongly recommend that products continue to be manufactured and specified to BS EN 13598-2:2009 until such a time as EN 13598-2 is amended and issued as a package with the updated EN 13598-1.

The UK participation in its preparation was entrusted to Technical Committee PRI/88/1, Plastics piping for non-pressure applications.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Plastics piping systems for non-pressure underground drainage and sewerage - Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) - Part 2: Specifications for manholes and inspection chambers

Systèmes de canalisations en plastique pour les branchements et les collecteurs d'assainissement enterrés sans pression - Poly(chlorure de vinyle) non plastifié (PVC-U), polypropylène (PP) et polyéthylène (PE) - Partie 2: Spécifications relatives aux regards et aux boîtes d'inspection et de branchement

Kunststoff-Rohrleitungssysteme für erdverlegte drucklose Abwasserkanäle und -leitungen - Weichmacherfreies Polyvinylchlorid (PVC-U), Polypropylen (PP) und Polyethylen (PE) - Teil 2: Anforderungen an Einsteigschächte und Kontrollschächte

This European Standard was approved by CEN on 12 May 2016.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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European foreword

This document (EN 13598-2:2016) has been prepared by Technical Committee CEN/TC 155 "Plastics piping systems and ducting systems", the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by January 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13598-2:2009.

EN 13598-2:2016 includes the following significant technical changes with respect to EN 13598-2:2009:

1) Test methods have been updated to those of the latest EN ISO Standards;

2) The confusion generated by having different classes of chamber in Part 1 and Part 2 and their possible misuse because of this has been clarified. This will necessitate a revision of the current Part 1;

3) The limiting clauses on the use of reclaim materials have been updated to help promote the use of reclaim and recycles materials.

This European standard is a supplementary standard for System Standards for plastics piping systems of a particular material for a specified application. There are a number of such System Standards.

System Standards are based on the results of the work being undertaken in ISO/TC 138 "*Plastics pipes, fittings and valves for the transport of fluids*", which is a Technical Committee of the International Organisation for Standardisation (ISO).

They are supported by separate standards on test methods and by European Standards for thermoplastic underground drainage and sewerage systems, to which references are made throughout the System Standard.

The System Standards are consistent with general standards on functional requirements and on recommended practice for installation.

This European Standard consists of the following parts under the general title *Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE)*:

— *Part 1: Specification for ancillary fittings including shallow inspection chambers*

— *Part 2: Specifications for manholes and inspection chambers* (this standard)

— *Part 3: Assessment of conformity* (CEN/TS)

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the definitions and requirements for buried manholes and inspection chambers installed in non-pressure drainage and sewerage systems to a maximum depth of 6 m from ground level to the invert of the main chamber and manufactured from unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP), polypropylene with mineral modifier (PP-MD) or polyethylene (PE). These products are intended for use in pedestrian or vehicular traffic areas and underground installations conforming to the general requirements given in EN 476 and are used outside the building structure (application area code "U"). They are therefore marked accordingly with a "U". Such products are also deemed to meet the requirements of EN 13598-1 for application area U without the need for further testing.

These manholes and inspection chambers may also be used for storm-water systems.

This European Standard is only applicable to those chamber / manhole components (base, riser, cone telescopic part and other near surface components) where the manufacturer has clearly stated in the documentation how the components shall be assembled to create a complete manhole or inspection chamber. This European standard only covers manholes and chambers with flow profile bases with or without sloping channels. It also covers the jointing of the component to the pipework system.

The frame cover and grating components shall, unless otherwise specified, comply with EN 124-1, EN 124-2, EN 124-3, EN 124-4, EN 124-5 and EN 124-6 [1] or EN 1253-4[2].

The products covered by this European standard comprise the following:

— manholes constructed on a drain or sewer to permit entry by personnel.

— inspection chambers providing access to the drainage or sewerage system by means of inspection and cleaning equipment.

NOTE 1 Shallow inspection chambers for use in non-roadway situations down to a depth of 1,25 m max are specified in EN 13598-1.

The manhole and inspection chamber components can be manufactured by various methods e.g. injection moulding, rotational moulding, low-pressure moulding or fabricated from components made in accordance with other standards.

