DRAFT INTERNATIONAL STANDARD ISO/DIS 13272

ISO/TC **138**/SC **1** Secretariat: **AFNOR**

Voting begins on: **2009-02-09** Voting terminates on: **2009-07-09**

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP), polypropylene with mineral modifiers (PP-MD) and polyethylene (PE) — Specifications for manholes and inspection chambers in traffic areas and underground installations

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), polypropylène avec modificateurs minéraux (PP-MD) et polyéthylène (PE) — Spécifications relatives aux regards et aux boîtes d'inspection et de branchement dans les zones de circulation et dans les réseaux enterrés

ICS 23.040.20; 23.040.45; 91.140.80; 93.030

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Conformément aux dispositions de la Résolution du Conseil 15/1993, ce document est distribué en version anglaise seulement.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 1, *Plastics pipes and fittings for soil, waste and drainage (including land drainage)*.

Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP), polypropylene with mineral modifiers (PP-MD) and polyethylene (PE) — Specifications for manholes and inspection chambers in traffic areas and underground installations

1 Scope

This International Standard specifies the definitions and requirements for buried manholes and inspection chambers installed 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 modifiers (PP-MD) or polyethylene (PE). These products are intended for use in traffic areas and underground installations conforming to the general requirements given EN 476 and are used outside the building structure (application area code “U”). They are therefore marked accordingly with a “U”.

This International Standard is only applicable to those chamber/manhole items where the manufacturer has clearly stated in the documentation how the components shall be assembled to create a complete manhole or inspection chamber.

The inspection chambers covered by this standard comprise the following:

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

— chambers, designated as manholes providing man access to the drainage or sewerage system.

The inspection chamber/manhole 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.

The jointing of components can be achieved using:

— elastomeric ring seal joints;

— adhesive joints for PVC-U;

— welded joints for PVC-U, PP and PE;

— extrusion welding;

— mechanical jointing.

NOTE Both manholes and inspection chambers can be site assembled from different components, but can also be manufactured as a single unit. In either case, the following functional parts can be recognized:

a) base (always present)

In case of a one-piece chamber or manhole, the base part ends at a distance of 300 mm measured from the top of the main channel.

b) riser (depth dependent)

c) telescopic part (design dependent)

d) cone (dependent on the design of near surface components and their recommended installation)

e) other near surface components

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.

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

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

ISO 1133:2005, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of the thermoplastics*

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

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

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

ISO 3127, *Thermoplastics piping systems — Determination of resistance to external blows by the round-the-clock method*

ISO 4435, *Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U)*

ISO 8772, *Plastics piping systems for non-pressure underground drainage and sewerage — Polyethylene (PE)*

ISO 8873, *Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene (PP)*

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

ISO 21138-1, *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: Material specifications and performance criteria for pipes, fittings and system*

ISO 21138-2, *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: Pipes and fittings with smooth external surface Type A*

ISO 21138-3, *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: Pipes and fittings with smooth internal and profiled external surface Type B*

ISO xxxxx, *Thermoplastics piping systems for non-pressure applications — Unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings — Determination of the viscosity number and K-value (EN 922)*

ISO xxxxx, *Thermoplastics piping systems for underground non-pressure applications — Test methods for leaktightness of elastomeric sealing ring type joints (EN 1277)*

ISO xxxxx, *Thermoplastics piping systems for non-pressure underground drainage and sewerage — Thermoplastics fittings — Test method for impact strength (EN 12061)*

ISO xxxxx, *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 (EN 14802)*

ISO xxxxx, *Thermoplastics piping systems for non-pressure underground drainage and sewerage — Thermoplastics inspection chamber and manhole bases — Test methods for buckling resistance (EN 14830)*

ISO xxxxx, *Thermoplastics piping systems for non-pressure underground drainage and sewerage — Thermoplastics shafts or risers for inspection chambers and manholes — Determination of ring stiffness (EN 14982)*

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

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

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

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

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

EN 14396, *Fixed ladders for manholes*

CEN/TS 14541, *Plastics pipes and fittings for non-pressure applications — Utilization of non-virgin PVC-U, PP and PE materials*

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*

3 Terms, definitions, symbols and abbreviations

For purposes of this standard, the terms, definitions, symbols and abbreviated terms given in ISO 4435, ISO 8772, ISO 8773, ISO 21138-1, ISO 21138-2, ISO 21138-3, EN 14758-1 and ISO 1043-1 and the following apply.

