INTERNATIONAL STANDARD

ISO 8085-2

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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

Reference number
ISO 8085-2:2001(E)

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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.

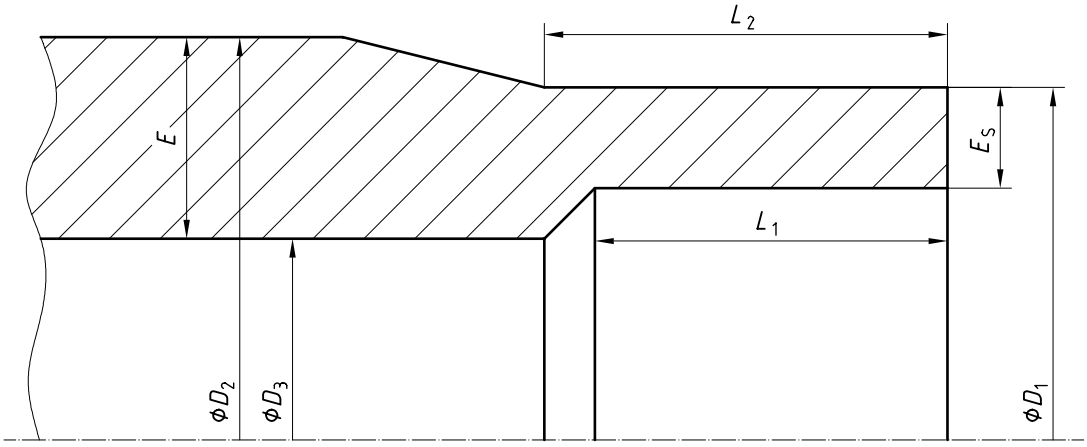

Figure 1 — Spigot-end dimensions

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/m3	⩾ 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.

6.3 Appearance of the joint (factory-made)

When viewed without magnification, the internal and external surfaces of the pipe and fitting after fusion-jointing shall be free from melt exudation outside the confines of the fitting, apart from that which may be declared acceptable by the fitting manufacturer.

7 Geometrical characteristics

7.1 General

The dimensions of the fittings shall be measured, not less than 24 h after manufacture, in accordance with ISO 3126, after being conditioned for at least 4 h without any support for re-rounding of the fusion ends.

This part of ISO 8085 concerns only fittings and assemblies and is not concerned with heating-tool dimensions.

The fittings are designated by the nominal diameter of the spigot, which corresponds to the nominal outside diameter d_n of the pipe with which they are to be used.

7.2 Spigot dimensions

The mean outside diameter D_1, the out-of-roundness (ovality) of the tubular part and the associated tolerances shall be as specified in Table 3.

The minimum bore D_3, the minimum value of the length L_2 of the tubular part and the minimum value of the cut-back length L_1 shall be as specified in Table 3.

The length L_2 of the tubular part shall be such that the following is possible (in any combination):

— the use of clamps required for butt fusion;

— assembly with an electrofusion fitting;

— assembly with a socket fusion fitting.

The cut-back length L_1 may be determined by jointing with a length of pipe, provided that the wall thickness of the latter is equal to E_S for its whole length.

Table 3 — Diameters and lengths of spigot fittings

Dimensions in millimetres

Nominal diameter d_n	Mean outside diameter of fitting			Out-of-roundness	Minimum bore	Minimum cut-back length	Minimum length of tubular part [a]
	$D_{1\,min}$	$D_{1\,max}$		max.	$D_{3\,min}$	$L_{1\,min}$	$L_{2\,min}$
		Grade A [b]	Grade B [b]				
16	16	—	16,3	0,3	9	25	41
20	20	—	20,3	0,3	13	25	41
25	25	—	25,3	0,4	18	25	41
32	32	—	32,3	0,5	25	25	44
40	40	—	40,4	0,6	31	25	49
50	50	—	50,4	0,8	39	25	55
63	63	—	63,4	0,9	49	25	63
75	75	—	75,5	1,2	59	25	70
90	90	—	90,6	1,4	71	28	79
110	110	—	110,7	1,7	87	32	82
125	125	—	125,8	1,9	99	35	87
140	140	—	140,9	2,1	111	38	92
160	160	—	161,0	2,4	127	42	98
180	180	—	181,2	2,7	143	46	105
200	200	—	201,3	3,0	159	50	112
225	225	—	226,4	3,4	179	55	120
250	250	—	251,5	3,8	199	60	129
280	280	282,6	281,6	4,2	223	75	139
315	315	317,9	316,8	4,8	251	75	150
355	355	358,2	357,1	5,4	283	75	164
400	400	403,3	402,3	6,0	319	75	179
450	450	454,1	452,6	6,8	359	100	195
500	500	504,5	502,9	7,5	399	100	212
560	560	565,0	563,2	8,4	447	100	235
630	630	635,0	633,6	9,5	503	100	255

[a] Spigot fittings may be delivered with a shorter tubular part for use in factory assemblies or with appropriate electrofusion fittings.

