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Plastics piping systems — Polyethylene (PE) pipes for irrigation — Specifications

Systèmes de canalisations en plastique — Tubes en polyéthylène (PE) pour l'irrigation — Spécifications

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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 2, *Plastics pipes and fittings for water supplies*.

This fourth edition cancels and replaces the third edition (ISO 8779:2010), which has been technically revised.

The main changes compared to the previous edition are as follows:

— The scope of this fourth edition has been modified to cover larger sizes of mains and sub-mains of irrigation piping system.

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 aim of this document is to specify the minimum requirements from polyethylene irrigation pipes that stay idle most of their life and are only pressurized for short periods from time to time. This condition is true for the majority of irrigation pipes in use, including laterals, sub-mains and even mains.

The normal conditions of use of irrigation pipes, as well as other important factors, differ widely from those of pipes used for long-term water distribution systems (according to the ISO 4427 series):

— Pressure regime: pressure is applied intermittently for short periods, adding up to maximum 15 % of any long period of time.

— Installation location: most pipes are laid above ground in fields, exposed to chemicals, soil cultivation operations, being stepped on, being run over by tractors, etc.

— Non-permanent connections: pipes are connected by removable and re-installable mechanical compression fittings, not by permanent fusion techniques.

— Movability: pipelines may be moved (manually or towed) between several locations in the field; they may also be disassembled at season's end and reassembled at the beginning of next season.

— End of life is mostly caused by external effects, mechanical or environmental, and not by failure under pressure.

— Lifetime expectancy is, consequently, much shorter: ten years maximum.

— Colours: pipes may be produced in non-black colours (e.g. violet, for irrigation by reclaimed water).

— Lower risk: a failure in an irrigation pipe has much lower impact, compared to a failure in long-term water distribution pipes.

Considering all factors above, the classification of pipe material in this document is by resistance to a standard series of pressure tests, rather than according to ISO 12162 (which relates to pipes under continuous pressure for 50 years), and material designation is therefore different. As explained above, fusion compatibility is not required either. Otherwise, this document follows ISO 4427-2 with regards to dimensions and test requirements.

In order to clearly restrict the use of this document to those pipes that fit the description above, the Scope specifies a usage limit of a maximum of 1 500 hours under pressure per year. For applications where pipes exceed or may exceed this limit, pipes complying with the ISO 4427 series should be selected.

Plastics piping systems — Polyethylene (PE) pipes for irrigation — Specifications

1 Scope

This document specifies the characteristics of pipes (mains, sub-mains and laterals) made from polyethylene (PE), intended for the conveyance of water for irrigation, at a water temperature up to 45 °C.

NOTE 1 For the effect of water temperature on the maximum operating pressure, see Annex A.

This document applies to pipes that will not be subjected to internal pressure for long periods, and not more than 1 500 hours/year. For piping applications with long-term continuous pressure, the ISO 4427 series applies.

NOTE 2 The expected lifetime of pipes covered by this document is ten years or less.

This document also specifies the properties of the material and the parameters for the test methods to which it refers.

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

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 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters*

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

ISO 6964, *Polyolefin pipes and fittings — Determination of carbon black content by calcination and pyrolysis — Test method*

ISO 8796, *Polyethylene PE 32 and PE 40 pipes for irrigation laterals — Susceptibility to environmental stress cracking induced by insert-type fittings — Test method and requirements*

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

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

ISO 18553, *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 http://www.electropedia.org/

3.1
main
main supply line within an irrigation system, including sub-mains

3.2
lateral
branch supply line within an irrigation system on which water distribution devices are mounted directly or by means of fittings, risers or tubes

Note 1 to entry: Examples of water distribution devices are sprinklers, emitters and drippers.

3.3
melt mass-flow rate
MFR
value relating to the viscosity of the molten material at a specified temperature and load measured in accordance with ISO 1133-1

Note 1 to entry: MFR is expressed in units of grams per 10 min (g/10 min).

3.4
nominal outside diameter
d_n
specified outside diameter, assigned to a nominal size DN/OD

Note 1 to entry: Expressed in millimetres.

3.5
mean outside diameter
d_{em}
value of the measurement of the outer circumference of the pipe or spigot end of a fitting in any cross-section divided by π (= 3,142), rounded to the next greater 0,1 mm

3.6
minimum mean outside diameter
$d_{em,\,min}$
minimum value of the outside diameter as specified for a given nominal size

3.7
maximum mean outside diameter
$d_{em,\,max}$
maximum value of the outside diameter as specified for a given nominal size

3.8
out-of-roundness
ovality
difference between the measured maximum outside diameter and the measured minimum outside diameter in the same cross-section of the pipe or spigot end of a fitting

3.9
nominal wall thickness
e_n
numerical designation of the wall thickness of a component, which is a convenient round number approximately equal to the manufacturing dimension

Note 1 to entry: Expressed in millimetres.