NOTE 2 Both manholes and inspection chambers can be site assembled from different components, but can also be manufactured as a single unit.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 476, *General requirements for components used in drains and sewers*

EN 681-1, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

EN 681-2, *Elastomeric Seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 2: Thermoplastic elastomers*

EN 681-3, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 3: Cellular materials of vulcanized rubber*

EN 681-4, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 4: Cast polyurethane sealing elements*

EN 1401-1, *Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: Specifications for pipes, fittings and the system*

EN 1852-1, *Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene (PP) — Part 1: Specifications for pipes, fittings and the system*

EN 12666-1, *Plastics piping systems for non-pressure underground drainage and sewerage Polyethylene (PE) — Part 1: Specifications for pipes, fittings and the system*

EN 13101:2002, *Steps for underground man entry chambers — Requirements, marking, testing and evaluation of conformity*

EN 13476-1, *Plastics 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) — Part 1: General requirements and performance characteristics*

EN 13476-2, *Plastics 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) — Part 2: Specifications for pipes and fittings with smooth internal and external surface and the system, Type A*

EN 13476-3, *Plastics 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) — Part 3: Specifications for pipes and fittings with smooth internal and profiled external surface and the system, Type B*

EN 13598-1:2010, *Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) — Part 1: Specifications for ancillary fittings including shallow inspection chambers*

EN 14396, *Fixed ladders for manholes*

EN 14758-1, *Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene with mineral modifiers (PP-MD) — Part 1: Specifications for pipes, fittings and the system*

EN ISO 580:2005, *Plastics piping and ducting systems — Injection-moulded thermoplastics fittings — Methods for visually assessing the effects of heating (ISO 580:2005)*

EN ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics (ISO 1043-1)*

EN ISO 1133-1:2011, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method (ISO 1133-1:2011)*

EN ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method (ISO 1183-1)*

EN ISO 1183-2, *Plastics — Methods for determining the density of non-cellular plastics — Part 2: Density gradient column method (ISO 1183-2)*

EN ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions (ISO 3126)*

EN ISO 9967, *Thermoplastics pipes — Determination of creep ratio (ISO 9967)*

EN ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT) (ISO 11357-6)*

EN ISO 13229, *Thermoplastics piping systems for non-pressure applications — Unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings — Determination of the viscosity number and K-value (ISO 13229)*

ISO 3127, *Thermoplastics pipes — Determination of resistance to external blows — Round-the-clock method*

ISO 13259, *Thermoplastics piping systems for underground non-pressure applications — Test method for leaktightness of elastomeric sealing ring type joints*

ISO 13263, *Thermoplastics piping systems for non-pressure underground drainage and sewerage — Thermoplastics fittings — Test method for impact strength*

ISO 13266, *Thermoplastics piping systems for non-pressure underground drainage and sewerage — Thermoplastics shafts or risers for inspection chambers and manholes — Determination of resistance against surface and traffic loading*

ISO 13267, *Thermoplastics piping systems for non-pressure underground drainage and sewerage — Thermoplastics inspection chamber and manhole bases — Test methods for buckling resistance*

ISO 13268, *Thermoplastics piping systems for non-pressure underground drainage and sewerage — Thermoplastics shafts or risers for inspection chambers and manholes — Determination of ring stiffness*

3 Terms, definitions, and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in EN 1401-1, EN 1852-1, EN 12666-1, EN 13476-1, EN 13476-2, EN 13476-3, EN 14758-1, EN ISO 1043-1 and the following apply:

3.1 Terms and definitions

3.1.1
inspection chamber
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

Note 1 to entry: See also EN 476 for non-circular chambers.

Note 2 to entry: Chamber components are normally installed at changes of direction of the pipeline

Note 3 to entry: Chamber components are subject to national safety regulations and / or local provisions. The installer should check for compliance prior to installation.

3.1.2
manhole
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 800 mm minimum inner diameter

Note 1 to entry: See also EN 476 for non circular manholes.

Note 2 to entry: Manhole components are normally installed at changes of direction of the pipeline

Note 3 to entry: Manhole components are subject to national safety regulations and / or local provisions regarding man-entry limitations. The installer should check for compliance prior to installation.

3.1.3
base component
bottom part of a manhole or inspection chamber, allowing direct connection to buried drain or sewer pipes and including integrally formed channels with benching as appropriate In case of a one-piece chamber or manhole, the base component ends at a distance of 300 mm measured from the top of the main channel

3.1.4
riser shaft
usually circular structure providing a vertical conduit between the base unit and the near ground level

Note 1 to entry: The riser shaft can be supplied either as a separate component for site jointing to the base unit, or integrally formed with the base unit by the manufacturer.

3.1.5
near-surface components
components intended to spread vehicular loading directly to the soil and provide a seating for the cover and its frame

Note 1 to entry: Near-surface components are usually used in areas of vehicular traffic loading.

3.1.6
telescopic part
part of the assembly that allows accommodation of settlement that might occur after installation and allows adjustment of the height of the chamber

Note 1 to entry: Telescopic parts are normally installed within 2 m of the ground level and eliminate the transmission of vehicular loading down the riser shaft.

3.1.7
cone
adapter allowing connection of the base and riser or riser/telescopic part to the near surface components

Note 1 to entry: Cones are normally installed within 2 m of the ground level.

