BRITISH STANDARD

BS EN
12201-3:2003

Plastics piping systems for water supply — Polyethylene (PE) —

Part 3: Fittings

The European Standard EN 12201-3:2003 has the status of a British Standard

ICS 23.040.45; 91.140.60

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 12201-3:2003. Collectively, EN 12201-1, EN 12201-2 and EN 12201-5 comprise a revision of:

— BS 6572:1985, *Specification for blue polyethylene pipes up to nominal size 63 for below ground use for potable water*;

— BS 6730:1986, *Specification for black polyethylene pipes up to nominal size 63 for above ground use for cold potable water*.

It is intended that these British Standards will be declared obsolescent by March 2005.

NOTE 1 The UK water industry has indicated that following the publication of this British Standard, the following Water Industry Specification will be declared obsolescent by March 2005 and retained for reference where applicable:

— WIS 4-32-14, *Specification for PE 80 and PE 100 electrofusion fittings for nominal sizes up to and including 630 mm*[1)];

— WIS 4-32-15, *Specification for PE 80 and PE 100 spigot fittings and drawn bends for nominal sizes up to and including 1 000 mm*[1)].

The UK participation in its preparation was entrusted by Technical Committee PRI/88 (previously PRI/61), Plastics piping systems, to Subcommittee PRI/88/2 (previously PRI/61/2), Plastics piping systems for pressure applications, 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.

NOTE 2 It was decided not to proceed with the publication of prEN 12201-6, *Recommended practice for installation*, and that existing national practices would be applicable. In the UK, in the absence of a British Standard covering installation, it is the opinion of Technical Committee PRI/88, Plastics piping systems, that reference to the *Polyethylene Pipe Systems Manual*[2)], a joint publication of WRc and BPF Plastic Pipes Group represents established UK practice.

NOTE 3 Part 7 has been prepared as a CEN/TS, to allow further development. CEN/TS 12201-7 is not mandatory under the Public Procurement Directive.

This British Standard, was published under the authority of the Standards Policy and Strategy Committee on 5 December 2003

1) Published by WRc, Swindon.
2) WRc/BPF PLASTIC PIPES GROUP. *Polyethylene Pipe Systems Manual*. Swindon: WRc, 2002.

Amendments issued since publication

Amd. No.	Date	Comments

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Attention is drawn to the following statutory regulations:

Health and Safety at Work etc. Act 1974 and subsequent regulations.

Attention is also drawn to any appropriate safety precautions. It is assumed in the drafting of a standard that the execution of its provisions is entrusted to appropriately qualified people.

Additional information

With reference to the Introduction and **5.6**, as yet there is no pan-European agreement on water quality requirements, so existing UK regulations remain in force. Regulation 25 of the Water Supply (Water Quality) Regulations 1989 specifies the circumstances in which water undertakers may use products in contact with water supplies in England and Wales. As part of the UK regulations, all pipes and fittings used to convey drinking water supplies are required to be approved under the provisions of Regulation 25(1) (a) or (b) as appropriate and the Water Regulation Advisory Scheme (WRAS) to ensure that their use will not cause adverse effect on water quality or a risk to health of consumers. In Scotland and Northern Ireland there are similar provisions. These regulations will be revised as necessary to comply with the EU Drinking Water Quality Directive.

The UK National Annex NA attached to this standard provides additional information on the selection and installation of piping systems and components in the UK.

Cross-references

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its 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 and ii, the EN title page, pages 2 to 26, an inside back cover and a back cover.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12201-3

March 2003

ICS 23.040.45; 91.140.60

English version

Plastics piping systems for water supply - Polyethylene (PE) - Part 3: Fittings

Systèmes de canalisations en plastique pour l'alimentation en eau - Polyéthylène (PE) - Partie 3: Aptitude à l'emploi

Kunststoff-Rohrleitungssysteme für die Wasserversorgung - Polyethylen (PE) - Teil 3: Formstücke

This European Standard was approved by CEN on 4 December 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 12201-3:2003 E

Contents

Foreword

This document EN 12201-3:2003 has been prepared by Technical Committee CEN /TC 155, "Plastics piping systems and ducting systems" the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2003, and conflicting national standards shall be withdrawn at the latest by March 2005.