3.1 Terms and definitions

3.1.1
inspection chamber
drainage or sewerage fitting used to connect drainage or sewerage installations and/or to change the direction of drainage or sewerage runs, 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 Shallow inspection chambers have a maximum depth from invert to top of the riser of 1,25 m. Deep inspection chambers are intended for installation at depths greater than 1,25 m.

NOTE 2 There are no recommendations for non circular inspection chamber risers in EN 476.

NOTE 3 See also EN 476 for non-circular chambers.

3.1.2
manhole
drainage or sewerage fitting used to connect drainage or sewerage installations and/or to change the direction of drainage or sewerage runs, which terminates at ground level with a riser shaft of 800 mm minimum inner diameter

NOTE 1 Rectangular riser sections have minimum internal dimensions of 750 × 1200 mm and elliptical risers have minimum axes of 900 mm x 1000 mm.

NOTE 2 The termination at ground level permits the introduction of cleaning, inspection and test equipment and the removal of debris and provides access for personnel.

NOTE 3 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.

3.1.3
base component
base 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

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

NOTE 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 which, where provided, connect to the top of the riser shaft and provide a seating for the cover and its frame

NOTE Near-surface components are only usually used in areas of vehicular traffic loading and are intended to spread vehicular wheel loadings into the ground and minimize the transmission of this load to the riser shaft.

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 Telescopic parts are normally installed within 2 m of the ground level.

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

NOTE 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
recyclable/reprocessable material that has been reformulated, by the use of additives and processing techniques, to meet an agreed specification

NOTE 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 mineral modified polypropylene

4 Material

4.1 Material for bases

4.1.1 Materials fulfilling one of the standards listed in Table 1

When a material fulfilling the requirements in one of the standards listed in Table 1 is used for manufacturing inspection chamber and manhole bases shall be deemed satisfactory, for deep chambers it shall additionally conform to the 1 000 h durability test specified in Table 2.

4.1.2 Materials not fulfilling one of the standards listed in Table 1

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

4.2 Material for risers and cones

4.2.1 Materials fulfilling one of the standards listed in Table 1

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

4.2.2 Materials fulfilling the requirements given in 4.1.2

A material fulfilling the requirements in 4.1.2 may be used for manufacturing risers and cones without additional material requirements.

4.2.3 Other materials

When a material not fulfilling 4.2.1 or 4.2.2 is used for manufacturing risers and cones the requirements specified in Table B.1 apply.

NOTE Different parts of inspection chamber and manhole assemblies may be manufactured from a combination of two or more of the specified materials.

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 standards listed in Table 1.

Table 1 — Standard materials and corresponding standards

Standard material	Corresponding Standard
Unplasticized poly(vinyl chloride) (PVC-U)	ISO 4435, ISO 21138-2 and ISO 21138-3
Polypropylene (PP)	ISO 8773, ISO 21138-2 and ISO 21138-3
Polyethylene (PE)	ISO 8772, ISO 21138-2 and ISO 21138-3
Polypropylene with mineral modifiers (PP-MD)	EN 14758-1

Table 2 — Base component requirements

Test parameters		Test method	Requirement
Characteristic Parameter	Value		
Durability:		Annex A and ISO XXXXX (EN 14830) [b]	No cracks
– test pressure	$-0{,}1\times H/R$ bar		
– maximum depth of groundwater above invert, H	H equal to be the declared [a] value in m, or ≥ 2 m in any case		
– rating factor, R	Shall conform to Table A.1		
– testing time, t	Shall conform to Table A.1		
– est temp. T	Shall conform to Table A.1		

[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.