3.1.8
chamber assembly
items collectively forming a buried inspection chamber or manhole

3.1.9
reformulated material
recycled / reprocessed material that has been reformulated, by the use of additives and processing techniques, to meet an agreed specification

Note 1 to entry: Typically the additives used would be stabilizers, pigments, etc; the reformulated material taking the form of homogeneous pellets, granules, powder, etc. with the produced batch having consistent physical properties.

3.2 Abbreviations

DN/ID	nominal size, inside diameter related
DN/OD	nominal size , outside diameter related
PVC-U	unplasticized poly(vinyl chloride)
PE	polyethylene
PP	polypropylene
PP-MD	polypropylene modified with minerals

4 Material

4.1 General

Components of manholes and inspection chambers may be manufactured from different materials or a combination of materials as specified below.

4.2 Virgin material for bases

4.2.1 Materials fulfilling one of the European Standards listed in Table 1

When a material fulfilling the requirements in one of the European Standards listed in Table 1 is used for manufacturing inspection chamber and manhole bases it shall additionally conform to the 1 000 h durability test specified in Table 2 and Table A.1.

4.2.2 Materials not fulfilling one of the European Standards listed in Table 1

When a material not fulfilling the requirements in one of the European Standards listed in Table 1 is used for manufacturing inspection chamber and manhole bases it shall conform to the 3 000 h durability test specified in Table 2 and Table A.1. The material shall also be characterised as specified in A.4.

4.3 Virgin material for risers and cones

4.3.1 Materials fulfilling one of the European Standards listed in Table 1

A material fulfilling the requirements in one of the European Standards listed in Table 1 may be used for manufacturing risers and cones without additional material requirements.

4.3.2 Materials fulfilling the requirements given in 4.2.2

A material already shown to meet the requirements in 4.2.2. may be used for manufacturing risers and cones without additional material requirements.

4.3.3 Other materials

When a material not fulfilling 4.3.1 or 4.3.2 is used for manufacturing risers and cones the requirements specified in Table B.1 apply.

Plastic components, fabricated or otherwise manufactured, may be used as sub components of the final assembly, provided that they have been manufactured in accordance with the European Standards listed in Table 1.

Table 1 — Standard materials and corresponding European Standards

Standard material	Corresponding European Standard
Unplasticized poly(vinyl chloride) (PVC-U)	EN 1401-1, EN 13476-2 and EN 13476-3
Polypropylene (PP)	EN 1852-1, EN 13476-2 and EN 13476-3
Polyethylene (PE)	EN 12666-1, EN 13476-2 and EN 13476-3
Polypropylene with mineral modifiers (PP-MD)	EN 14758-1

Table 2 — Base component requirements

Test parameters		**Test method**	**Requirement**
Characteristic Parameter	Value		
Durability: - test pressure - maximum depth of groundwater above invert, H - rating factor, R - testing time, t - test temp. T	 $-0{,}1\times H/R$ bar H equal to be the declared value [a] in m, or ≥ 2 m in any case Shall conform to Table A.1 Shall conform to Table A.1 Shall conform to Table A.1	Annex A and ISO 13267 [b]	No cracks or crazes
[a] The manufacturer shall declare the maximum allowable depth of ground water. [b] When testing for the durability of materials rubber ring joints between the riser and base or base to base may be welded.			

4.4 Utilisation of non-virgin materials

4.4.1 Bases

Non virgin materials may be used provided they comply with 4.2.2. Batch to batch variability shall be controlled by the properties in Table A.2.

4.4.2 Risers and cones

Non virgin materials may be used provided they comply with 4.3.3. Batch to batch variability shall be controlled by the properties in Table B.1.

4.5 Sealing rings

The sealing ring material shall conform to all the requirements in EN 681-1, EN 681-2, EN 681-3 or EN 681-4, as applicable.

The sealing ring shall have no detrimental effects on the properties of the components and shall not cause the test assembly to fail the performance requirements given in Clause 9.

NOTE Sealing rings may be retained using components made from materials other than those of the actual inspection chamber or manhole.

5 General characteristics

5.1 General

When viewed without magnification, the internal and external surfaces of inspection chambers and manholes shall be smooth, clean and free from defects likely to prevent conformity with this standard. Pipe ends or spigots on inspection chambers and manholes shall be cleanly cut and square with the axis of the ends of the component and within any cutting zone if so recommended by the manufacturer.

5.2 Colour

Chamber components, if manufactured in layers, shall have their surface layers coloured throughout.

Any colour may be used.

6 Geometrical characteristics

6.1 Dimensions

6.1.1 General

The internal diameter of the riser shaft shall be used to classify the nominal size of inspection chambers or manholes.

All dimensions shall be measured in accordance with EN ISO 3126.

In addition to the dimensional requirements defined below, chambers and manholes shall conform to the geometrical characteristics specified in EN 476.