This standard is a Part of a System Standard for plastics piping systems of a particular material for a specified application. There are a number of such System Standards.

System Standards are based on the results of the work being undertaken in ISO/TC 138 "*Plastics pipes, fittings and valves for the transport of fluids*", which is a Technical Committee of the International Organization for Standardization (ISO).

They are supported by separate standards on test methods to which references are made throughout the System Standard.

The System Standards are consistent with standards on general functional requirements and standards on installation practices.

This European Standard consists of the following Parts, under the general title *Plastics piping systems for water supply — Polyethylene (PE)*:

— *Part 1: General.*

— *Part 2: Pipes.*

— *Part 3: Fittings* (this standard).

— *Part 4: Valves.*

— *Part 5: Fitness for purpose of the system.*

— *Part 7: Guidance for the assessment of conformity.* [1)]

NOTE It was decided not to publish a Part 6: Recommended practice for installation. Instead, existing national practices would be applicable.

This Part of this European Standard includes the following:

— Annex A (normative): Socket fusion fittings;

— Annex B (informative): Examples of typical terminal connection for electrofusion fittings;

— Bibliography.

System Standards for piping systems of other plastics materials used for the conveyance of water include the following:

EN 1452, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U)*

prEN 1796, *Plastics piping systems for water supply with or without pressure — Glass-reinforced thermosetting plastics (GRP) based on polyester resins (UP)*

For components which have conformed to the relevant national standard before [DAV], as shown by the manufacturer or by a certification body, the national standard may continue to be applied until the [DAV + 24 months].

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard : Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovak Republic, Spain, Sweden, Switzerland and the United Kingdom.

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1) to be published as a CEN/TS.

Introduction

The System Standard, of which this is Part 3, specifies the requirements for a piping system and its components when made from polyethylene (PE), intended to be used for water supply intended for human consumption, including the conveyance of raw water prior to treatment.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this standard:

a) this standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;

b) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

Requirements and test methods for material and components, other than fittings, are specified in EN 12201-1, EN 12201-2 and EN 12201-4. Characteristics for fitness of purpose are covered in EN 12201-5 and prCEN/TS 12201-7 gives guidance for the assessment of conformity.

This Part of this European Standard covers the characteristics of fittings.

1 Scope

This Part of this European Standard specifies the characteristics of fittings made from polyethylene (PE) intended for the conveyance of water for human consumption, including raw water prior to treatment.

It also specifies the test parameters for the test methods referred to in this standard.

In conjunction with other Parts of this European Standard (see Foreword) it is applicable to PE fittings, their joints and to joints with components of PE and other materials intended to be used under the following conditions:

a) a maximum operating pressure, MOP, up to 25 bar [2)];

b) an operating temperature of 20 °C as a reference temperature.

NOTE 1 For applications operating at constant temperature greater than 20 °C and up to 40 °C, see annex A of EN 12201-1:2003.

This European Standard covers a range of maximum operating pressures and gives requirements concerning colours and additives.

NOTE 2 It is the responsibility of the purchaser or specifier to make the appropriate selections from these aspects, taking into account their particular requirements and any relevant national guidance or regulations and installation practices or codes.

These fittings can be of the following types:

—fusion fittings;

- butt fusion fittings;
- socket fusion fittings (see annex A);
- electrofusion fittings;

—mechanical fittings;

- compression fittings;
- flanged fittings.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 681-1, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber.*

EN 681-2, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 2: Thermoplastics elastomers.*

EN 728, *Plastics piping and ducting systems — Polyolefin pipes and fittings — Determination of the oxidation induction time.*

EN 921:1994, *Plastics piping systems — Thermoplastics pipes — Determination of resistance to internal pressure at constant temperature (including corrigendum of 1995).*

EN 1716, *Plastics piping systems — Polyethylene (PE) tapping tees — Test method for impact resistance of an assembled tapping tee.*

EN 12201-1:2003, *Plastics piping systems for water supply — Polyethylene (PE) — Part 1: General.*

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2) 1 bar = 10^5 N/m^2

EN 12201-2:2003, *Plastics piping systems for water supply — Polyethylene (PE) — Part 2: Pipes.*

