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Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications —

Part 2: Spigot fittings for butt fusion, for socket fusion using heated tools and for use with electrofusion fittings

Raccords en polyéthylène pour utilisation avec des tubes en polyéthylène pour la distribution de combustibles gazeux — Série métrique — Spécifications —

Partie 2: Raccords à bouts mâles pour assemblage par soudage bout à bout, pour assemblage dans une emboîture au moyen d'outils chauffés et pour utilisation avec des raccords électrosoudables

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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 3.

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 part of ISO 8085 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8085-2 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 4, *Plastics pipes and fittings for the supply of gaseous fuels*.

ISO 8085 consists of the following parts, under the general title *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications*:

— *Part 1: Fittings for socket fusion using heated tools*

— *Part 2: Spigot fittings for butt fusion, for socket fusion using heated tools and for use with electrofusion fittings*

— *Part 3: Electrofusion fittings*

Annex A forms a normative part of this part of ISO 8085.

Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications —

Part 2: Spigot fittings for butt fusion, for socket fusion using heated tools and for use with electrofusion fittings

1 Scope

This part of ISO 8085 specifies the requirements for polyethylene (PE) spigot fittings intended to be used with PE pipes and fittings for the supply of gaseous fuels.

In addition, it specifies some general properties of the material from which these fittings are made.

This part of ISO 8085 also lays down requirements for dimensions and performance of such fittings.

It is applicable to spigot fittings designed to be fusion-jointed to

— PE pipes conforming to ISO 4437;

— socket fusion fittings conforming to ISO 8085-1;

— electrofusion fittings conforming to ISO 8085-3;

— other spigot fittings conforming to this part of ISO 8085.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 8085. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 8085 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3:1973, *Preferred numbers — Series of preferred numbers*

ISO 161-1:1996, *Thermoplastics pipes for the conveyance of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series*

ISO 497:1973, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers*

ISO 1133:1997, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics*

ISO 1183 (all parts), *Plastics — Methods for determining the density of non-cellular plastics*

ISO 1872-1:1993, *Plastics — Polyethylene (PE) moulding and extrusion materials — Part 1: Designation system and basis for specifications*

ISO 3126:—[1], *Plastics piping systems — Plastics piping components — Measurement and determination of dimensions*

ISO 4065:1996, *Thermoplastic pipes — Universal wall thickness table*

ISO 4437:1997, *Buried polyethylene (PE) pipes for the supply of gaseous fuels — Metric series — Specifications*

ISO 6964:1986, *Polyolefin pipes and fittings — Determination of carbon black content by calcination and pyrolysis — Test method and basic specification*

ISO 8085-1:2001, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 1: Fittings for socket fusion using heated tools*

ISO 8085-3:2001, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 3: Electrofusion fittings*

ISO 9356:1989, *Polyolefin pipe assemblies with or without jointed fittings — Resistance to internal pressure — Test method*

ISO 9080:—[2], *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*

ISO/TR 10837:1991, *Determination of the thermal stability of polyethylene (PE) for use in gas pipes and fittings*

ISO/TS 10839:2000, *Polyethylene pipes and fittings for the supply of gaseous fuels — Code of practice for design, handling and installation*

ISO 11414:1996, *Plastics pipes and fittings — Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion*

ISO 11922-1:1997, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*

ISO 12162:1995, *Thermoplastics materials for pipes and fittings for pressure applications — Classification and designation — Overall service (design) coefficient*

ISO 12176-1:1998, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 1: Butt fusion*

ISO 13477:1997, *Thermoplastics pipes for the conveyance of fluids — Determination of resistance to rapid crack propagation (RCP) — Small-scale steady-state test (S4 test)*

ISO 13478:1997, *Thermoplastics pipes for the conveyance of fluids — Determination of resistance to rapid crack propagation (RCP) — Full-scale test (FST)*

ISO 13479:1997, *Polyolefin pipes for the conveyance of fluids — Determination of resistance to crack propagation — Test method for slow crack growth on notched pipes (notch test)*

ISO 13953:2001, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

ISO 18553:—[3], *Method for the assessment of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*

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1) To be published. (Revision of ISO 3126:1974)

2) To be published. (Revision of ISO/TR 9080:1992)

3) To be published. (Revision of ISO 11420:1996 and ISO 13949:1997)

ASTM D 4019-94, *Standard Test Method for Moisture in Plastics by Coulometric Regeneration of Phosphorus Pentoxide*

3 Terms and definitions

For the purposes of this part of ISO 8085, the following terms and definitions apply.