NOTE Chamber and manhole components are subject to national safety regulations and / or local provisions regarding man-entry limitations. The installer should check for compliance prior to installation.

6.1.2 Socket and spigot diameters, socket wall thicknesses, length of engagement (A_{min}) and length of spigot

Socket and spigot diameters, socket wall thicknesses, length of engagement, length of spigots and their tolerances shall enable compatibility to pipe work in accordance with the product standards of the pipes that they are intended to be connected to.

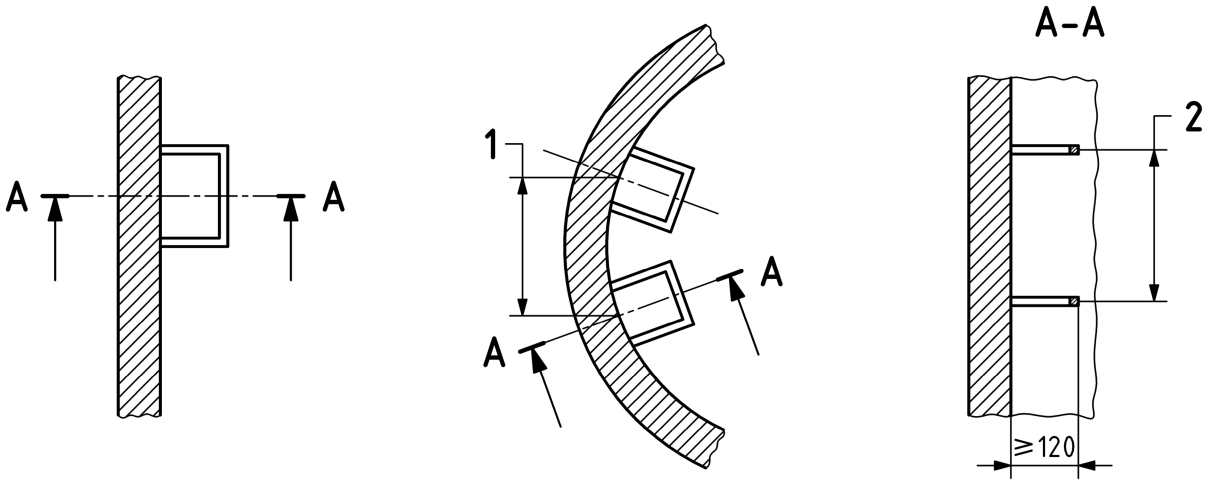
NOTE These requirements are not valid for riser to base connections or sockets or spigots of risers.

6.2 Additional requirements for Manhole Steps and fixed Ladders

Manhole steps shall conform to national safety regulations. Ladders fixed to the manhole shall conform to EN 14396.

If a unit contains steps, these shall have a minimum projection of 120 mm from the face of the riser shaft. Vertical spacing within a finished structure shall relate to the internal height of the units (see Figure 1) and shall be within the range 250 mm to 350 mm. Single steps shall be fixed, with a tolerance of ± 10 mm, alternatively at centres in vertical plan within the range 270 mm and 300 mm, double steps shall be fixed vertically above each other.

Dimensions in millimetres



a) Plan: Double step in rectangular unit	b) Plan: Single steps in circular or elliptical unit	c) Elevation A-A

Key

1 range 270 mm to 300 mm

2 range 250 mm to 350 mm

NOTE Single or double steps can be used

Figure 1 — Steps

7 Mechanical characteristics

When tested as detailed in Table 3 and Table 4, as applicable, the chamber /manhole shall conform to the corresponding requirements.

Table 3 — Mechanical characteristics of manholes and inspection chamber bases

Test parameters		Test method	Requirement
Characteristic Parameter	Value		
Structural integrity: - test pressure - maximum depth of groundwater above invert, *H* - test temp., *T* - testing time, *t*	 −0,1*H* bar *H* to be declared [a], in m, or taken as 2 m [b] whichever is the greater (20 to 25) °C ≥ 1000 h	Annex C and ISO 13267 [c]	No collapse or cracks Predicted 50 year vertical H deformations ≤ 5 % of the main sewer pipe outside diameter [d] or for double wall constructions < than the initial gap between the base and the invert of flow channel. Predicted 50 year horizontal W deformation ≤ 10 % of the main sewer pipe outside diameter [d]
Impact resistance:	Test temperature = (23 ± 2) ˚C	Annex D	No cracks or other damages impairing the function of the base.
Impact Strength (Drop test) [e]: - fall height - impact point - test temperature, *T*	 500 mm Weakest point (−10 ± 2) °C	ISO 13263	No cracks or other damages impairing the function of the base.

a) The manufacturer shall declare the maximum allowable depth of ground water.