4.3 Utilisation of non-virgin materials

Manufacturers may use their own rework material and externally purchased reformulated material up to their specified dosing levels in the manufacture of inspection chambers and manholes.

Externally purchased reprocessable and recyclable material (excluding reformulated) shall be permitted when as specified in the standards listed in CEN/TS 14541. Their suitability in a specific design shall be proven by testing as described in Annex A and their variability from batch to batch monitored via the material characteristics listed in Table A.2.

4.4 Sealing rings

The sealing ring material shall conform to 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 ISO 3126.

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, wall thicknesses, length of engagement (A_{min}) and length of horizontal spigot

Socket and spigot diameters, wall thicknesses, length of engagement, length of spigots and their tolerances should enable compatibility to pipe work in accordance with the product standards of the pipes that they are intended to be connected to with a maximum invert continuity step of the following:

— Up to and including DN/OD 315 or DN/ID 300 – 6 mm ;

— Greater than DN/OD 315 or DN/ID 300 – (0,02 × DN) mm with a maximum of 30mm in any case.

6.2 Additional requirements

6.2.1 Manhole and inspection chamber tops

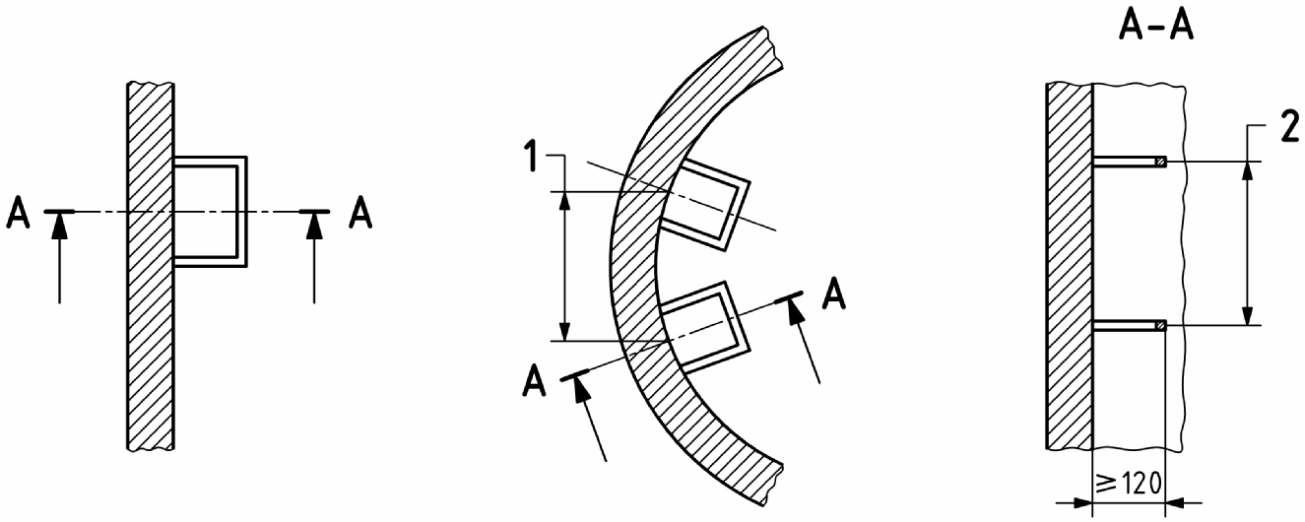
The frame, cover or grating shall, unless otherwise specified, conform to the appropriate design in national Standards

6.2.2 Manholes steps and ladders

Manhole steps and ladders shall conform to either EN 13101 or EN 14396, as appropriate taking National safety regulations into account.