3.10
wall thickness at any point
e
value of the measurement of the wall thickness at any point around the circumference of a component

3.11
minimum wall thickness at any point
e_{min}
minimum value of the *wall thickness at any point* (3.10) around the circumference of a component as specified

3.12
maximum wall thickness at any point
e_{max}
maximum value of the *wall thickness at any point* (3.10) around the circumference of a component as specified

3.13
standard dimension ratio
SDR
numerical designation of a pipe series, which is a convenient round number, approximately equal to the ratio of the *nominal outside diameter* (3.4), d_n, of a pipe to its *nominal wall thickness* (3.9), e_n

3.14
tolerance
permissible variation of the specified value of a quantity expressed as the difference between the permissible maximum and permissible minimum values

3.15
pressure class
PC
the *maximum allowable working pressure* (3.16) of the pipe at a temperature of 20 °C

3.16
maximum allowable working pressure
MAWP
highest water pressure in the pipe which is allowed in continuous use

Note 1 to entry: Maximum allowable working pressure is expressed in bar.

4 Material

4.1 General

The pipes shall be manufactured from polyethylene containing only those additives that are necessary for the manufacture and use of the pipes in accordance with this document. All additives shall be uniformly dispersed.

The pipe material shall not support the growth of algae and bacteria.

The pipes shall be protected against degradation by solar (UV) radiation using carbon black or other suitable additives.

Pipes that are exposed to light during their usage shall be opaque.

Coextruded layered pipes are allowed and shall comply with all the requirements of this document. All layers of a pipe shall be made from the same material type.

4.2 Use of reprocessable material

Clean, reprocessable material generated from a manufacturer's own production may be used, if it is derived from the same material as used for the relevant production.

4.3 Physical characteristics of the material

The material used for the manufacture of pipes, including all layers of coextruded pipes, shall conform to the requirements given in Table 1.

Table 1 — Characteristics of the PE material

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Carbon black content (black compound only)	(2 – 2,5) % mass fraction	In accordance with ISO 6964		ISO 6964
Carbon black dispersion (black compound only)	≤ grade 3 Rating of dispersion A1, A2, A3 or B	In accordance with ISO 18553[a]		ISO 18553
Oxidation induction time (OIT)	≥20 min	Test temperature Number of test pieces[c]	200 °C[b] 3	ISO 11357-6
Pigment dispersion (nonblack compound only)	≤ grade 3	In accordance with ISO 18553[a]		ISO 18553

[a] In case of dispute, the test pieces for carbon black dispersion and pigment dispersion shall be prepared by the microtome method.

[b] The test may be carried out as an indirect test at 210 °C, providing there is a clear correlation to the results at 200 °C. In case of dispute, the test temperature shall be 200 °C.

[c] The number of test pieces given indicates the quantity required to establish a value for the characteristic described in this table. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan.

[d] Nominated value given by the compound producer.

Table 1 *(continued)*

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Melt mass-flow rate (MFR) for Polyethylene Irrigation 3,2 and 4,0	0,2 – 1,4 g/10 min Maximum deviation of ±25 % of the nominated value[d]	Load Test temperature Duration Number of test pieces[c]	2,16 kg 190 °C 10 min According to ISO 1133-1	ISO 1133-1
Melt mass-flow rate (MFR) for Polyethylene Irrigation 6,3, 8,0 and 10,0	0,15 – 1,4 g/10 min Maximum deviation of ±25 % of the nominated value[d]	Load Test temperature Duration Number of test pieces[c]	5 kg 190 °C 10 min According to ISO 1133-1	ISO 1133-1

[a] In case of dispute, the test pieces for carbon black dispersion and pigment dispersion shall be prepared by the microtome method.

[b] The test may be carried out as an indirect test at 210 °C, providing there is a clear correlation to the results at 200 °C. In case of dispute, the test temperature shall be 200 °C.

[c] The number of test pieces given indicates the quantity required to establish a value for the characteristic described in this table. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan.

[d] Nominated value given by the compound producer.

4.4 Designation and classification

The pipe material shall be classified by conformance with all pressure test (hydrostatic strength) requirements in Table 5 and shall be designated in accordance with Table 2.

Table 2 — Material designation by conformance with pressure test requirements of Table 5

Pipe material designation	Pipe complies with pressure test requirements of Table 5		
	Test parameters (copied from Table 5)		
	100 h at 20 °C	165 h at 80 °C	1 000 h at 80 °C
	Circumferential (hoop) stress, MPa		
Polyethylene Irrigation 3,2	6,5	2,0	1,5
Polyethylene Irrigation 4,0	7,0	2,5	2,0
Polyethylene Irrigation 6,3	8,0	3,5	3,2
Polyethylene Irrigation 8,0	10,0	4,5	4,0
Polyethylene Irrigation 10,0	12,0	5,4	5,0

5 Geometrical characteristics

5.1 Measurements

The dimensions of the pipe shall be measured in accordance with ISO 3126. In case of dispute, the measurements shall be made not less than 24 h after manufacture and the pipe being conditioned for at least 4 h at (23 ± 2) °C.

The length of straight pipes and coils shall not be less than that agreed on by the manufacturer and the customer.

Pipes shall be coiled such that localized deformation, e.g. buckling and kinking, is prevented.