b) The value of minimum 2 metre or 0,2 bar pressure is based on the need to safeguard structural integrity where there is no groundwater present. In such cases chamber bases need to resist soil (6 metre depth) and installation loads. Additionally in non-groundwater areas, storm water can load the bases for a relatively short period.

c) Preferrable the channel configuration straight through configuration shall be tested, but other channel configuations can be used. For double wall constructions an addition measurement of the inwards deformation in the centre/midpoint of the outer wall is needed. This to prove that the deformation of the outer wall extrapolated to 50 years does not influence the vertical *H* deformation of the flow channel.

d) Values are related to an extrapolated 50 years prediction – see Annex C.

e) For bases intended to be used in areas where installation is usually carried out at low temperatures it may be required in the national foreword to conform to the requirements of the impact Strength (Drop Test) as specified in Table 3. After passing the test an ice crystal may be added to the marking. The manufacture shall initially carry out a series of tests to find the weakest point.

Table 4 — Mechanical characteristics and fitness for purpose of manholes and inspection chamber risers, telescopic part and manhole steps

Test parameters		Test method	Requirement
Characteristic Parameter	Value		
Riser and Telescopic part [a]			
Ring stiffness [b]		ISO 13268	≥ 2 kN/m^2
Manhole steps			
Strength: - vertical load	2 kN	EN 13101:2002,	Deformations ≤10 mm under load Remaining deformation ≤ 5 mm
Pull out resistance: - horizontal pull out force	1 kN		No pull out

[a] Where the telescopic part is intended to be installed within 1,25 m from the surface, it does not have to be subject to stiffness testing and the specification for minimum stiffness is, therefore, not appropriate.

[b] A higher stiffness might be needed, in cohesive soils and at depths greater than 4 m (see 10.3).

8 Physical characteristics

When tested in accordance with the test method detailed in Table 5 any injection moulded PVC-U components shall conform to the requirements of Table 5.

Table 5 — Physical characteristics of PVC-U injection moulded components

Test parameters		Test method	Requirement
Characteristic	Value		
Effect of heating [a]	Test temperature (150 ± 2) °C Heating time	Method A of EN ISO 580:2005 air Shall conform to EN ISO 580	b

[a] Large test pieces may be cut to fit the oven.

[b] 1) Within a radius of 15 times the wall thickness around the injection point(s) the depth of cracks, delamination or blisters shall not exceed 50% of the wall thickness at that point;

2) Within a radius of 10 times the wall thickness from the diaphragm zone the depth of cracks, delamination or blisters shall not exceed 50% of the wall thickness at that point;

3) Within a radius of 10 times the wall thickness from the ring gate the length of cracks, running through the overall thickness of the wall shall not exceed 50% of the wall thickness at that point;

4) The weld line shall not have opened more than 50% of the wall thickness at that line;

5) In other parts of the surface the depths of cracks and delaminations shall not exceed 30 % of the wall thickness at that point. Blisters shall not exceed a length of 10 times the wall thickness.

9 Performance requirements

9.1 General performance

When tested in accordance with the test methods and parameters specified in columns three, four and five of Table 6, the joints and the system shall conform to the requirements given in columns one and two of Table 6. If these are additionally marked as application area D then these products shall additionally be tested to show compliance to the elevated temperature cycling requirement of EN 13598-1:2010, Clause 10.

Table 6 — Fitness for purpose characteristics

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Base				
Tightness of elastomeric ring sealing joints for pipe-base connection [a] [b] [c]		Test temp Pipe deflection Socket deflection	(23 ± 5) °C ≥ 10 % ≥ 5 % [b]	ISO 13259: Condition D
	No leakage	Low test pressure	0,05 bar	
	No leakage	High test pressure	0,5 bar	
	≤ −0,27 bar	Negative test pressure	−0,3 bar	
		Deflection for: $d_e \leq 315$ $315 < d_e \leq 630$ $d_e > 630$	 2° 1,5° 1°	
Water tightness of base-riser connection	No leakage	Test pressure	0,5 bar 0,05 bar −0,3 bar	ISO 13259: Condition A
Riser				
Water tightness between elements and accompanying components	No leakage	Test pressure Testing time	0,1H bar [d] 15 min	Chamber filled with water to the maximum water table depth recommended by the manufacturer.
Telescopic part when positioned deeper then 0,5 m below ground surface				
Water tightness	No leakage	Testing time	15 min	Chamber with telescopic part filled with water.
Cone				
Water tightness	No leakage	Testing time	15 min	Chamber with cone filled with water
Load bearing capacity	No collapse, no cracking	Test load for: Class A: Class B: Class D: Class E:	ISO 13266, Table 1	ISO 13266
Near surface components				
Load bearing capacity	No collapse, no cracking	Test load: Class A: Class B: Class D: Class E:	ISO 13266, Table 1	ISO 13266

[a] Test data from a socket of the same design but on another product may be used to prove this requirement.

