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

Part 3: Electrofusion fittings

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

Partie 3: Raccords électrosoudables

Reference number
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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 8085-3 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*

Annexes B, C and D form a normative part of this part of ISO 8085. Annex A is for information only.

In this corrected version of ISO 8085-3:2001, the reference to Table 5 in 7.2.2.2 b) has been corrected to read “conform to Table 4…”.

In addition, Clause 2 (normative references) has been updated by inserting the years of publication of ISO 9080, ISO 18553 and EN 682.

Users should further note that normative reference ASTM D 4019-94 (cited in Table 1) has been withdrawn without replacement.

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

Part 3: Electrofusion fittings

1 Scope

This part of ISO 8085 specifies the requirements for polyethylene (PE) electrofusion 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 electrofusion fittings designed to be fusion-jointed to PE pipes conforming to ISO 4437, and to spigot fittings conforming to ISO 8085-2.

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 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 1167:1996, *Thermoplastics pipes for the conveyance of fluids — Resistance to internal pressure — Test method*

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*

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

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 8085-2:2001, *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*

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

ISO 9080:2003, *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 11413:1996, *Plastics pipes and fittings — Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting*

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

ISO 12176-2:2000, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 2: Electrofusion*

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 13951:2001, *Plastics piping systems — Test method for the resistance of polyolefin pipe/pipe or pipe/fitting assemblies to tensile loading*

ISO 13954:1997, *Plastics pipes and fittings — Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm*

ISO 13955:1997, *Plastics pipes and fittings — Crushing decohesion test for polyethylene (PE) electrofusion assemblies*

ISO 13957:1997, *Plastics pipes and fittings — Polyethylene (PE) tapping tees — Test method for impact resistance*

ISO 18553:2002, *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*

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

EN 682:2002, *Elastomeric seals — Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*

EN 12117:1997, *Plastics piping systems — Fittings, valves and ancillaries — Determination of gaseous flow rate/pressure drop relationships*

IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)*

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

3.1.2
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

3.1.3
mean inside diameter
arithmetic mean of at least two inside diameters measured at right angles to each other in transverse planes

3.1.4
out-of-roundness of a socket
maximum inside diameter minus the minimum inside diameter of the socket, measured in the same plane, parallel to the plane of the mouth

3.1.5
maximum out-of-roundness of a socket
greatest value of the out-of-roundness between the plane of the mouth and a plane separated from it by a distance L_1 (the design penetration depth)

3.1.6
standard dimension ratio of a fitting
SDR
quotient of the nominal outside diameter and the nominal wall thickness

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

3.1.7
wall thickness of a fitting
E
wall thickness at any point of the body of the fitting which could be subjected 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[2)]

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

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:

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

3.5 Definitions specific to the design of electrofusion fittings

3.5.1
electrofusion socket fitting
polyethylene (PE) fitting which contains one or more integral heating elements that are capable of transforming electrical energy into heat to produce a fusion joint with a spigot-end or a pipe

3.5.2
electrofusion saddle fitting
polyethylene (PE) fitting (top-loading or wrap-round) which contains one or more integral heating elements that are capable of transforming electrical energy into heat to produce a fusion joint with a pipe

3.5.3
tapping tee
electrofusion saddle fitting which contains an integral cutter designed to cut through the pipe wall

NOTE The cutter remains in the body of the saddle after installation.

3.5.4
branch saddle
electrofusion saddle fitting which requires an ancillary cutting tool to drill a hole in the adjoining main pipe

3.5.5
U-regulation
control of the energy supplied, during fusion-jointing of an electrofusion fitting, by regulating the voltage

3.5.6
I-regulation
control of the energy supplied, during fusion-jointing of an electrofusion fitting, by regulating the current

4 Symbols

4.1 Symbols for electrofusion socket fittings

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

D_1 is the mean inside diameter in the fusion zone, i.e. the mean inside diameter measured in a plane parallel to the plane of the mouth at a distance of $L_3 + 0{,}5L_2$ from the plane of the mouth.

D_2 is the minimum bore, i.e. the minimum diameter of the flow channel through the body of the fitting.