EN 12201-5, *Plastics piping systems for water supply — Polyethylene (PE) — Part 5: Fitness for purpose of the system.*

EN ISO 1133:1999, *Plastics — Determination of the melt-mass flow rate (MFR) and the melt-volume flow rate (MVR) of thermoplastics (ISO 1133:1997).*

prEN ISO 3126:1999, *Plastics piping systems — Plastics piping components — Measurement and determination of dimensions (ISO/DIS 3126:1999).*

ISO 4059:1978, *Polyethylene (PE) pipes — Pressure drop in mechanical pipe-jointing systems — Method of test and requirements.*

ISO 4433-1:1997, *Thermoplastics pipes — Resistance to liquid chemicals — Classification — Part 1: Immersion test method.*

ISO 4433-2:1997, *Thermoplastics pipes — Resistance to liquid chemicals — Classification —Part 2: Polyolefin pipes.*

ISO 9624, *Thermoplastics pipes for fluids under pressure — Mating dimensions of flange adapters and loose backing flanges.*

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 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/DIS 13956:1996, *Plastics pipes and fittings — Determination of cohesive strength — Tear test for polyethylene (PE) assemblies.*

3 Terms and definitions, symbols and abbreviations

For the purposes of this European Standard, the terms and definitions, symbols and abbreviations given in EN 12201-1:2003 and the following apply.

3.1
electrofusion socket fitting
polyethylene (PE) fitting which contains one or more integrated heating elements, that are capable of transforming electrical energy into heat to realise a fusion joint with a spigot end or a pipe

3.2
electrofusion saddle fitting
polyethylene (PE) fitting which contains one or more integrated heating elements, that are capable of transforming electrical energy into heat to realise a fusion on to a pipe

3.2.1
tapping tee
electrofusion saddle fitting (top loading or wrap round) which contains an integral cutter, to cut through the wall of the main pipe. The cutter remains in the body of the saddle after installation

3.2.2
branch saddle
electrofusion saddle fitting (top loading or wrap round) which requires an ancillary cutting tool for drilling the hole in the adjoining main pipe

3.3
spigot end fitting
polyethylene (PE) fitting where the outside diameter of the spigot length is equal to the nominal outside diameter, d_n, of the corresponding pipe

3.4
mechanical fitting
fitting for assembling polyethylene (PE) pipe to another PE pipe or any other element of the piping system

The mechanical fitting can be supplied for field assembly or pre-assembled by the manufacturer. The fitting generally includes a compression part to provide pressure integrity, leaktightness and resistance to end loads. A support sleeve inserted into the pipe bore provides a permanent support for the PE pipe to prevent creep in the pipe wall under radial compressive forces.

NOTE 1 The metallic parts of the fitting can be assembled to metallic pipes by screw threads, compression joints, welded or flanged connections, including PE flanges. The fitting can allow either a dismountable or permanently assembled joint.

NOTE 2 In some cases the supporting ring can also act as a grip ring.

3.5
voltage regulation
control of energy supplied, during the fusion process of an electrofusion fitting, by means of the voltage parameter

3.6
intensity regulation
control of energy supplied, during the fusion process of an electrofusion fitting, by means of the current parameter

4 Material

4.1 PE compound

The PE compound from which the fittings are made shall conform to EN 12201-1:2003.

4.2 Material for non-polyethylene parts

4.2.1 General

All components shall conform to the relevant European Standard(s). Alternative standards may be utilised in cases where suitable European Standards do not exist provided that the fitness for purpose can be demonstrated.

The materials and constituent elements used in making the fitting (including elastomers, greases, and any metal parts) shall be as resistant to the external and internal environments as the other elements of the piping system and shall have a life expectancy under the following conditions at least equal to that of the PE pipe conforming to EN 12201-2:2003 with which they are intended to be used:

a) during storage;

b) under the effect of the fluids being conveyed;

c) taking account of the service environment and operating conditions.

The requirements for the level of material performance for non-polyethylene parts shall be at least as stringent as that of the PE compound for the piping system.

Fittings material in contact with the PE pipe shall not adversely affect the pipe performance or initiate stress cracking.