[b] Where it is not practical due to chamber design to deflect either the socket or spigot then the test should be carried out using a differential 5% deflection or if this is impractical tested as condition C of ISO 13259.

[c] Where direct connections between non-thermoplastics materials are made to the chamber and manhole bases then the watertightness tests from the relevant pipe product standards shall be used.

[d] General: Tightness tests for bases in respect of infiltration (negative pressures) and exfiltration positive pressures, H is in meters. Actual test pressure is related to usage at maximum depth of installation below the water table. In cases where chambers are marked for use above the groundwater table, the test shall be carried out at H = 2 m. The riser and base can be held together by strapping.

9.2 Characterization of rotationally moulded product submitted for performance testing

The initial product weight of rotationally moulded products submitted for performance testing as detailed in Table 6 shall be determined prior to carrying out the tests. The weight of subsequent production shall be maintained to within the following limits:

— Initial product weight < 10 kg – subsequent production > 96 %

— Initial product weight ≥ 10 ≤ 50 kg – subsequent production > 97 %

— Initial product weight > 50 kg – subsequent production > 98 %

10 Marking of inspection chambers and manholes and additional documentation

10.1 Marking of inspection chamber bases and manhole bases

Inspection chambers and manholes shall be marked in accordance with Table 7.

Marking elements shall be printed or formed either directly on the component or on a label, in such a way that, after storage, handling and installation, the required legibility is maintained.

NOTE 1 Table 7 specifies two levels of legibility for each of the required markings, coded as follows:

- a = durable in use;

- b = legible at least until the system is installed.

NOTE 2 The manufacturer is not responsible for marking being made illegible due to actions during installation and use such as painting, scratching, covering of the components or by use of e.g. detergents on the components unless agreed with, or specified by the manufacturer.

Marking shall not initiate cracks or other types of defects, which would adversely influence the performance of the manhole or inspection chamber.

Marking by indentation, reducing the wall thickness less than 0,25 mm, shall be deemed to conform to this clause without infringing the requirements for the wall thickness specified in this European Standard.

The size of the marking shall be such that the marking is legible without magnification.

Table 7 — Minimum required marking of inspection chamber bases and manhole bases

Aspect	Marking or symbols	Legibility code
- Number of this European Standard	EN 13598-2	b
- Manufacturer's name and/or trade mark	Xxx	a
- Application area code	U	b
- Nominal size(s) of riser shaft	e.g. 800	b
- Material(s)	e.g. PP	a
- Manufacturer's information	a	b
- Maximum allowed groundwater depth above invert [b] [c]	e.g.: H = 2 m	a
-Standard maximum installation depth [c]	Max installation depth : 6 m	b
- Cold climate performance [d]	❄ (ice crystal)	b

a For providing traceability the following details shall be given:
– the production period year in figures or in code;
– a name or code for the production site if the manufacturer is producing in different sites, nationally and/or internationally.

b E.g. H is 2 m when tested with –0,2 bar pressure.

c These depths may optionally be marked as detailed in Figure 2.

d This marking is only applicable to products meeting the optional ISO 13263 impact requirement in Table 3.

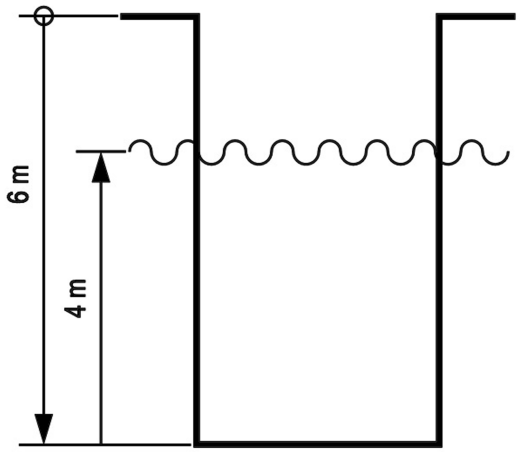


Figure 2 — Example of optional depth marking

10.2 Marking of components other than bases

All separately sold components e.g. cones and risers intended for site assembly shall be marked with the material and manufacturer's identification along with the year of manufacture. Pre-assembled components should also be marked with the material identification of the major sub components.

10.3 Additional documentation

The manufacturer's installation guide including at least the following:

— recommended bedding and sidefill compaction;

— a specified cover solution with load bearing capacity class

— sizes and specification of the pipes that the chamber is intended to be connected to;

— a drawing of assembled chamber including the near surface components.

Annex A
(normative)

Durability of materials used in specific base designs

A.1 General

The durability of bases is carried out as a check on the durability of the material as used in the specific design. The material durability shall be determined at elevated temperature, as described in Clause A.2 and Clause A.3.