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



Plan: Double step in rectangular unit

Plan: Single steps in circular or elliptical unit

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 deep chambers:			
– test pressure	– 0,1H bar	Annex C and ISO XXXXX (EN 14830) [c]	No collapse or cracks
– maximum depth of groundwater above invert, H	H to be declared [a], in m, or taken as 2 m [b] whichever is the greater		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.
– test temp., T	(20 to 25) °C		
– testing time, t	≥ 1000 h		Predicted 50 year horizontal W deformation ≤ 10 % of the main sewer pipe outside diameter [d]
Shallow chambers:			
Test temperature	(23 ± 2) °C	ISO XXXXX (EN 1277) Condition A	No damage to the structure that could be deemed to impair its function [e]
Test period	100 h		
Internal negative pressure	– 0,3 bar		
Impact resistance:	1 kg; 2,5 meters; r = 50 mm striker; T = (23 ± 2) °C	Annex D	No cracks or other damages impairing the function of the base.
Impact Strength (Drop test) [f]		ISO XXXXX (EN 12061)	No cracks or other damages
– fall height	500 mm		
– impact point	Weakest point		
– test temperature, T	(–10 ± 2) °C		

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

[b] The value of minimum 2 meter 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 meter depth) and installation loads. Additionally in non-groundwater areas, storm water can load the bases for a relatively short period.

[c] 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] The test assembly shall include at least the entire base unit of the inspection chamber. The negative pressure shall be maintained by external means throughout the 100 h test period prior to the pipe joints being subjected to the negative pressure part of the tightness tests as described in Table 6.

[f] Optional test, for bases intended to be used in areas where installation is usually carried out at temperatures below -10 °C. After passing the test an ice crystal may be added to the marking.

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

Test parameters		Test method	Requirement
Characteristic Parameter	Value		
Riser and Telescopic part [a]			
Ring stiffness [b]		ISO XXXXX (EN 14982)	≥ 2 kN/m^2
Ladder steps			
Strength: – vertical load	2 kN	EN 13101, EN 14396	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	ISO 580, Method A, air Shall conform to 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.

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 XXXXX (EN 1277), 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 XXXXX (EN 1277), Condition A
Elevated temperature cycling [e]	No leakage	Shall conform to ISO XXXXX (EN 1055)		ISO XXXXX (EN 1055), Test arrangement b) [Figure 2 of ISO XXXXX (EN 1055)
Riser				
Water tightness between elements and accompanying components	No leakage	Test pressure Testing time	0,1 H 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 each class:	Table 1 of ISO XXXXX (EN 14802)	ISO XXXXX (EN 14802)
Near surface components				
Load bearing capacity	No collapse, no cracking	Test load for each class:	Table 1 of ISO XXXXX (EN 14802)	ISO XXXXX (EN 14802)

[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 XXXXX (EN 1277).

[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.

[e] Test required for shallow inspection chamber bases only – the base has to be supported vertically and shall be capable of being sealed for pressure testing.

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

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 fitting.

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 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 standard	ISO XXXXX	b
– Manufacturer's name and/or trade mark	Xxx	a
– Nominal size(s)	e.g. 800	b
– Material(s)	Either PVC-U or PVC, PP, PP-MD, PE	a
– Manufacturer's information	a	b
– Maximum allowed groundwater depth above invert [b]	Max. groundwater depth :x m	a
– Standard maximum installation depth	Max installation depth : 6 m	b
– Cold climate performance [c]	(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. x is 4 m when tested with –0,4 bar pressure.

[c] This marking is only applicable to products which fulfil the requirement of the optional impact test (ISO XXXXX (EN 12061)) (see Table 3).

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 manufacturers identification along with the year of manufacture. Prefabricated components should also be marked with the material identification of the major sub components.

10.3 Additional documentation

The manufacturer's installation guide shall include at least the following:

— worst soil type and compaction allowed;

— highest allowed traffic class;

— a specified cover solution;

— 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 A.2 and 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 as 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 XXXXX (EN 14830) using the test parameters and rating factor as given in Table A.1.

Table A.1 — Test parameters

Material	Temperature T °C	Standard material (4.1.1) Rating factor R for 1 000 h	Non standard material (not conforming to 4.1.1) rating factor R for 3 000 hour	Test pressure
PVC	60 ± 2	3,5	3,5	See Table 2
PP and PP-MD	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 ISO 15493 [1] and ISO 15494 [2]. Further evidence on rating factors for roto-moulded materials is sought.				

