INTERNATIONAL STANDARD

ISO 8779

Third edition
2010-03-01

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

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

Reference number
ISO 8779:2010(E)

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Published in Switzerland

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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 8779 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 third edition cancels and replaces the second edition (ISO 8779:2001), which has been technically revised. The scope of this third edition has been enlarged to cover the mains and sub-mains of irrigation piping systems, which were previously specified in ISO 4427.

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

1 Scope

This International Standard specifies the pipes (mains, sub-mains and laterals) with nominal outside diameters from 12 mm up to and including 63 mm made from polyethylene (PE) intended to be used for the conveyance of water for irrigation.

It also specifies the general properties of PE and the test parameters for the pipes designated as PE 32 and PE 40 by checking referenced points as given in 4.4, to be used under the following conditions:

— nominal pressures of PN 2,5, PN 4, PN 6, PN 8 and PN 10, as applicable,

— at temperatures up to and including 45 ºC, as specified in Annex A.

NOTE Pipes with a diameter of 75 mm and nominal pressure (PN) of 4 bar[1)] are also included in this International Standard.

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 1133-1, *Plastics — Determination of the melt volume-flow rate (MVR) and melt mass-flow rate (MFR) of thermoplastics materials — 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 4065:1996, *Thermoplastics pipes — Universal wall thickness table*

ISO 4427-2:2007, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 2: Pipes*

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

1) 1 bar = 0,1 MPa = 0,1 N/mm^2 = 10^5 N/m^2.

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

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

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 International Standard, the following terms and definitions apply.

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

3.2
irrigation 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 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 MFR is expressed in units of grams per 10 min (g/10 min).

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

3.5
outside diameter at any point
d_e
value of the measurement of the outside diameter through its cross-section at any point of the pipe rounded to the next greater 0,1 mm

3.6
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

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

3.8
maximum mean outside diameter
$d_{em,\,max}$
maximum value of the outside diameter as specified for a given nominal size

3.9
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

3.10
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 in millimetres

3.11
wall thickness at any point
e
value of the measurement of the wall thickness at any point around the circumference of a component

3.12
minimum wall thickness at any point
e_{min}
minimum value of the wall thickness at any point around the circumference of a component as specified

3.13
maximum wall thickness at any point
e_{max}
maximum value of the wall thickness at any point around the circumference of a component as specified

3.14
mean wall thickness
e_m
arithmetic mean of a number of measurements regularly spaced around the circumference of the component in the same cross-section of the component, including the measured minimum and the measured maximum values of the wall thickness

3.15
pipe series
S
dimensionless number for pipe designation conforming to ISO 4065

NOTE 1 The relationship between the pipe series, S, and the standard dimension ratio, SDR, is given by Equation (1):

$$S = \frac{SDR - 1}{2} \tag{1}$$

NOTE 2 Adapted from ISO 4065:1996, definition 3.6.

3.16
standard dimension ratio
SDR
ratio of the nominal outside diameter, d_n, of a pipe to its nominal wall thickness, e_n

[ISO 4065:1996, definition 3.5]

3.17
tolerance
permissible variation of the specified value of a quantity expressed as the difference between the permissible maximum and permissible minimum values

3.18
nominal pressure
PN
numerical designation used for reference purposes related to the mechanical characteristics of the component of a piping system

NOTE For plastic piping systems conveying water, it corresponds to the maximum continuous operating pressure, expressed in bar, which can be sustained with water at 20 °C, based on the minimum design coefficient.

3.19
maximum operating pressure
MOP
maximum effective pressure of the fluid in the piping system, expressed in bar, which is allowed in continuous use

NOTE 1 It takes into account the physical and the mechanical characteristics of the components of a piping system.

NOTE 2 It is calculated using Equation (2):

$$\mathrm{MOP} = \frac{20\,(\mathrm{MRS})}{C \times [\mathrm{SDR} - 1]} \tag{2}$$

3.20
lower prediction limit
σ_{LPL}
quantity, with the dimensions of stress expressed in megapascals, which can be considered as a property of the material, and which represents the 97,5 % lower confidence limit of the predicted hydrostatic strength at 20 °C for 50 years with internal water pressure

3.21
minimum required strength
MRS
value of σ_{LPL} rounded down to the next smaller value of the R10 series or R20 series, depending on the value of σ_{LPL}

NOTE R10 and R20 series are the Renard number series according to ISO 3[1] and ISO 497[2].