4.2.2 Metal parts

All parts susceptible to corrosion shall be adequately protected.

When dissimilar metallic materials are used which may be in contact with moisture, steps shall be taken to avoid galvanic corrosion.

4.2.3 Elastomers

Elastomeric materials used for the manufacture of seals shall conform to EN 681-1 or EN 681-2, as applicable.

4.2.4 Other materials

Greases or lubricants shall not exude on to the fusion areas, and shall not affect the long-term performance of the fitting nor have any adverse effect on the quality of the water.

5 General characteristics

5.1 Appearance

When viewed without magnification, the internal and external surfaces of the fitting shall be smooth, clean and free from scoring, cavities and other surface defects to an extent that would prevent conformity of the fitting to this standard.

5.2 Design

The design of the fitting shall be such that, when assembling the fitting onto the pipe or other components, the electrical coils and/or seals are not displaced.

5.3 Colour

The fitting shall be blue or black.

NOTE For above ground installations, all blue components should be protected from direct UV light.

5.4 Electrical characteristics for electrofusion fittings

The electrical protection that shall be provided by the system depends on the voltage and the current intensity used and on the characteristics of the electricity power.

For voltages greater than 25 V, direct human contact with the energised parts shall not be possible when the fitting is in the fusion cycle during assembly in accordance with the instructions of the manufacturer of the fittings and the assembly equipment, as applicable.

NOTE 1 This type of fitting is a part of an electrical system as defined in EN 60335-1[1], IEC 60364-1[2] and IEC 60449[3]. A protection against direct contacts with active parts (live conductors) is required for conformity to EN 60529[4]. This protection is a function of the work site conditions.

NOTE 2 See annex B for examples of typical electrofusion terminal connectors.

The surface finish of the terminal pins shall allow a minimum contact resistance in order to satisfy the resistance tolerance requirements (nominal value $\pm$ 10 %).

5.5 Appearance of factory made joints

The internal and external surfaces of the pipe and fitting after fusion jointing, examined visually without magnification, shall be free from melt exudation outside the confines of the fitting, apart from that which may be declared acceptable by the fitting manufacturer or used as a fusion marker.

Any melt exudation shall not cause wire movement in electrofusion fittings such that it leads to short-circuiting, when jointed in accordance with the manufacturer's instructions. There shall be no excessive creasing of the internal surfaces of the adjoining pipes.

5.6 Effect on water quality

Attention is drawn to the requirements of national regulations (see introduction).

6 Geometrical characteristics

6.1 Measurement of dimensions

The dimensions of the fittings shall be measured in accordance with prEN ISO 3126:1999. In the case of dispute the measurement of dimensions shall be made not less than 24 h after manufacture after being conditioned for at least 4 h at (23 ± 2) °C.

6.2 Dimensions of electrofusion sockets

6.2.1 Diameters and lengths of electrofusion sockets

When measured in accordance with 6.1 the diameters and lengths of electrofusion sockets (see Figure 1) shall conform to Table 1.

Table 1 — Electrofusion socket dimensions

Dimensions in millimetres

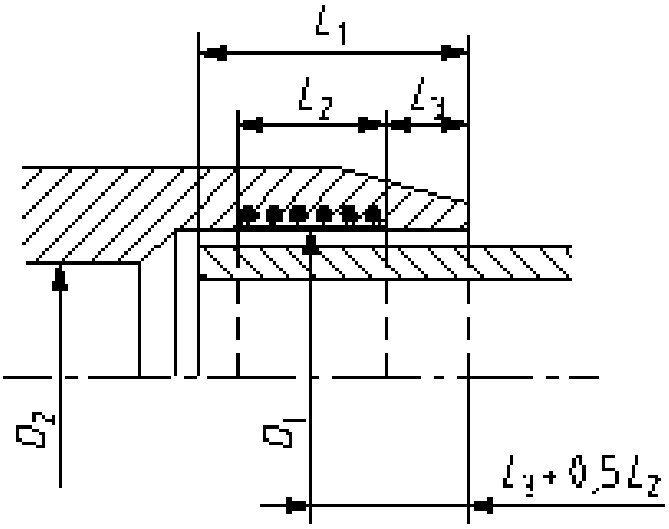
Nominal diameter of the fitting	Design depth			Fusion zone
d_n	$L_{1,min}$		$L_{1,max}$	$L_{2,min}$[a]
	Intensity regulation	Voltage regulation		
20	20	25	41	10
25	20	25	41	10
32	20	25	44	10
40	20	25	49	10
50	20	28	55	10
63	23	31	63	11
75	25	35	70	12
90	28	40	79	13
110	32	53	82	15
125	35	58	87	16
140	38	62	92	18
160	42	68	98	20
180	46	74	105	21
200	50	80	112	23
225	55	88	120	26
250	73	95	129	33
280	81	104	139	35
315	89	115	150	39
355	99	127	164	42
400	110	140	179	47
450	122	155	195	51
500	135	170	212	56
560	147	188	235	61
630	161	209	255	67