When determining durability, two samples shall be taken and one used to determine the basic material durability, the other sample shall be used as a reference for determining the material properties. See A.4 and Table A.2.

NOTE Apart from the base, loaded by a sustained combined load, the other components are primarily under a condition of compressive loads.

A.2 Test procedure

The durability of bases shall be determined in accordance with the test procedure given in ISO 13267 using the test parameters and rating factor as given in Table A.1.

Table A.1 — Test parameters

Material	Temperature *T* °C	Standard material (4.2.1) Rating factor *R* for 1 000 hour	Non standard material (not conforming to 4.2.2) rating factor *R* for 3 000 hour	Test pressure
PVC	60 ± 2	3,5	3,5	See Table 2
PP	80 ± 2	3,4	3,4	See Table 2
PE	80 ± 2	4,1	4,1	See Table 2
PP roto-moulded	80 ± 2	3,6	3,6	See Table 2
PE roto-moulded	60 ± 2	3,6	3,6	See Table 2
NOTE Rating factors for PVC, PP and PE are determined from the standard regression curves defined in EN ISO 15493 [3] and EN ISO 15494 [4].				

A.3 Evaluation of data

The test sample shall be inspected after the test is completed. If there are no cracks, the material / design combination shall be deemed to be durable for at least 50 years.

A.4 Material characteristics

Pieces shall be taken from the second sample and used to determine the characteristic values of the material as specified in Table A.2.

NOTE These characteristics together with the manufacturer's Quality plan dimensions and the mass of roto-moulded components (see 9.2), provide the means to carry out the assessment of conformity as detailed in factory production and control procedures.

Table A.2 — Material characteristics to be determined

Characteristic	Test method	Requirement	Roto-moulded		Injection-moulded [a]				Recycled materials
			PE	PP	PE	PP [b]	PP-MD [c]	PVC	
Density [d]	EN ISO 1183-1 or EN ISO 1183-2	Max. deviation from agreed value [kg/m^3]	± 25	± 25	± 25	± 25	± 25	± 25	± 25
Oxidation induction time at 200 °C (measured on product)	EN ISO 11357-6	Value	≥ 10	≥ 8	≥ 10	≥ 8	≥ 8	NA	PE: ≥ 10 PP: ≥ 8
K-value	EN ISO 13229	Max. deviation from agreed value	NA	NA	NA	NA	NA	±3	For PVC only: ±3
MFR	EN ISO 1133-1 [e]	Max. upper deviation from agreed value	X > 1,5: +20% X ≤ 1,5: +0,3 g/10min	X > 1,5: +20% X ≤ 1,5: +0,3 g/10min	X > 1,5: +20% X ≤ 1,5: +0,3 g/10min	X > 1,5: +20% X ≤ 1,5: +0,3 g/10min	X > 1,5: +20% X ≤ 1,5: +0,3 g/10min	NA	For all except PVC: X > 1,5: +20% X ≤ 1,5: +0,3g/10min
		Lower deviation	Free	Free	Free	Free	Free		Free

a This includes conventional and low pressure moulding materials.

b For low pressure injection-moulded components, (typically with melt pressures of less than 140 bar), the max upper deviation can be 100% for MFR < 2,0.

c For PP-MD, the PP base material shall have an OIT of 8 minimum.

d Any method of EN ISO 1183-1 and EN ISO 1183-2 may be used, provided the result of the determination is accompanied with a reference to the method used for the determination. In case of dispute, the immersion method given in EN ISO 1183-1 shall be used. Density is not applicable to low pressure moulding.

e For PE: 190 °C, 5kg . For PP: 230 °C, 2,16 kg. For PE roto-moulding: 190 °C, 2,16 kg.

NOTE "NA" denotes "Not applicable"; X is the determined value when tested.

Annex B
(normative)

Material requirements for materials used in specific shafts and cones

The minimum material requirements for shafts and cones made of materials according to 4.3.3 is specified in Table B.1.

The declared characteristics as specified by the manufacturer shall be as the material characteristic values of the product as specified in Table B.1.

NOTE These characteristics together with the manufacturer's Quality Plan dimensions and the mass of roto-moulded components (see 9.2), provide the means to carry out the assessment of conformity as detailed in factory production and control procedures.