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] c	PVC	
Density [d]	ISO 1183-1 or ISO 1183-2	Max. deviation from agreed value [kg/m3]	± 25	± 25	± 25	± 25	± 25	± 25	± 25
Thermal stability at 200 °C (measured on product)	ISO 11357-6	Value	≥ 10	≥ 8	≥ 10	≥ 8	≥ 8	NA	PE: ≥ 10 PP: ≥ 8
K-value	ISO XXXXX (EN 922)	Max. deviation from agreed value	NA	NA	NA	NA	NA	± 3	For PVC only: ± 3
MFR	ISO 1133 [e] [e]	Max. upper deviation from agreed value X	X > 1,5: +20% X ≤ 1,5: +0,3 g/min	X > 1,5: +20% X ≤ 1,5: +0,3 g/min	X > 1,5: +20% X ≤ 1,5: +0,3 g/min	X > 1,5: +20% X ≤ 1,5: +0,3g/min	X > 1,5: +20% X ≤ 1,5: +0,3g/min	NA	For all except PVC: X > 1,5: +20% X ≤ 1,5: +0,3g/min
		Lower deviation	Free	Free	Free	Free	Free		Free

[a] This includes conventional and low pressure moulding materials.

[b] For low pressure injection-moulded components, 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 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, 5 kg – condition T. For PP: 230 °C, 2,16 kg - condition M. For PE roto-moulding: 190 °C, 2,16 kg – condition D.

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 4.2.3 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]	ISO 1183-1 or ISO 1183-2	Max. deviation from declared value [kg/m3]	± 25	± 25	± 25	± 25	± 25	± 25	± 25
Thermal stability at 200 °C (measured on product)	ISO 11357-6	Declared value	≥ 10	≥ 8	≥ 10	≥ 8	≥ 8	NA	PE: ≥ 10 PP: ≥ 8
K-value	ISO XXXXX (EN 922)	Min value	NA	NA	NA	NA	NA	58	58 For PVC only
		Max. deviation from declared value	NA	NA	NA	NA	NA	$^{+0}_{-3}$	$^{+0}_{-3}$
MFR	ISO 1133 [e]	Max. upper deviation from declared value Y	Y > 1,5: +20% Y ≤ 1,5: +0,3 g/min	Y > 1,5: +20% Y ≤ 1,5: +0,3 g/min	Y > 1,5: +20% Y ≤ 1,5: +0,3 g/min	Y > 1,5: +20% Y ≤ 1,5: +0,3 g/min	Y > 1,5: +20% Y ≤ 1,5: +0,3 g/min	NA	For all except PVC: Y > 1,5: +20% Y ≤ 1,5: +0,3 g/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, 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 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 - condition T. For PP: 230 °C, 2,16 kg - condition M. For PE roto-moulding: 190 °C, 2,16 kg – condition D.

NOTE "NA" denotes "Not applicable". Y is the determined 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 XXXXX (EN 14830).

C.3 Evaluation of data

The 50-years deformation can be calculated as described in ISO XXXXX (EN 14830).

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:

$(\delta/d)_v = Y50,_v/d$ and $(\delta/d)_h = Y_{50,h}/d$.

where

d is the nominal width of the flow profile.

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

NOTE 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 chamber bases

D.1 Test equipment

The test equipment shall be as given in ISO 3127.

D.2 Test procedure

Place the complete chamber base on a vee block in such a way that at least a 30 mm gap between base and block is achieved at point of impact.

For larger chamber bases, the apparatus can be modified to allow those chambers to fit – the vee block may be eliminated but the 30 mm gap shall remain between both 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 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.

Bibliography

[1] ISO 15493, *Plastic piping systems for industrial applications in ABS, PVC-U and PVC-C.*

[2] ISO 15494, *Plastic piping systems for industrial applications in PB, PE (PE 63, PE 80 and PE 100) and PP-H, PP-B, PP-R.*

[3] ENV 1046, *Plastics piping and ducting systems — Systems outside building structures for the conveyance of water or sewage — Practices for installation above and below ground.*