[b] Tolerance grades in accordance with ISO 11922-1.

Formulae for calculating the equivalent dimensions of non-metric fitting series are given in annex A.

7.3 Wall thickness

7.3.1 Minimum wall thickness of the corresponding pipes

The most commonly used SDR values are 17,6 and 11,0. For specific applications, other SDR values may be used, taken from any series given in ISO 4065 or ISO 161-1. Table 4 gives, for SDR 17,6 and SDR 11,0, the minimum wall thicknesses e_{min} which are most commonly used for gas.

Table 4 — Minimum wall thicknesses

Dimensions in millimetres

Nominal diameter d_n	Minimum wall thickness e_{min}	
	SDR 17,6	SDR 11
16	2,3	3,0
20	2,3	3,0
25	2,3	3,0
32	2,3	3,0
40	2,3	3,7
50	2,9	4,6
63	3,6	5,8
75	4,3	6,8
90	5,2	8,2
110	6,3	10,0
125	7,1	11,4
140	8,0	12,7
160	9,1	14,6
180	10,3	16,4
200	11,4	18,2
225	12,8	20,5
250	14,2	22,7
280	15,9	25,4
315	17,9	28,6
355	20,2	32,3
400	22,8	36,4
450	25,6	40,9
500	28,4	45,5
560	31,9	50,9
630	35,8	57,3

7.3.2 Wall thickness E_S of the fusion end

The wall thickness of the fusion end-piece E_S shall be equal to the nominal wall thickness of the corresponding pipe series with tolerances as in ISO 4437, except between the plane of the entrance face and a plane parallel to it, at a distance not greater than $0{,}01 d_n \pm 1$ mm, where a thickness reduction for e.g. a chamfered edge shall be permissible.

7.3.3 Wall thickness E of the fitting

In conforming to the performance requirements given in clause 8, fittings and associated fusion joints may use an appropriate combination of fitting wall thickness E and material strength MRS (see 5.5).

Any changes in wall thickness inside the body of the fitting shall be gradual in order to prevent stress concentrations.

7.4 Other dimensions

Other dimensions and dimensional characteristics appropriate to each manufacturer, such as overall dimensions or clamping requirements, shall be specified in the manufacturer's technical file.

8 Mechanical characteristics

Fittings shall be tested using pipes which conform to ISO 4437. Test assemblies shall be assembled in accordance with ISO 11414 and in accordance with the manufacturer's instructions, using fusion-jointing equipment conforming to ISO 12176-1.

When tested in accordance with the methods specified in Table 5, using the parameters indicated, the fitting/pipe assemblies shall have mechanical characteristics conforming to the requirements given in Table 5.

Table 5 — Mechanical properties

Property	Units	Requirement [a]	Test parameters		Test method
Hydrostatic strength at 20 °C	h	Failure time $\geqslant$ 100	End caps	Type a)	ISO 9356
			Orientation	Unimportant	
			Conditioning time	1 h	
			Type of test	Water-in-water	
			Pressure calculated to produce the following circumferential (hoop) stress:		
			PE 80 pipe	10 MPa	
			PE 100 pipe	12,4 MPa	
			Test temperature	20 °C	
Hydrostatic strength at 80 °C	h	Failure time $\geqslant$ 165	End caps	Type a)	ISO 9356
			Orientation	Unimportant	
			Conditioning time	12 h	
			Type of test	Water-in-water	
			Pressure calculated to produce the following circumferential (hoop) stress:		
			PE 80 pipe	4,6 MPa	
			PE 100 pipe	5,5 MPa	
			Test temperature	80 °C	
Hydrostatic strength at 80 °C	h	Failure time $\geqslant$ 1 000	End caps	Type a)	ISO 9356
			Orientation	Unimportant	
			Conditioning time	12 h	
			Type of test	Water-in-water	
			Pressure calculated to produce the following circumferential (hoop) stress:		
			PE 80 pipe	4 MPa	
			PE 100 pipe	5 MPa	
			Test temperature	80 °C	
Decohesive strength	—	—	Test temperature	23 °C $\pm$ 2 °C	ISO 13953 [b]

[a] For the hydrostatic strength test at 80 °C, only brittle failures shall be taken into account. If ductile failure occurs before the required time, a lower stress shall be selected and the minimum test time shall be obtained from the line through the stress/time points given in Table 6.