L_1 is the design penetration depth of the pipe or of the male end of a spigot fitting.

L_2 is the nominal length of the fusion zone, corresponding to the heated length.

L_3 is the nominal unheated entrance length of the fitting, i.e. the distance between the mouth of the fitting and the near end of the fusion zone.

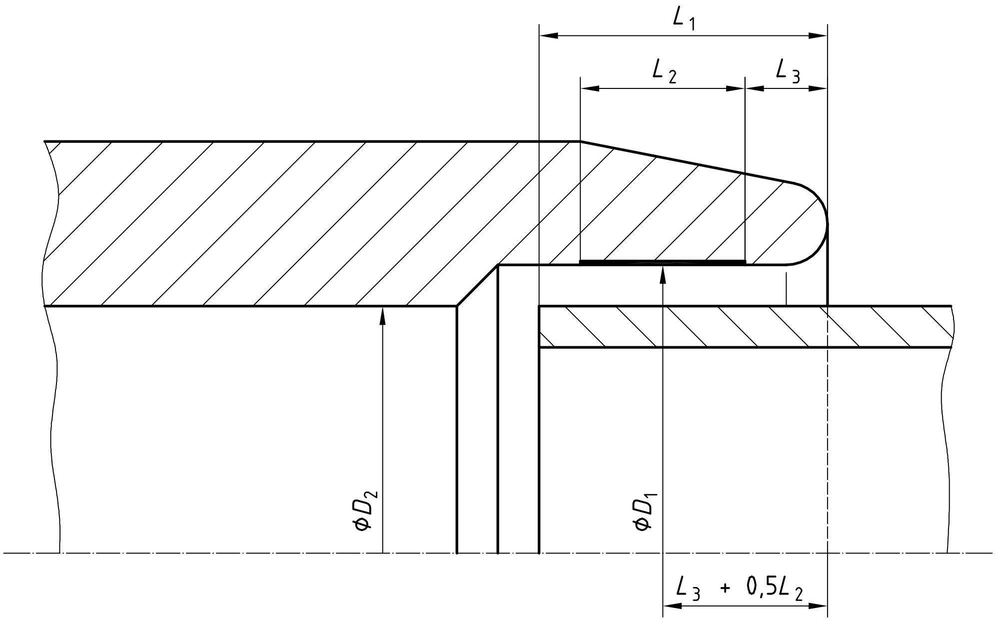

Figure 1 — Socket dimensions

4.2 Symbols for electrofusion tapping tees

The main symbols used for tapping tees are shown in Figure 2, where

h is the height of the service pipe, i.e. the distance between the axis of the main pipe and the axis of the service pipe.

L is the width of the tapping tee, i.e. the distance between the axis of the main pipe and the plane of the mouth of the service pipe.

H is the height of the tapping tee, i.e. the distance from the top of the main pipe to the top of the tapping tee.

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.

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.

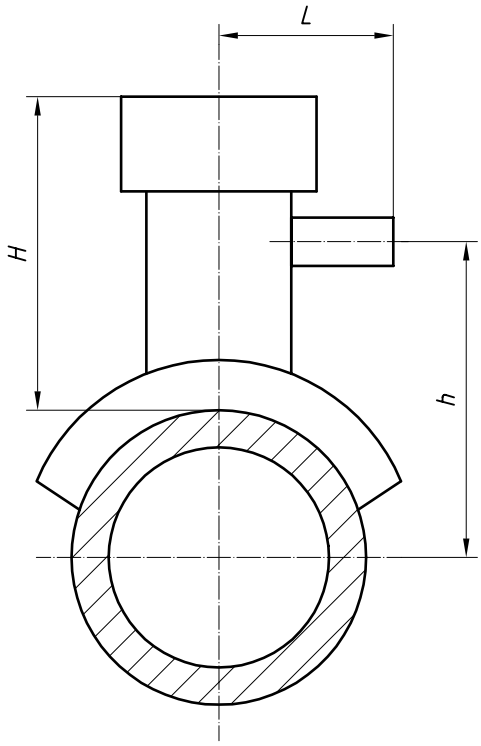

Figure 2 — Tapping tee dimensions

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 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.

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.