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Plastics piping systems for non-pressure underground conveyance and storage of non-potable water — Arch-shaped, corrugated wall chambers made of PE or PP used for retention, detention, transportation and storage systems — Product specifications and performance criteria

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 138, Plastics pipes, fittings and valves for the transport of fluids, Subcommittee SC 01, plastics pipes and fittings for soil waste and drainage (including land drainage).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

WD 4982 is a system standard covering arch-shaped, corrugated wall chambers made of PE, PP and used for infiltration, attenuation and storage of storm water.

At the time of drafting of this ISO standards the drafting committee is not aware of the existence of chambers made of unplasticized polyvinylchloride (PVC-U) materials. If unplasticized polyvinylchloride (PVC-U) chambers are produced or available in the market they will be included in this standard.

The arch-shaped, corrugated wall chambers and end caps are part of a buried structural system which includes both the arch-shaped chamber, end caps and the surrounding backfill material. Proper design of arch-shaped, corrugated wall chamber systems requires consideration of the structural contribution from the surrounding backfill materials.

Arch-shaped chambers are installed as one horizontal layer on a firm foundation and embedded with fill around and above each individual unit.

Although differing in geometry, when properly installed the structural behaviour of chambers is similar to circular thermoplastic pipes. Guidance for structural design can be found in ASTM F2787, *Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers*.

Guidance for installation can be found in Annex G.

Plastics piping systems for non-pressure underground conveyance and storage of non-potable water — Arch-shaped, corrugated wall chambers made of PE or PP used for retention, detention, transportation and storage systems — Product specifications and performance criteria

1 Scope

This document gives the definitions and specifies the minimum requirements for injection moulded, compression moulded, extruded and thermoformed thermoplastics arch-shaped chambers, including integral components, used in underground systems for retention, detention, transportation and storage of non-potable water (e.g., storm water) and manufactured from polyethylene (PE) and polypropylene (PP).

These chambers are intended for buried underground use in one horizontal layer, e.g., in landscape, pedestrian or vehicular traffic areas.

In the case of detention and retention systems, the main purpose of the chambers is to retain water, for later infiltration in the ground or for later use in non-potable applications (irrigation, cleaning, sanitary facilities, etc), or to detain water during a storm, transferring it in a controlled way to the public storm water network.

Applications include commercial, residential, agricultural, and highway drainage, including installation under parking lots and roadways.

Product properties are determined by a combination of material specifications, design and manufacturing process.

These chambers are intended to be used as elements in a modular system where the manufacturer has clearly stated in the documentation how the components are assembled to create a complete retention, detention, transportation or storage system.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact testISO 472, Plastics — Vocabulary*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

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

ISO 604, *Plastics — Determination of compressive properties*

ISO 899-1, *Plastics — Determination of creep behaviour — Part 1: Tensile creep*

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

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

ISO 9967, *Thermoplastics pipes — Determination of creep ratio*

ISO 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

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

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

ISO 3451-1, *Plastics — Determination of ash — Part 1: General methods*

ISO 9969, *Thermoplastics pipes — Determination of ring stiffness*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472, ISO 1043-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 General terms

3.1.1
Arch-shaped chambers
chambers are arch-shaped products which define a subsurface open space when installed

Note 1 to entry: The arch-shaped chambers may have perforations, inspection ports or other features that may or may not reduce the mechanical capacity of a chamber

3.1.2
end caps
end caps, integral or separate, are arch-shaped products which cover the open ends of the chamber rows

3.1.3
corrugation
periodic shape of arch-shaped chamber or end cap walls. A wall profile consists of a regular pattern of alternating crests and valleys connected by webs

3.1.4
system
construction consisting of a single horizontal layer of connected arch-shaped chambers and caps and associated with backfill material

3.1.5
detention system
system designed to reduce the peak flow from a given site by providing a temporary underground storm water storage facility

Note 1 to entry: also known as “attenuation.”

3.1.6
retention system
system designed to provide a temporary underground storage facility from which storm water infiltrates into the surrounding ground

Note 1 to entry: also known as “infiltration.”

3.1.7
storage system
system designed to provide an underground storage facility for storm water.

3.1.8
type testing
initial testing performed to prove that the material is capable of conforming to the requirements given in the relevant standard.

3.2 Material terms

3.2.1
material
material specified for a particular component in a chamber

3.2.2
virgin material
material in the form such as granules or powder that have not been subjected to use or processing other than that required for their manufacture and to which no reprocessed or recycled material has been added

3.2.3
mineral modified material
material to which minerals have been added during specified processing operation(s) which during such processing is distributed in the material

3.2.4
reworked material
material prepared from rejected unused chambers and end caps and/or integral components, including trimmings from the production of chambers and end caps, that will be reprocessed in a manufacturer’s plant after having been previously processed by the same manufacturer by a process such as moulding, extrusion or thermoforming, and for which the complete formulation is the same

3.2.5
non-virgin material
material from used or unused infiltration and attenuation chambers and end caps which have been cleaned and crushed or ground, or material from used or unused PP or PE products other than infiltration and attenuation chambers and end caps, regardless of where they are manufactured

3.2.6
agreed specification
specification of the relevant material characteristics agreed between the supplier of the material and the chamber and end cap manufacturer

3.3 Geometric terms

3.3.1
arch-shaped chamber width
W
maximum horizontal outside dimension (y-direction) of chamber at feet

3.3.2
Arch-shaped chamber span
S
Maximum horizontal clear inside dimension (y-direction) of chamber at feet

3.3.3
chamber height
H
maximum vertical outside dimension (z-direction) of chamber from bottom to top

3.3.4
chamber rise
R
Maximum vertical clear inside dimension (z-direction) of chamber from bottom to top