[b] Test to failure: ductile failure = pass, brittle failure = fail.

Table 6 — Hydrostatic strength (80 °C) — Stress/minimum failure time correlation

PE 80		PE 100	
Stress MPa	**Minimum failure time** h	**Stress** MPa	**Minimum failure time** h
4,6	165	5,5	165
4,5	219	5,4	233
4,4	293	5,3	332
4,3	394	5,2	476
4,2	533	5,1	688
4,1	727	5,0	1 000
4,0	1 000	—	—

In the event of modification of the fusion-jointing parameters, the manufacturer shall ensure that the joint conforms to clause 8.

9 Physical characteristics

When determined in accordance with the methods specified in Table 7, using the test parameters indicated, the physical characteristics of the fittings shall conform to the requirements given in Table 7.

Table 7 — Physical characteristics of fittings

Characteristic	Units	Requirement	Test parameters	Test method
Thermal stability	minutes	> 20	200 °C [a]	ISO/TR 10837
Melt mass-flow rate (MFR)	g/10 min	The MFR of the material of the manufactured fitting shall not differ by more than ± 20 % from the MFR of the batch compound from which the fitting was manufactured	190 °C/5 kg (set of conditions T)	ISO 1133

[a] The 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.

10 Technical file

The manufacturer of the fittings shall ensure the availability of a technical file (generally confidential) containing all relevant data necessary to prove the conformity of the fittings to this part of ISO 8085. The file shall include all results of type-testing and shall conform to the relevant publicly available technical brochure. It shall also include all data necessary to implement a traceability system where required.

The manufacturer's technical file shall include at least the following information:

a) conditions of use (pipe and fitting temperature limits, SDRs and out-of-roundness);

b) dimensions;

c) assembly instructions;

d) required fusion-jointing equipment;

e) fusion-jointing instructions (fusion-jointing parameters with limits).

If applicable, the fact that the production site is certified to e.g. ISO 9001 or ISO 9002 shall also be stated in the technical file.

11 Marking

11.1 General

Unless otherwise specified in Table 8, the marking elements shall be printed or formed directly on the fitting in such a way that, after storage, handling and installation in accordance with ISO/TS 10839, legibility is maintained.

NOTE The manufacturer is not responsible for marking being illegible due to actions caused during installation and use such as painting, scratching, covering of the components or using detergents on the components unless agreed to or specified by the manufacturer.

Marking shall not initiate cracks or other types of defect which adversely influence the performance of the fitting.

If printing is used, the colour of the printed information shall differ from the basic colour of the fitting.

The size of the markings shall be such that they are legible without magnification.

There shall be no marking on that part of the spigot beyond the minimum spigot length.

11.2 Minimum required marking

The minimum required markings are specified in Table 8.

Table 8 — Minimum required markings

Item	Marking
Reference to this part of ISO 8085 [a]	ISO 8085-2
Manufacturer's name and/or trademark [b]	Name or symbol
Nominal diameter(s) d_n of pipe(s) to which fitting is intended to be jointed	e.g. 110
Material and designation	e.g. PE 80
Applicable pipe series	SDR (e.g. SDR 11 and/or SDR 17,6)
Manufacturing information [b]	— the production period (year and month in figures or in code); — name or code for production site if manufacturer produces at different sites, nationally and/or internationally.
Fluid to be conveyed [a]	Gas

[a] This information may be printed on a label associated with the fitting or on the bag containing an individual fitting.

[b] To provide traceability.

11.3 Additional marking

Additional information relative to the fusion-jointing conditions, e.g. fusion and cooling time, may be given on a label which may be attached to a fitting or may be separate from the fitting.

12 Packaging

The fittings shall be packaged in bulk or individually protected where necessary in order to prevent deterioration. Whenever possible, they shall be placed in individual bags in cardboard boxes or cartons.