Table B.1 — Material characteristics to be determined

Characteristic	Test method	Requirement	Roto-moulded		Injection-moulded [a]				Recycled materials
			PE	PP	PE	PP [b]	PP-MD [c]	PVC	
Density [d]	EN ISO 1183-1 or EN ISO 1183-2	Max. deviation from declared value [kg/m^3]	± 25	± 25	± 25	± 25	± 25	± 25	± 25
Oxidation induction time at 200 °C (measured on product)	EN ISO 11357-6	Value	≥ 10	≥ 8	≥ 10	≥ 8	≥ 8	NA	PE: ≥ 10 PP: ≥ 8
K-value	EN ISO 13229	Min. Value	NA	NA	NA	NA	NA	55	For PVC only: 55
		Max. deviation from agreed value	NA	NA	NA	NA	NA	±3	For PVC only: ±3
MFR	EN ISO 1133-1[e]	Max. upper deviation from declared value	*Y* > 1,5: +20% *Y* ≤ 1,5: +0,3 g/10 min	*Y* > 1,5: +20% *Y* ≤ 1,5: +0,3 g/10min	*Y* > 1,5: +20% *Y* ≤ 1,5: +0,3 g/10min	*Y* > 1,5: +20% *Y* ≤ 1,5: +0,3 g/10min	*Y* > 1,5: +20% *Y* ≤ 1,5: +0,3 g/10min	NA	For all except PVC: *X* > 1,5: +20% *X* ≤ 1,5: +0,3g/10 min
		Lower deviation	Free	Free	Free	Free	Free		Free

a This includes both conventional and low pressure moulding materials.

b For low pressure injection-moulded components, (typically with melt pressures of less than 140 bar), the max upper deviation can be 100% for MFR < 2,0.

c For PP-MD, the PP base material shall have an OIT of 8 minimum.

d Any method of EN ISO 1183-1 and ISO 1183-2 may be used, provided the result of the determination is accompanied with a reference to the method used for the determination. In case of dispute, the immersion method given in EN ISO 1183-1 shall be used. Density is not applicable to low pressure moulding.

e For PE: 190 °C, 5kg . For PP: 230 °C, 2,16 kg. For PE roto-moulding: 190 °C, 2,16 kg

NOTE "NA" denotes "Not applicable"; *Y* is the declared value when tested.

Annex C
(normative)

Structural integrity of base

C.1 General

The structural integrity of bases shall be determined as the predicted 50 year deflection at ambient temperature as described below.

C.2 Test procedure

The structural integrity of bases shall be determined in accordance with the test procedure given in ISO 13267.

C.3 Evaluation of data

The 50-years deformation can be calculated as described in ISO 13267.

NOTE 1 For the predicted final deformation in the vertical, and the horizontal directions respectively, the final result according to this method of calculation is as follows:

$(\delta/d)_v = Y_{50,v}/d$ and $(\delta/d)_h = Y_{50,h}/d$.

where:

d = the nominal diameter of the flow profile (mm)

$Y_{50,v}$ = the extrapolated vertical deformation of the flow profile (mm)

$Y_{50,h}$ = the extrapolated horizontal deformation of the flow profile (mm)

$(\delta/d)v$ = measured decrease in diameter vertically measured (mm)

$(\delta/d)h$ = measured increase in diameter vertically measured (mm)

If the predicted 50 years vertical deformation is higher than 2 % or the horizontal deformation is higher than 4 %, the correlation coefficient R shall at least be 0,9. (see EN ISO 9967) In all other cases, the correlation coefficient shall be ignored.

NOTE 2 When the deformation in the horizontal direction (width of flow profile) is less than 10 %, normal inspection and cleaning equipment can be entered in the sewer system. When the deformation in the vertical direction is less than 5 %, effects on flow performance can be neglected.

Annex D
(normative)

Impact test on manhole or chamber bases

D.1 Test equipment

The test equipment shall be as given in ISO 3127.

D.2 Test procedure

Place the base in such a way as to ensure a 30 mm min gap under the point of impact. This can be achieved either by placing the chamber on a flat surface or by use of a v block.

The apparatus can be modified to allow bases to fit. The vee block may be eliminated but the 30 mm gap shall remain both between the end of the guiding pipe and point of impact and between the ground and the base at the point of impact.

Use a straight pipe with an internal diameter of 100 mm to 106 mm and a length of 2,5 m. Place one end of this pipe in the middle of the main flow profile of the manhole or chamber base in a vertical position, perpendicular to the chamber base.

Drop a striker type d90 (see ISO 3127) with mass 1 kg, from 2,5 m to hit the centre point of the flow profile

Use one strike per test sample.

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[1] EN 124 (parts 1 to 6), *Gully tops and manhole tops for vehicular and pedestrian areas*

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[3] EN ISO 15493, *Plastics piping systems for industrial applications — Acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C) — Specifications for components and the system — Metric series (ISO 15493)*

[4] EN ISO 15494, *Plastics piping systems for industrial applications — Polybutene (PB), polyethylene (PE), polyethylene of raised temperature resistance (PE-RT), crosslinked polyethylene (PE-X), polypropylene (PP) — Metric series for specifications for components and the system (ISO 15494)*

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