British Standard

BRITISH STANDARD

BS 2782-11: Method 1150B:1998
ISO 11414: 1996

Methods of testing plastics —

Part 11: Thermoplastics pipes, fittings and valves —

Method 1150B: Plastics pipes and fittings — Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion

ICS 23.040.20; 23.040.45

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National foreword

This British Standard reproduces verbatim ISO 11414:1996 and implements it as the UK national standard.

This international standard is incorporated into BS 2782 *Methods of testing plastics*: Part 11 *Thermoplastics pipes, fittings and valves,* as Method 1150B:1998, for association with related test methods for plastics materials and plastics piping components.

The UK participation in its preparation was entrusted by Technical Committee PRI/61, Plastics piping systems and components, to Subcommittee PRI/61/4, Methods of test for thermoplastics piping systems and components, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

The responsible UK technical committee considers that certain aspects of the text as published are misleading and require clarification or further attention as follows.

a) In clause **6**, the opening paragraph requires use of pipes and fittings conforming to ISO 4427, ISO 4437 and ISO 8085-2 as applicable. The method may be applicable where one or more of the components conforms to some other standard, in which case reference to this method should be modified accordingly.

b) The purpose of this document is to establish performance with a test piece incorporating a misalignment. It is applicable for type testing to show that a joint could tolerate the sorts of level of butt misalignment likely to occur in practice.

In clause **6** a), the words “at the most” before the limiting values for misalignment are in each case therefore considered to be misleading, because they require the preparation of joints with less misalignment and permit the use of joints with no misalignment for the conduct of this test, which was not the intention. For the purposes of testing components and joints for adequate tolerance of misalignment, the UK technical committee considers that the words “at the most” should be read as “at least”.

For field installation however, for which deliberate misalignment is inappropriate, the UK committee’s advice to supplement the third paragraph of the scope is that any misalignment during field assembly should not exceed the applicable value given in clause **6** a).

c) In clause **6** b), for the English text, the words “over a maximum of one-third of the circumference” are incorrectly located. As printed, the text appears to require that not more than one third of each butt fusion face is prepared and planed, leaving the rest “as received”. Furthermore, this would be difficult and deleterious if the faces are initially truly plane and square to their axes.

In the view of the UK technical committee, the words in question should for the English text have been located following "clearance D_w", to achieve the following meaning: Prepare and plane the whole of each butt fusion face so that:

1) any subsequent clearance D_w between the faces does not extend over more than one third of the circumference;

2) any such clearance does not exceed 0,3 mm when $d_n < 200$ or 0,5 mm when $d_n \geq 200$.

In Table A.1, the heater plate temperatures given are not unsuitable, but as indicated in the third paragraph of the scope, they do not necessarily align with or supersede those used in the field. For field installation in the UK, heater plate temperatures of $\left(230 \frac{+10}{-5}\right)°C$ are generally used for all pipe sizes.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

References are made to ISO 4427, ISO 4437 and ISO 8085-2, for which there are no identical British Standards, because the corresponding British Standards are expected to be replaced by implementation of the relevant Parts of EN 1555.

WARNING NOTE. This British Standard, which is identical with ISO 11414:1996, does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the method should be operated only by trained personnel.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, the ISO title page, pages ii to iv, pages 1 to 4 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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INTERNATIONAL STANDARD

ISO 11414

First edition
1996-06-01

Plastics pipes and fittings — Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion

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

Reference number
ISO 11414:1996(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.

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.

International Standard ISO 11414, 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.*

Annex A and Annex B form an integral part of this International Standard.

Descriptors: Plastics products, pipes (tubes), polyethylene, plastic tubes, pipe fittings, joining, fusion welding, butt welds, tests, specimen preparation.

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1 Scope

This International Standard specifies a method for preparing butt-fusion-jointed test piece assemblies between polyethylene (PE) pipes and spigot-ended fittings.

It specifies the assembly parameters involved, such as the ambient temperature, joint geometry and fusion parameters, taking into account the service condition limits specified in the relevant product standards, as well as the type of pipe to be used.

