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Plastics pipes and fittings — Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting

Tubes et raccords en matières plastiques — Préparation d'éprouvettes par assemblage tube/raccord électrosoudable en polyéthylène (PE)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 5, *General properties of pipes, fittings and valves of plastic materials and their accessories — Test methods and basic specifications*.

This third edition cancels and replaces the second edition (ISO 11413:2008) which has been technically revised.

The changes compared to the previous addition are as follows:

— normative references have been updated;

— Annex D has been technically revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Plastics pipes and fittings — Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting

1 Scope

This document specifies a method for the preparation of test pieces assembled from polyethylene (PE) pipes or spigot-ended fittings and electrofusion fittings (e.g. socket fittings such as couplers, or saddles).

The assembly criteria specified include parameters such as ambient temperature, fusion conditions, fitting and pipe dimensions, pipe configuration (coiled or straight pipe), taking into account the limiting service conditions specified by the relevant product standards.

This document can apply to other shapes, e.g. re-rounded pipes, dependent on the manufacturer's instructions.

NOTE For the purpose of this document, PE is understood to be PE, PE-RT or PE-X.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 4427-2, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 2: Pipes*

ISO 4427-3, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 3: Fittings*

ISO 4437-2, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 2: Pipes*

ISO 4437-3, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 3: Fittings*

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

ISO 14531-1, *Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications — Part 1: Pipes*

ISO 15494, *Plastics piping systems for industrial applications — Polybutene (PB), polyethylene (PE), polyethylene of raised temperature resistance (PE-RT), crosslinked polyethylene (PE-X), polypropylene (PP) — Metric series for specifications for components and the system*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
reference time
t_R
theoretical fusion time indicated by the fitting manufacturer for the reference ambient temperature

3.2
fusion energy
electrical energy supplied during the fusion-jointing cycle as measured at the terminals of the fitting at a given ambient temperature, T_a, and for electrical parameters whose values lie within the tolerance ranges stated by the manufacturer

Note 1 to entry: The fitting manufacturer is generally required to state in the technical file any variations in fusion energy input required as a function of the ambient temperature in the range T_{min} to T_{max}

Note 2 to entry: Where applicable, energy measurement should exclude the effect of terminal contact resistance.

3.3
reference energy
energy supplied to a fitting having a nominal electrical resistance and using the nominal fusion parameters defined by the manufacturer at the reference ambient temperature, T_R

3.4
maximum energy
maximum value of the fusion energy supplied for jointing at a given ambient temperature, T_a

3.5
minimum energy
minimum value of the fusion energy supplied for jointing at a given ambient temperature, T_a

3.6
nominal energy
nominal energy supplied for jointing at given ambient temperature, T_a

4 Symbols

4.1 General symbols (see Figure A.1)

d_e outside diameter of a pipe or fitting spigot, which is equal to the nominal outside diameter

d_{em} mean outside diameter of a pipe or fitting spigot in conformity with the relevant International Standard for the product concerned and calculated from the measured circumference

$d_{em,p}$ mean outside diameter of a pipe or fitting spigot after preparation for assembly with the outer layer removed by scraping or peeling and calculated from the circumference measured in a radial plane coincident with the centre of the fusion zone at a distance $L_3 + 0{,}5L_2$ from the face of the fitting socket after assembly

D_{im} mean inside diameter of the fusion zone of a fitting in the radial plane located at distance $L_3 + 0{,}5L_2$ from the face of the fitting socket

$D_{im,max}$ maximum theoretical value of D_{im}, as stated by the fitting manufacturer

$D_{i,max}$ maximum inside diameter of the fusion zone of the fitting

$D_{i,min}$ minimum inside diameter of the fusion zone of the fitting

e_n nominal wall thickness, in millimetres, of the pipe

e_s depth of scraping or the thickness of material removed from the pipe surface by peeling

L_2 nominal length of the fusion zone as indicated by the fitting manufacturer

L_3 nominal distance from the face of the fitting socket to the leading edge of the fusion zone

4.2 Clearances

4.2.1 Socket fittings

C_1 clearance between fitting bore and outside diameter of unscraped pipe

$C_1 = D_{im} - d_{em}$

C_2 clearance between fitting bore and outside diameter of scraped pipe

$C_2 = C_1 + 2e_s$

NOTE 1 C_2 can be obtained by machining the unscraped pipe to bring its mean outside diameter d_{em} to the value $d_{em,p}$ calculated from the formula (see also NOTE to 5.1):

$d_{em,p} = D_{im} - C_2$

C_3 maximum theoretical clearance between fitting bore and outside diameter of unscraped pipe

$C_3 = D_{im,max} - d_e$

C_4 maximum theoretical clearance between fitting bore and outside diameter of scraped pipe

$C_4 = C_3 + 2e_s$

NOTE 2 C_4 can be obtained by machining the unscraped pipe to bring its mean outside diameter d_{em} to the value $d_{em,p}$ calculated from the formula:

$d_{em,p} = D_{im} - C_4$

4.2.2 Saddles

The clearance between saddle fittings and pipes is assumed to be zero.

