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Plastic piping systems for non-pressure underground conveyance and storage of non-potable water — Boxes used for retention, detention, transportation and storage systems — Specifications for storm water boxes made of PP and PVC-U

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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.

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 transport of fluids, Subcommittee SC 1, Plastics pipes and fittings for soil, waste and drainage (including land drainage).

ISO 4981 consists of the following parts under the general title Plastics piping systems for non-pressure underground conveyance and storage of non-potable water - Boxes used for storage, transportation, detention and retention systems:

- *Part 1: Specifications for storm water boxes made of PP, PE and PVC-U* [this document];
- *Part 2: Assessment of Conformity* [expected].

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

The products covered by this standard are part of storm water management system.

This standard is intended to reflect the current state of knowledge of determining and predicting the long-term lifetime of product groups mentioned in the scope while maintaining reasonable testing times for producers and developers of these systems

The International Organization for Standardization (ISO) [and/or] International Electrotechnical Commission (IEC) draw[s] attention to the fact that it is claimed that compliance with this document may involve the use of a patent.

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Guidance for installation can be found in the CEN/TR 17179:2018^[1]

Guidance for design can be found in the CEN/TR 17152-3 (under construction)

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Plastic piping systems for non-pressure underground conveyance and storage of non-potable water — Boxes used for retention, detention, transportation and storage systems — Specifications for storm water boxes made of PP and PVC-U

1 Scope

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

These boxes are intended for buried underground use, e.g. in landscape, pedestrian or vehicular traffic areas.

In the case of detention and retention systems, the main purpose of the boxes 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 retain 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.

A box can either be factory assembled or site assembled from different components.

These boxes 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 storage, transportation, detention or retention system. They are installed as one or more horizontal layers on a firm foundation and embedded with fill around and above the complete system.

NOTE 1 Non load bearing component(s) can be manufactured by various methods e.g. extrusion, injection moulding, rotational moulding, compression moulded, thermoforming and low-pressure injection moulding and are not part of this standard.

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.

EN 17150, *Plastics piping systems for non-pressure underground conveyance and storage of non-potable water - Test method for determination of short-term compression strength of boxes*

EN 17151, *Plastics piping systems for non-pressure underground conveyance and storage of non-potable water - Test method for determination of long-term compression strength of boxes*

ISO 179-1, *Plastics - Determination of Charpy impact properties - Part 1: Non-instrumented impact test (ISO 179-1)*

ISO 306, *Plastics - Thermoplastic materials - Determination of Vicat softening temperature (VST) (ISO 306)*

ISO 472:2013, *Plastics — Vocabulary*

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

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

ISO 527-3, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets*

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

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

ISO 899-2, *Plastics — Determination of creep behaviour — Part 2: Flexural creep by three-point loading*

ISO 1043-1:2011, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

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

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 3451-5, *Plastics — Determination of ash — Part 5: Poly(vinyl chloride)*

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

ISO 11358-1, *Plastics - Thermogravimetry (TG) of polymers - Part 1: General principles (ISO 11358-1)*

ISO 11922-1, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*

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*

3 Terms and definitions

In addition to the terms and definitions given below, the terms and definitions given in ISO 472, ISO 1043-1 and ISO 11922-1 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

box

thermoplastic cuboid shaped element, with or without sidewalls, used to create a modular system

3.2**integral component**

load bearing component contributing to the overall strength of the box

3.3**modular system**

system made of repeating boxes

3.4**detention system**

modular system designed to attenuate the peak flow from a given site by providing a temporary underground storm water storage facility

Note 1 to entry: Also known as 'Attenuation'

3.5**retention system**

modular 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'

3.6**storage system**

modular system designed to provide an underground storage facility for storm water

3.7**porosity**

total available volume for water storage divided by the total envelope cuboid volume for a box

3.8**long-term compression strength**

maximum applied compression stress for which the box will survive without creep rupture for 50 years determined as the lower 95 % confidence limit (LCL) for the stress leading to a failure at the extrapolated lifetime, in kN/m²

3.9**material**

material specified for a particular component in a box

Note 1 to entry: Boxes consisting of components of different materials are possible.

3.10**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

3.11**mineral modified material**

material to which minerals have been added during specific processing operation(s) which during such processing is distributed in the material

3.12**own reprocessed material**

material prepared from rejected unused boxes and/or integral components, including trimmings from the production of boxes, 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

3.13

non-virgin material

material from used or unused storage, transportation, detention and retention boxes which have been cleaned and crushed or ground, or material from used or unused PE, PP or PVC-U products other than storage, transportation, detention and retention boxes, regardless of where they are manufactured

3.14

agreed specification

specification of the relevant material characteristics agreed between the supplier of the material and the box manufacturer

3.15

test duration period

specifies a series of creep rupture tests failing in a specific period of time

3.16

type testing

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

4 Symbols and abbreviations

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

4.1 Symbols

e maximum thickness of the component tested in mm

4.2 Abbreviations

OIT	oxidation induction time
PE	polyethylene
PP	polypropylene
PVC-U	unplasticized polyvinylchloride
IR	Infrared
P	Porosity
TDP	test duration period

5 Material

5.1 General

The material shall be one of the following: PE, PP or PVC-U, 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 Polypropylene (PP) material

5.2.1 General

The material shall be one of the following: PP virgin, PP modified, or PP non-virgin material, conforming to [clause 5.2.2](#) – [5.2.4](#) as appropriate.

5.2.2 Polypropylene (PP) virgin material

The material for boxes and integral components shall be a compound of PP virgin material and those additives that are needed to facilitate the manufacture of box or integral components conforming to the requirements of this document.

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

5.2.3 Polypropylene (PP) modified material

The material for boxes and integral components 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 box or integral components 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 own reprocessed material is added to a level of less than 10 %, the material for boxes can still be considered as modified.

5.2.4 Polypropylene (PP) non-virgin material

The material for boxes and integral components shall be a compound of non-virgin PP material, and those additives that are needed to facilitate the manufacture or improve the properties of box or integral components conforming to the requirements of this document.

Non-virgin materials shall be permitted to be used up to 100 % or added to virgin or own reprocessed 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 Polyethylene (PE) material

5.3.1 General

The material shall be one of the following: PE virgin, PE modified, or PE non-virgin material conforming to [clause 5.3.2](#) – [5.3.4](#) as appropriate.

5.3.2 Polyethylene (PE) virgin material

The material for boxes and integral components shall be a compound of PE virgin material and those additives that are needed to facilitate the manufacture of box or integral components conforming to the requirements of this document.

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