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Buried polyethylene (PE) pipes for the supply of gaseous fuels — Metric series — Specification

*Canalisations enterrées en polyéthylène (PE) pour réseaux de distribution de combustibles
gazeux — Série métrique — Spécifications*

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Buried polyethylene (PE) pipes for the supply of gaseous fuels — Metric series — Specification

1 Scope and field of application

This International Standard specifies the required physical properties of pipes of polyethylene (PE) intended to be used for the supply of gaseous fuels. In addition, it specifies some general properties of the material from which these pipes are made.

This International Standard also lays down dimensional requirements and acceptable pressure ratings for pipes.

When using polyethylene pipes for the transport of gaseous fuels, the presence of other constituents in the gas must be taken into account, as, at a certain level of concentration, these constituents could impair the properties of the pipe.

2 References

ISO 161-1, *Thermoplastics pipes for the transport of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series*.

ISO 1167, *Plastics pipes for the transport of fluids — Determination of the resistance to internal pressure*.

ISO/R 1183, *Plastics — Methods for determining the density and relative density (specific gravity) of plastics excluding cellular plastics*.

ISO 1872, *Polyethylene thermoplastic materials — Designation*.¹⁾

ISO 2506, *Polyethylene pipes (PE) — Longitudinal reversion — Test methods and specification*.

ISO 3126, *Plastics pipes — Measurement of dimensions*.

ISO 3607, *Polyethylene (PE) pipes — Tolerances on outside diameters and wall thicknesses*.

ISO 4065, *Thermoplastics pipes — Universal wall thickness table*.

ISO 4607, *Plastics — Methods of exposure to natural weathering*.

ISO 6259, *Polyethylene (PE) pipes — Determination of tensile properties*.²⁾

3 Material

3.1 The base material from which the pipe is produced shall be polyethylene to which shall be added only those anti-oxidants, UV stabilizers and pigments necessary for the manufacture of pipes to the specification and to its end use including weldability. (See annex A, clause A.3.) The nominal density of the base material, when determined in accordance with 6.1, shall be greater than 930 kg/m³.³⁾

All additives shall be uniformly dispersed.⁴⁾

3.2 Clean rework generated from a manufacturer's own production of pipe to this specification, may be used, if it is derived from the same resin as used for the relevant production.

3.3 When tested by the method described in 6.5, the material, tested as pipe, shall meet the requirements of 4.2.1, 4.2.2 and 4.2.3.^{40e4-9fa2-}

From the data obtained, the manufacturer shall state whether the material conforms with the requirements of type A, B or C (see table 1).

4 Performance requirements

4.1 Effects of gas constituents on the hydrostatic strength

When tested by the method described in 6.4, the pipe shall withstand a hoopstress of 2 MPa at 80 °C for at least 30 h. The test shall be carried out on 32, 40 or 50 mm SDR 11 (or S 5) pipe.

4.2 Hydrostatic strength⁵⁾

4.2.1 Long-term hydrostatic strength at 20 °C

When tested in accordance with 6.5.1, the material in pipe form shall be shown to have a 95 % lower confidence limit of the

1) For the purposes of this International Standard, this reference is specifically to the 1972 edition.

2) At present at the stage of draft.

3) A PE of density greater than 930 kg/m³ corresponds to classification 3, 4 or 5 in accordance with clause 3 of ISO 1872. (See 6.1.)

4) Specifications and test methods are being developed.

5) These requirements are tentative and subject to revision.

5.1.3 Tolerances

5.1.3.1 Wall thickness

The maximum permissible variation between the nominal wall thickness, e , and the wall thickness at any point, e_p , shall be in accordance with ISO 3607.

5.1.3.2 Mean outside diameter¹⁾

The maximum permissible variation between the mean outside diameter, d_m , and the nominal outside diameter, d_n , for normal tolerance pipe shall be in accordance with ISO 3607, and for close tolerance pipe as given in table 3 (see 6.2 and annex A, clause A.4).

Table 3 — Dimensions for close and normal tolerance pipe

Dimensions in millimetres

Outside diameter nom.	Tolerance	
	min. CT	normal
20	+0,3 0	+0,3 0
25		+0,3 0
32		+0,3 0
40	+0,4 0	+0,4 0
50		+0,5 0
63		+0,6 0
75	+0,5 0	+0,7 0
90	+0,6 0	+0,9 0
110		+1 0
125		+1,2 0
140	+0,8 0	+1,3 0
160	+1 0	+1,5 0
180	+1,2 0	+1,7 0
200	+1,3 0	+1,8 0
225	+1,4 0	+2,1 0
250	+1,5 0	+2,3 0

5.1.3.3 Roundness

The roundness shall be specified by agreement between user and manufacturer.

5.2 Pipe properties

5.2.1 Surface finish

The internal and external surfaces of the pipe shall be clean, smooth and reasonably free from grooving or other defects (see 6.3), which might impair its functional properties.