3.22
design stress
σ_{S}
allowable stress, expressed in megapascals, for a given application derived by dividing MRS by the coefficient C and rounding to the next lower value in the R20 series

NOTE It is expressed as Equation (3):

$$\sigma_{\mathrm{S}} = \frac{\mathrm{MRS}}{C} \tag{3}$$

3.23
overall service coefficient
design coefficient
C
overall coefficient with a value greater than 1, which takes into consideration service conditions as well as properties of the components of a piping system other than those represented in the lower confidence limit

3.24
working conditions
operation of pipes for an expected life of 10 years, considering the temperature and the manipulation, and the functionality of the pipes defined by this International Standard as 1 500 h/yr, and the rest of the time without pressure, installed in the fields

4 Material

4.1 General

The pipes shall be manufactured from polyethylene containing only those antioxidants, additives, colorants and carbon black necessary for manufacture in accordance with this International Standard.

The pipes shall, insofar as possible, not support the growth of algae and bacteria.

Pipes that are exposed to light shall be opaque.

The pipes shall be UV protected against degradation.

All additives shall be uniformly dispersed.

Layered pipes are allowed and shall comply with Annex A of ISO 4427-2:2007.

4.2 Use of reprocessable and recyclable material

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

4.3 Physical characteristics of the material

The material used for the manufacture of pipes shall conform to the requirements given in Table 1.

Table 1 — Characteristics of the PE material

Characteristics	Requirements	Test parameter		Test method
		Parameter	Value	
Carbon black content (black compound only)	(2 to 2,5) % mass fraction	Shall conform to ISO 6964		ISO 6964
Carbon black dispersion (black compound only)	⩽ grade 3	Shall conform to ISO 18553[a]		ISO 18553
Oxidation induction time	⩾ 20 min	Test temperature Number of test pieces[c]	200 °C[b] 3	ISO 11357-6
Pigment dispersion (non-black compound only)	⩽ grade 3	Shall conform to ISO 18553[a]		ISO 18553
Melt mass-flow rate (MFR) for PE 32 and PE 40	0,2 – 1,4 g/10 min Maximum deviation of ± 25 % of the nominated value[d]	Load Test temperature Time Number of test pieces[c]	2,16 kg 190 °C 10 min As specified in ISO 1133-1	ISO 1133-1 condition D

[a] In case of dispute, the test pieces for carbon black dispersion and pigment dispersion shall be prepared by the compression 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 material shall be designated by the material type (PE) and the classification related to the reference points established in accordance with Table 2.

Table 2 — Material designation and testing in accordance with reference points

Designation	100 h at 20 °C	165 h at 80 °C	1 000 h at 80 °C
	MPa	MPa	MPa
PE 32	6,5	2,0	1,5
PE 40	7,0	2,5	2,0

NOTE Reference points are taken from existing national documents[3][4].

5 Geometrical characteristics

5.1 Measurements

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

5.2 Mean outside diameter and out-of-roundness

The mean outside diameters, d_{em}, and the out-of-roundness (ovality) shall be in accordance with Table 3.

Table 3 — Mean outside diameters and out-of-roundness

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean outside diameter[a]		Maximum out-of-roundness (ovality)[b]
		$d_{em, min}$	$d_{em, max}$	
12	12	12,0	12,3	1,2
16	16	16,0	16,3	1,2
20	20	20,0	20,3	1,2
25	25	25,0	25,3	1,2
32	32	32,0	32,3	1,3
40	40	40,0	40,4	1,4
50	50	50,0	50,5	1,4
63	63	63,0	63,6	1,5
75	75	75,0	75,7	1,6

[a] In accordance with ISO 11922-1, grade A.

[b] In accordance with ISO 11922-1, grade N.

NOTE For coiled pipe, the manufacturer and the purchaser shall come to an agreement on the maximum out-of-roundness.

5.3 Wall thicknesses and their tolerances

The wall thickness shall be in accordance with Table 4.