3.1 Geometrical definitions

3.1.1
mean outside diameter of a tubular part of a fitting
D_1
arithmetic mean of a number of measurements of the outer circumference of the tubular part of the fitting in any cross-section, divided by π (3,141 6) and rounded up to the nearest 0,1 mm

3.1.2
nominal diameter of a fitting
d_n
the nominal diameter of a fitting is taken as the nominal diameter of the corresponding pipe series

3.1.3
nominal wall thickness of a fitting
e_n
the nominal wall thickness of a fitting is taken as the nominal wall thickness of the corresponding pipe series

3.1.4
out-of-roundness of the tubular part of a fitting
maximum outside diameter minus the minimum outside diameter of the fusion end-piece measured in the same plane, parallel to the plane of the spigot end, at a distance not greater than L_2 (tube length) from that plane

3.1.5
standard dimension ratio of a fitting
SDR
quotient of the nominal outside diameter and the nominal wall thickness

$$\text{SDR} = \frac{d_n}{e_n}$$

3.1.6
wall thickness of a fitting
E
wall thickness at any point of the body of the fitting which could be submitted to the full stress induced by the pressure of the gas in the piping system

3.2 Material definitions

3.2.1
virgin material
thermoplastics material in a form such as granules or powder which has not been previously processed other than for compounding and to which no reprocessable or recyclable materials have been added

3.2.2
reprocessable material
thermoplastics material prepared from clean unused rejected pipes, fittings or valves, produced in a manufacturer's plant by a process such as injection-moulding or extrusion, which will be reprocessed in the same plant

NOTE Such material may include trimmings from the production of such pipes, fittings and valves.

3.2.3
compound
homogenous mixture of base polymer (PE) and additives, e.g. anti-oxidants, pigments and UV-stabilizers, at concentrations necessary for the particular application

3.3 Definitions related to material characteristics

3.3.1
lower confidence limit
σ_{lcl}
quantity with the dimensions of stress, in megapascals, which can be considered as a property of the material and represents the 97,5 % lower confidence limit of the mean long-term hydrostatic strength at 20 °C for 50 years determined by pressurizing internally with water

3.3.2
overall service (design) coefficient
C
overall coefficient, with a value larger than 1,0, 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

NOTE For gas applications, C can have any value equal to or greater than 2,0.

3.3.3
minimum required strength
MRS
the value of σ_{lcl} rounded down to the next lower value in the R 10 series when σ_{lcl} is less than 10 MPa, or to the next lower value in the R 20 series when σ_{lcl} is greater than or equal to 10 MPa

NOTE The R 10 and R 20 series are the Renard number series as defined in ISO 3 and ISO 497.

3.3.4
melt mass-flow rate
MFR
value relating to the viscosity of molten thermoplastic material at a specified temperature and rate of shear

3.4 Definitions related to service conditions

3.4.1
gaseous fuel
any fuel which is in the gaseous state at a temperature of +15 °C and a pressure of 1 bar[4)]

3.4.2
maximum operating pressure
MOP
maximum effective pressure of the gas in a piping system, expressed in bars, which is allowed in continuous use

NOTE It takes into account the physical and the mechanical characteristics of the components of a piping system and is given by the equation:

$$\mathrm{MOP} = \frac{20 \times \mathrm{MRS}}{C \times (\mathrm{SDR} - 1)}$$

4) 1 bar = 10^5 N/m^2 = 0,1 MPa

4 Symbols

The dimensions and symbols used in this part of ISO 8085 are shown in Figure 1, where

D_1 is the mean outside diameter of the fusion end-piece, measured in any plane parallel to the plane of the mouth and at a distance not greater than L_2 from that plane.

D_2 is the mean outside diameter of the body of the fitting.

D_3 is the minimum bore, i.e. the minimum diameter of the flow channel through the body of the fitting. This diameter does not include the fusion bead, if any.

E is the thickness of the wall of the fitting at any point.

E_S is the thickness of the fusion-face wall at any point up to a maximum distance L_1 (the cut-back length) from the mouth.

L_1 is the length of the cut-back section of the fusion end-piece, i.e. the initial depth of the spigot, necessary for butt fusion or electrofusion.

L_2 is the length of the tubular section of the fusion end-piece.

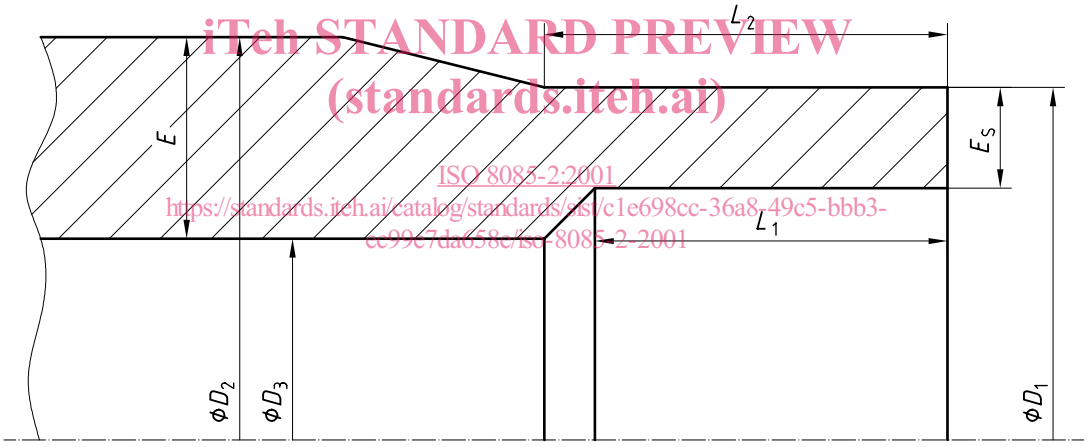

Figure 1 — Spigot-end dimensions

5 Material

5.1 Technical data

The technical data referred to in Table 1 concerning the materials used shall be made available by the fitting manufacturer.