4.3 Ambient temperature

T_a ambient temperature at which a joint is made

NOTE The ambient temperature can vary from the minimum temperature, T_{min}, to the maximum temperature, T_{max}, as specified either in the product standard or by agreement between the manufacturer and the purchaser.

T_R reference ambient temperature of (23 ± 2) °C

T_{max} maximum permitted ambient temperature for joint assembly

T_{min} minimum permitted ambient temperature for joint assembly

5 Joint assembly

5.1 General

The joints shall be made using pipes and/or spigot-ended fittings conforming to ISO 4427-2, ISO 4427-3, ISO 4437-2, ISO 4437-3, ISO 14531-1, ISO 15494 or other standards, as applicable, e.g. standards for pipe renovation, and electrofusion fittings for which the dimensions conform to ISO 4427-3 or ISO 4437-3, or other standards, as applicable. Unless otherwise specified, the pipes selected for the assembly shall be of the same pressure rating as the fitting. The preparation of the assembly for testing shall be carried out in accordance with the electrofusion fitting manufacturer's written procedures and the jointing parameters.

Unless a greater scraping depth is recommended by the manufacturer, the minimum scraping depth e_S shall be 0,2 mm.

NOTE In cases where the pipes do not need to be scraped, the minimum scraping depth, e_S, can be zero.

5.2 Procedure

Carry out the following procedure, where steps d) and e) shall be carried out in a temperature-controlled environment maintaining the temperature to within ±2 °C and large enough to contain the fitting, the pipes and the holding apparatus. Fittings shall not be used within 170 h of manufacture.

a) Measure, at the reference temperature T_R, the parts to be joined to determine the dimensional characteristics defined in 4.1 and illustrated in Figure A.1, as well as the values of the electrical parameters in accordance with Annex D.

b) Prepare the pipes to achieve the necessary clearance conditions, at the reference temperature T_R, as given in 4.2.

c) Mount the fitting on the pipes in accordance with the manufacturer's instructions.

d) Condition the assembly and the associated apparatus for a period conforming to Table 1 at the applicable ambient temperature T_a specified in Annex C.

Table 1 — Conditioning periods

Nominal wall thickness, e_n mm	Minimum conditioning period h
$e_n < 3$	1
$3 \le e_n < 8$	3
$8 \le e_n < 16$	6
$16 \le e_n < 32$	10
$32 \le e_n$	16

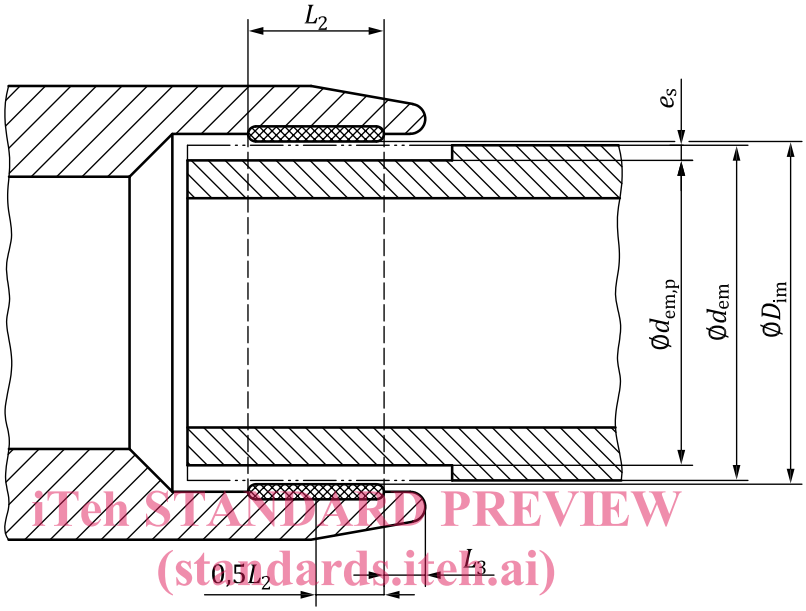
e) With the assembly conditioned at ambient temperature T_a, carry out the fusion jointing in accordance with the fitting manufacturer's instructions at the energy levels indicated in Annex C.

f) Leave the joint to cool down according to the fitting manufacturer's instructions.

g) Proceed to the tests as given in the relevant product standards.

Annex A
(normative)

Symbols for dimensions of an electrofusion socket



Key

L_2	nominal length of the fusion zone
L_3	length of the unheated section of the socket
D_{im}	$(D_{i,max} + D_{i,min})/2$
d_{em}	C/π where C is the circumference of the unscraped pipe
$d_{em,p}$	(by analogy) = C_p/π where C_p is the circumference of the scraped pipe to be assembled with the fitting
e_s	$(d_{em} - d_{em,p})/2$

Figure A.1 — Dimensions of an electrofusion socket