3.3.5
Arch-shaped chamber length
L
maximum horizontal outer dimension (x-direction) of chamber from one end to the other

3.3.6
wall thickness
e
measured wall thickness at any point of a chamber

3.3.7
corrugation height
e_c
linear distance in radial direction from bottom surface of the valley to the outer surface of the crest, taken in a particular spot in the chamber

3.3.8
corrugation area
A
area of chamber wall [mm^2/mm] in x-y-plane at feet and y-z-plane at crown

3.3.9
moment of inertia, corrugation
I
moment of inertia of chamber wall around x-axis [mm^4/mm]

3.4 Mechanical terms

3.4.1
flattening capacity
specific mechanical characteristic of arch-shaped chambers determined in the arch stiffness test

3.4.2
arch stiffness constant (ASC)
specific mechanical characteristic of arch-shaped chambers determined in arch stiffness test [kN/m]

3.4.3
end-cap stiffness constant (CSC)
specific mechanical characteristic of end caps determined in shell stiffness test [kN]

3.1.4.5
stub compression strength
Specific mechanical characteristic of arch-shaped chambers determined in stub compression test. [kN/m]

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

4.1 Symbols

L length of chamber

L_{ASC} length of chamber in arch stiffness test

H height of chamber

e wall thickness (at any point)

e_c corrugation height

S span of chamber

R rise of chamber

R_0 initial rise

F loading force

4.2 Abbreviated terms

ASC arch stiffness constant

MFR melt mass-flow rate

OIT oxidation induction time

PE Polyethylene

PP Polypropylene

CSC end-cap stiffness constant

5 Material

5.1 General

The material shall be one of the following: PE or PP, to which may be added: mineral modifier(s) of known specification, additives needed to facilitate the manufacture or improve the properties of components conforming to this document.

The material shall have an agreed specification between supplier and manufacturer or the interested parties.

5.2 Polyethylene (PE) material

5.2.1 General

The material shall be one of the following: PE virgin, PE modified, or PE non-virgin material conforming to clause 5.2.2 – 5.2.4, as appropriate.

5.2.2 Polyethylene (PE) virgin material

The material for arch-shaped chambers and end caps shall be a compound of PE virgin material and those additives that are needed to facilitate the manufacture of arch-shaped chambers and end caps conforming to the requirements of this document.

When reworked material is added to a level of less than 10 %, the material for chambers can still be considered as virgin.

5.2.3 Polyethylene (PE) modified material

The material for arch-shaped chambers and end caps shall be a compound of PE virgin material modified with minerals and those additives that are needed to facilitate the manufacture or improve the properties of arch-shaped chambers and end caps conforming to the requirements of this document.

If calcium carbonate is used, only coated calcium carbonate shall be used.

The content of minerals in the final compound shall be less than 50 % by mass.

When reworked material is added to a level of less than 10 %, the material for chambers can still be considered as modified.

5.2.4 Polyethylene (PE) non-virgin material

The material for arch-shaped chambers and end caps shall be a compound of non-virgin PE material, and those additives that are needed to facilitate the manufacture or improve the properties of arch-shaped chambers and end caps conforming to the requirements of this document.

Non-virgin materials shall be permitted to be used up to 100 % or added to virgin or reworked material or a mixture of those two materials.

The content of minerals in the final compound shall be less than 50 % by mass.

5.3 Polypropylene (PP) material

5.3.1 General

The material shall be one of the following: PP virgin, PP modified, or PP non-virgin material, conforming to clause 5.3.2 – 5.3.4 as appropriate.

5.3.2 Polypropylene (PP) virgin material

The material for arch-shaped chambers and end caps shall be a compound of PP virgin material and those additives that are needed to facilitate the manufacture of chambers or end caps conforming to the requirements of this document.

When reworked material is added to a level of less than 10 %, the material for chambers can still be considered as virgin.

5.3.3 Polypropylene (PP) modified material

The material for arch-shaped chambers and end caps shall be a compound of PP virgin material modified with minerals and those additives that are needed to facilitate the manufacture or improve the properties of arch-shaped chambers and end caps conforming to the requirements of this document.

If calcium carbonate is used, only coated calcium carbonate shall be used.

The content of minerals in the final compound shall be less than 50 % by mass.

When reworked material is added to a level of less than 10 %, the material for chambers can still be considered as modified.

5.3.4 Polypropylene (PP) non-virgin material

The material for arch-shaped chambers and end caps shall be a compound of non-virgin PP material, and those additives that are needed to facilitate the manufacture or improve the properties of arch-shaped chambers and end caps conforming to the requirements of this document.

Non-virgin materials shall be permitted to be used up to 100 % or added to virgin or reworked material or a mixture of those two materials.

5.4 The content of minerals in the final compound shall be less than 50 % by mass. Chamber and end cap material characteristics

A product in this document is formed by a combination of a material specification, a design and a manufacturing process. Table 1 specifies the minimum required tests to fingerprint the material.

When tested in accordance with the test methods as specified in Table 1, using the indicated parameters, the material used for the chambers and end caps shall have the characteristics conforming to the requirements given in Table A.1.

Table 1 — Material characteristics of chambers and end caps

Characteristic	Material	Requirement	Test parameters		Test method
Tensile strength – Short term	PE	Declared value but not less than the value obtained on material from the same production batch of material used for type testing	Test speed Specimen type	50 mm/min 1A	ISO 527-2
	PP	Declared value but not less than the value obtained on material from the same production batch of material used for type testing	Test speed Specimen type	50 mm/min 1A	ISO 527-2
Note: Due to the fact that these characteristics only fingerprint the used material, the values can be declared. Nevertheless, the durability of the material is tested according to ISO 1167-1 and 1167-2.					