Any change in the choice of materials affecting the quality shall require fresh type-testing of the fitting in accordance with clause 8.

Table 1 — Characteristics of the PE compound [a]

Property	Units	Requirement	Test parameters	Test method
Density	kg/m^3	⩾ 930 (base polymer)	23 °C	ISO 1183, ISO 1872-1
Melt mass-flow rate	g/10 min	± 20 % of value declared by compound producer	190 °C/5 kg (set of conditions T)	ISO 1133:1997
Thermal stability	minutes	> 20	200 °C [b]	ISO/TR 10837
Volatile-matter content	mg/kg	⩽ 350		ISO 4437:1997, annex A
Water content [c]	mg/kg	⩽ 300		ASTM D 4019
Carbon black content [d]	% (*m*/*m*)	2,0 % to 2,5 %		ISO 6964
Carbon black dispersion [d]	grade	⩽ 3		ISO 18553
Pigment dispersion [e]	grade	⩽ 3		ISO 18553
Resistance to gas constituents	h	⩾ 20	80 °C, 2 MPa	ISO 4437:1997, annex B
Resistance to rapid crack propagation (RCP): [f]				
Full-scale (FS) test: d_n > 250 mm	MPa	The critical pressure in the FS test shall be greater than or equal to the value of the MOP of the system multiplied by 1,5	0 °C	ISO 13478
or				
S4 test [g]	MPa	The critical pressure in the S4 test shall be greater than or equal to the value of the MOP of the system divided by 2,4, minus 0,72 (expressed in bars) [h]	0 °C	ISO 13477
Resistance to slow crack growth, e_n > 5 mm [f]	h	165	80 °C, 8,0 bar [i] 80 °C, 9,2 bar [j]	ISO 13479

[a] Non-black compounds shall conform to the weathering requirements of ISO 4437.

[b] Test may be carried out at 210 °C provided that there is a clear correlation with the results at 200 °C. In cases of dispute, the reference temperature shall be 200 °C.

[c] Only applicable if the compound does not conform to the requirement for volatile-matter content. In cases of dispute, the requirement for water content shall apply.

[d] For black compounds only.

[e] Pigment dispersion method for non-black compounds only.

[f] Only applicable to material in pipe form.

[g] Shall be performed on pipe with a wall thickness ⩾ 15 mm.

[h] If this requirement is not met, then retesting using the full-scale (FS) test shall be performed (the calculation formula is still under study).

[i] Test parameters for PE 80, SDR 11.

[j] Test parameters for PE 100, SDR 11.

5.2 Compound

The compound from which the fitting is produced shall be polyethylene which shall be made by adding only those additives necessary for the manufacture and end use of fittings conforming to this specification and for their fusion jointing.

All additives shall be uniformly dispersed. The additives shall not have a negative influence on the performance with respect to fusability.

5.3 Reprocessable material

Only clean reprocessable material generated from a manufacturer's own production of fittings to this specification may be used, and it shall be derived from the same resin as used for the relevant production.

5.4 Characteristics of the PE compound

The fittings shall be made of

a) virgin material,

b) reprocessable material or

c) a combination of virgin and reprocessable material.

The PE compound from which the fitting is manufactured shall conform to the requirements given in Table 1.

5.5 Classification

PE compounds shall be classified by MRS as specified in Table 2.

Table 2 — Classification of PE compounds

Designation	σ_{lcl} (20 °C, 50 years, 97,5 %) MPa	MRS MPa
PE 80	$8{,}00 \leqslant \sigma_{lcl} \leqslant 9{,}99$	8,0
PE 100	$10{,}00 \leqslant \sigma_{lcl} \leqslant 11{,}19$	10,0

The classification shall be established by the producer of the compound using the ISO 9080 extrapolation method and stated in accordance with ISO 12162.

5.6 Compatibility

Conformity to clause 8 shall be established by the fitting manufacturer to ensure compatibility of the fittings with PE pipes conforming to ISO 4437. The PE pipe compound(s) used for this demonstration, the fusion condition(s) and the tooling shall be as detailed in the fitting manufacturer's technical file (see clause 10).

6 General requirements

6.1 Multiple connections

If a fitting includes socket(s) for fusion with heated tools, or electrofusion socket(s), these shall conform to the relevant product standard.

6.2 Appearance of the fitting

When viewed without magnification, the internal and external surfaces shall be smooth, clean and free from scoring, cavities and other surface defects which might prevent conformity to this part of ISO 8085.

The spigot ends of the fitting shall be cut cleanly and square to the axis of the tubular part.