The ends shall be cleanly cut and square with the pipe axis.

5.2.2 Heat reversion

When tested by the method described in 6.7, at no point around the pipe shall the length change by more than 3 %.

On inspection after testing, the pipe shall show no faults such as cracks, cavities and blisters.

5.2.3 Tensile strength at yield

When tested by the method described in 6.8, the tensile strength at yield at 23 °C for each of the specimens tested shall not be less than the values stated in table 4.

Table 4 — Tensile strength at yield

Type	B and C	A
Minimum tensile strength at yield, MPa	15	19

5.2.4 Elongation at break

When tested by the method described in 6.8, the elongation at break at 23 °C for each of the specimens tested shall not be less than 350 %.

5.2.5 Resistance to internal hydraulic pressure

When tested by the method described in 6.9, the time to failure shall not be less than the values stated in table 1 for the type declared in 3.3.

6 Test methods

6.1 Density of material

The nominal density shall be determined in accordance with ISO/R 1183 and the sample shall be prepared in accordance with ISO 1872.

6.2 Dimensional measurements

Dimensions shall be measured in accordance with ISO 3126.

6.3 Surface finish

The internal and external surfaces of the pipe shall be visually examined without magnification.

¹⁾ This clause is provisional : tolerances are under study.

6.6 Properties after weathering

6.6.1 Exposure aspects and site¹⁾

Test racks and specimen fixtures shall be made from inert materials which will not affect the test results. Wood, non-corrosive aluminium alloys, stainless steel or ceramics have been found suitable. Brass, steel or copper shall not be used in the vicinity of the test specimens. The test site shall be equipped with instruments to record the received energy of sunlight and ambient temperatures.

The equipment shall be capable of supporting specimens of pipe such that the exposed surface of the pipe specimens shall be at 45° to the horizontal facing to the equator. Normally, the exposure site shall be on open ground well away from trees and buildings. For exposures at 45° facing south in the northern hemisphere, no obstruction, including adjacent racks, in an easterly, southerly or westerly direction shall subtend a vertical angle greater than 20°, or in a northerly direction greater than 45°. For exposures in the southern hemisphere facing north, corresponding provisions apply.

6.6.2 Test specimens

The test specimens shall be approximately 1 m long. These will normally have been selected from the thinnest wall pipes within a random range of diameters. The batch of pipes from which the specimens are selected shall conform to all the requirements of this specification.

6.6.3 Procedure

The pipe samples shall be identified and full particulars of the short-term test results to this specification recorded. They shall then be exposed to a total energy of at least 3,5 GJ/m².

They shall then be removed and tested in accordance with the provisions of 5.2.4 and 5.2.5.

6.7 Heat reversion

The heat reversion test shall be performed in accordance with ISO 2506. The test temperature of type B and type C PE pipes shall also be that specified in ISO 2506.

6.8 Tensile strength at yield and elongation at break

The yield point and elongation shall be measured in accordance with ISO 6259.

6.9 Resistance to internal hydraulic pressure

The test for the internal hydraulic pressure resistance shall be performed in accordance with ISO 1167. Unless otherwise specified (see 6.4) the tank and the sample shall be filled with water.

7 Marking²⁾

All marking shall be in accordance with national standards and shall include the word "Gas", the name or trade name of the manufacturer and the date of production.

Close tolerance pipe shall be identified by marking the letters CT on the pipe after the nominal outside diameter.

The length of coiled pipes may be indicated on the coil.

1) For additional information on the exposure test, refer to ISO 4607.

2) To be reviewed.

Annex B

Squeeze-off technique

(This annex is given for information.)

B.1 In certain countries the technique of squeeze-off is used to restrict the flow of gas in PE pipelines whilst effecting maintenance and repair operations.

If the user desires to employ the technique, the pipe manufacturer shall provide evidence to the user that after squeeze-off and rerounding in accordance with the method recommended by the manufacturer or the possible use of a reinforcement sleeve, the long-term strength of the pipe is not harmfully affected by this technique.

B.2 The evidence can be given by the following procedure.

B.2.1 The apparatus shall be standard squeeze-off equipment as recommended by the pipe manufacturer and the Codes of Practice within each country.

B.2.2 The specimen shall be a pipe the minimum free length of which shall be eight times the outside diameter of the pipe (between fittings of any type) with a minimum of 250 mm.

The specimen shall be closed with pressure-tight end load bearing end-caps or plugs which shall be provided with connections for entry of the water and the release of air.

B.2.3 The pipe shall be conditioned at a temperature of 0 ± 0.5 °C for a minimum period of 10 h. Within 10 min of this conditioning, the centre of the pipe shall be squeezed-off to the level specified by the pipe manufacturer or the Codes of Practice, whichever specifies the smaller separation. This squeeze-off shall be maintained for a minimum period of 60 min. The specimen shall then be rounded and tested at 80 °C at a stress level of 3 MPa and shall withstand that stress for 170 h.

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