This International Standard is intended to enable the effect of site assembly variables on joint performance to be determined. The fusion-jointing procedures and parameters used in the field can differ from those in this document, depending on the manufacturer's written procedures and/or local standards.

NOTE 1 The assembly and fusion-jointing technique described in this International Standard is applicable whatever the polyethylene resin employed, provided it is used in accordance with ISO/TR 11647. Deviations from the fusion cycle specified, in order to demonstrate joint performance, are permitted.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4427:—, *Polyethylene (PE) pipes for water supply — Specifications*[1)].

ISO 4437:—, *Plastics pipes and fittings — Buried polyethylene (PE) pipes for the supply of gaseous fuels — Metric series — Specifications*[2)].

ISO 8085-2:—, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 2: Spigot fittings for butt fusion jointing, for socket fusion using heated tools and for use with electrofusion fittings*[1)].

ISO/TR 11647:1996, *Fusion compatibility of polyethylene (PE) pipes and fittings.*

3 Symbols used

3.1 Symbols used in more than one phase of the fusion-jointing cycle

e_n the nominal pipe wall thickness;

d_n the nominal external diameter of the pipe;

p the pressure applied to the butt-fusion joint interface;

t the length of each phase in the fusion cycle;

T_{max} the maximum permissible ambient temperature;

T_{min} the minimum permissible ambient temperature.

3.2 Joint geometry

D_a the misalignment between the pipes or fittings to be butt-fused, expressed in terms of the difference, in millimetres, between, the external diameters;

D_w the clearance between the fusion faces, expressed in terms of the gap, in millimetres, between the prepared faces.

3.3 Ambient temperature

T_a the ambient temperature at which the joint is made.

NOTE 2 The ambient temperature may vary from the minimum temperature T_{min} to the maximum temperature T_{max} defined either in the system standards or by agreement between the manufacturer and purchaser.

3.4 Butt-fusion cycle parameters

3.4.1 *General*

T the heater-plate temperature, measured in the zone of the heater-plate surface in contact with the pipe or spigot ends to be butt-fused.

3.4.2 *Phase 1: Heating*

p_1 the interface pressure during the heating phase, i.e. the pressure applied in the contact zone, expressed in newtons per square millimetre (N/mm^2) (MPa);

B_1 the initial bead width, taken as the bead width at the end of the heating phase, expressed in millimetres;

t_1 the heating time, taken as the time necessary to obtain a bead of width B_1 in the joint region during the heating phase.

[1)] To be published.
[2)] To be published. (Revision of ISO 4437:1988)

3.4.3 *Phase 2: Heat soak*

p_2 the pressure between the heater plate and the pipe or spigot ends during the heat soak phase, expressed in newtons per square millimetre (N/mm^2);

t_2 the duration of internal heating during the heat soak phase, expressed in seconds.

3.4.4 *Phase 3: Withdrawal of heater plate*

t_3 the time between the moment when the heater plate is removed from the pipe and/or spigot ends and the moment when the pipe and/or spigot ends are placed in contact with each other, expressed in seconds.

3.4.5 *Phase 4: Pressure increase*

t_4 the time required to establish the butt-fusion pressure, expressed in seconds.

3.4.6 *Phase 5: Butt fusion*

p_5 the pressure applied to the contact zone during the butt-fusion phase, expressed in newtons per square millimetre (N/mm^2);

t_5 the time during which the assembly remains under the butt-fusion pressure in the machine, expressed in minutes.

3.4.7 *Phase 6: Cooling*

t_6 the cooling time, during which the butt-fused assembly is not subjected to any rough handling, expressed in minutes; this cooling can take place outside the machine;

B_2 the bead width obtained at the end of the cooling phase, expressed in millimetres.

4 Pipes used for test assemblies

The pipes used for test assemblies shall be taken from straight lengths.

5 Apparatus

The butt-fusion machine used shall be fitted with an automatic fusion-pressure regulator enabling the pressure to be kept constant during the whole of phases 1, 2 and 5 of the fusion cycle.