The boxes or cartons and/or the individual bags shall bear at least one label with the manufacturer's name, the type of part, the dimensions of the part, the number of units in the box or carton, and any special storage conditions and storage time limits.

Annex A
(normative)

Formulae for calculating the equivalent dimensions of non-metric fitting series

A.1 Mean outside diameter

The minimum value of the mean outside diameter D_1 is equal to the nominal diameter d_n of the fitting.

The maximum value of the mean outside diameter, D_1, of fittings of tolerance grade A is given by

$D_1 = 1{,}009 \times d_n + 0{,}1$ mm for 280 mm $\leqslant d_n <$ 355 mm;

$D_1 = 1{,}002 \times d_n + 2{,}5$ mm for 355 mm $\leqslant d_n <$ 450 mm;

$D_1 = 1{,}008 \times d_n + 0{,}5$ mm for 450 mm $\leqslant d_n <$ 560 mm;

$D_1 = 1{,}000 \times d_n + 5{,}0$ mm for 560 mm $\leqslant d_n \leqslant$ 630 mm.

The maximum value of the mean outside diameter D_1 of fittings of tolerance grade B is given by

$D_1 = 1{,}003 \times d_n + 0{,}23$ mm for 16 mm $\leqslant d_n <$ 90 mm;

$D_1 = 1{,}006 \times d_n + 0{,}07$ mm for 90 mm $\leqslant d_n <$ 225 mm;

$D_1 = 1{,}004 \times d_n + 0{,}50$ mm for 225 mm $\leqslant d_n <$ 355 mm;

$D_1 = 1{,}005\,5 \times d_n + 0{,}12$ mm for 355 mm $\leqslant d_n \leqslant$ 630 mm.

All results shall be rounded to the nearest tenth of a millimetre.

A.2 Out-of-roundness

The maximum value of the out-of-roundness Δd_e of the tubular part of the fitting is given by

$\Delta d_e = 0{,}015 \times d_n$ mm for 16 mm $\leqslant d_n <$ 63 mm;

$\Delta d_e = 0{,}900$ mm for d_n = 63 mm;

$\Delta d_e = 0{,}015 \times d_n$ mm for 63 mm $< d_n \leqslant$ 630 mm.

All results shall be rounded up to the nearest tenth of a millimetre.

A.3 Minimum bore D_3

The minimum bore D_3 of the fitting is given by

$D_3 = 1{,}0 \times d_n - 7{,}0$ mm for 16 mm $\leqslant d_n <$ 40 mm;

$D_3 = 0{,}8 \times d_n - 1{,}0$ mm for 40 mm $\leqslant d_n \leqslant$ 630 mm.

All results shall be rounded to the nearest millimetre.

A.4 Cut-back length L_1

The minimum cut-back length L_1 is given by

L_1 = 25 mm for d_n < 90 mm;

L_1 = 0,2 × d_n + 10,0 mm for 90 mm ⩽ d_n < 280 mm;

L_1 = 75 mm for 280 mm ⩽ d_n < 450 mm;

L_1 = 100 mm for 450 mm ⩽ d_n ⩽ 630 mm.

The cut-back length L_1 may also be determined by jointing with a length of pipe, provided that the wall thickness of the latter is equal to E_S for its whole length.

All results shall be rounded to the nearest millimetre.

A.5 Length of tubular part L_2

The length of the tubular part of the fitting shall be such that the following is possible (in any combination):

— the use of clamps required for butt welding;

— assembly with an electrofusion fitting;

— assembly with a socket-fusion fitting.

The minimum value of the length of the tubular part is given by

L_2 = 41 mm for d_n < 32 mm;

L_2 = 0,60 × d_n + 25 mm for 32 mm ⩽ d_n < 110 mm;

L_2 = 0,33 × d_n + 45,5 mm for 110 mm ⩽ d_n < 225 mm;

L_2 = 0,34 × d_n + 43 mm for 225 mm ⩽ d_n < 280;

L_2 = 150 mm for d_n = 280 mm;

L_2 = 0,34 × d_n + 43 mm for 280 mm < d_n ⩽ 630 mm.

Up to and including a nominal diameter d_n of 200 mm, all results shall be rounded to the nearest millimetre. Above a nominal diameter d_n of 225 mm, all results shall be rounded to the nearest multiple of 5 mm.

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