6 Jointing procedure

Using straight pipes and fittings conforming to ISO 4427, ISO 4437 and ISO 8085-2, as applicable, join the components as follows, deviations from the procedure being permitted to demonstrate improvements in joint performance (appearance or mechanical properties).

a) Fix the pipes and/or fittings in the butt-fusion machine in such a manner as to obtain a misalignment D_a of, at the most, 0,5 mm when $d_n < 200$ or at the most $0{,}1e_n$ or 1 mm, whichever is the greater, when $d_n \geqslant 200$.

b) Prepare and plane the butt-fusion faces over a maximum of one-third of the circumference by means of a planing machine to limit the clearance D_w to 0,3 mm when $d_n < 200$ or to 0,5 mm when $d_n \geqslant 200$.

c) Perform the butt fusion using the parameters specified in Annex A, repeating the procedure on fresh test assemblies while varying the parameters within the limits given in Annex B.

Annex A (normative)
Butt-fusion cycle and parameters

Figure A.1 illustrates the butt-fusion cycle and Table A.1 gives reference values for the parameters in each phase.

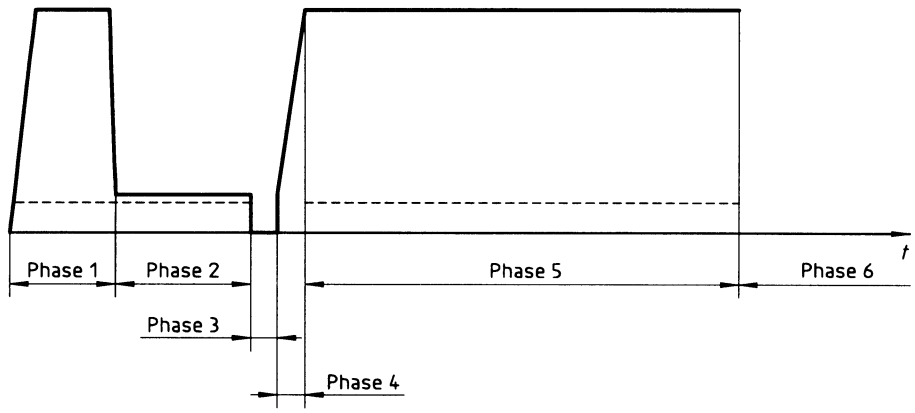

Figure A.1

Table A.1

Parameters		Values	Units
Heater-plate temperature, T $63 \leqslant d_n \leqslant 250$ $250 < d_n$		 210 ± 10 225 ± 10	°C
Phase 1	Pressure, p_1[a]	$0{,}18 \pm 0{,}02$	N/mm^2 (MPa)
	Time, t_1	measured as the time until B_1 is reached	s
	Bead width, B_1	$d_n \leqslant 180$: $1 < B_1 \leqslant 2$ $180 < d_n \leqslant 315$: $2 < B_1 \leqslant 3$ $315 < d_n$: $3 < B_1 \leqslant 4$	mm
Phase 2	Pressure, p_2[a]	$0{,}03 \pm 0{,}02$	N/mm^2 (MPa)
	Time, t_2	$(30 + 0{,}5d_n) \pm 10$	s
Phase 3	Time, t_3	maximum: $3 + 0{,}01d_n \leqslant 8$	s
Phase 4	Time, t_4	maximum: $3 + 0{,}01d_n \leqslant 6$	s
Phase 5	Pressure, p_5[a]	$0{,}18 \pm 0{,}02$	N/mm^2 (MPa)
	Time, t_5	minimum: 10	min
Phase 6	Time, t_6	minimum: $1{,}5e_n$ and maximum 20 min	min

[a] Note that this pressure is the interface pressure and is related to d_n, e_n and the butt-fusion equipment used.

Annex B (normative)
Limits on values of butt-fusion parameters

Table B.1 gives the limits placed on the values of the parameters used in evaluating the jointing procedure.

Table B.1

Conditions	**Ambient temperature**[a]		**Heater-plate temperature,** T	**Butt-fusion pressure,** p
	Symbol	Value, °C	°C	N/mm^2
Minimum	T_{min}	-5^{0}_{-2}	205 ± 5	0,15 ± 0,02
Maximum	T_{max}	40 ± 2	230 ± 5	0,21 ± 0,02

[a] Other values may be used if specified in the appropriate system standard.

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