[a] Increased fusion zone lengths are applicable for fittings rated to higher pressures, in order to meet the performance requirements of this standard

The mean inside diameter of the fitting in the middle of the fusion zone, D_l, shall not be less than d_n.

The manufacturer shall declare the actual maximum and minimum values of D_1 and L_1 to determine suitability for clamping and joint assembly.

In the case of a fitting having sockets of differing sizes, each one shall conform to the requirements for the corresponding nominal diameter.



Key

D_1 is the "mean inside diameter in the fusion zone" measured in a plane parallel to the plane of the mouth at a distance of $L_3 + 0{,}5L_2$;
D_2 is the bore which is the minimum diameter of the flow channel through the body of the fitting where $D_2 \geq (d_n - 2e_{min})$;
L_1 is the "design penetration depth" of the pipe or male end of a spigot fitting. In the case of a coupling without a stop, it is not greater than half the total length of the fitting;
L_2 is the heated length within a socket as declared by the manufacturer to be the nominal length of the fusion zone;
L_3 is the distance between the mouth of the fitting and the start of the fusion zone as declared by the manufacturer to be the nominal unheated entrance length of the fitting L_3 shall be ≥ 5 mm.

Figure 1 — Dimensions of electrofusion sockets

6.2.2 Wall thicknesses

The wall thickness of the body of the fitting at any point, E, shall be equal to or greater than e_{min} for the corresponding pipe for any part of the fitting located at a distance beyond $2L_1/3$ from all entrance faces of the fitting when the fitting and the corresponding pipe are made from a polyethylene with the same designation. If the fitting is produced from a polyethylene with an MRS designation different from that of the corresponding pipe, the preferred relationship between the wall thickness of the fitting, E, and the pipe, e_{min}, shall conform to Table 2.

Table 2 — Relationship between pipe and fitting wall thicknesses

Material		Relationship between fitting wall thickness, E, and pipe wall thickness, e_{min}
Pipe	Fitting	
PE 80	PE 100	$E \geq 0{,}8e_{min}$
PE 100	PE 80	$E \geq 1{,}25e_{min}$

In order to prevent stress concentrations, any changes in wall thickness of the fitting body shall be gradual.

NOTE Fittings conforming to ISO 8085-3 [5] are deemed to satisfy the requirements of this standard.

6.3 Dimensions of spigotted fittings

When measured in accordance with 6.1, the spigot dimensions shall conform to the requirements given in Table 3 (see Figure 2).

Table 3 — Spigot dimensions

Dimensions in millimetres

Nominal outside diameter of spigot	Mean outside diameter of the fusion end [a]			For electrofusion and butt fusion				Socket fusion	For butt fusion only			
		Grade A	Grade B	Out-of-roundness	Min. bore	Cut back length	Tubular length [b]	Tubular length	Out-of-roundness	Cut back length	Tubular length Normal [c]	Tubular length Special [d]
d_n	$D_{1,min}$	$D_{1,max}$	$D_{1,max}$	max.	D_2	$L_{1,min}$	$L_{2,min}$	$L_{2,min}$	max.	$L_{1,min}$	$L_{2,min}$	$L_{2,min}$
20	20,0	—	20,3	0,3	13	25	41	11	—	—	—	—
25	25,0	—	25,3	0,4	18	25	41	12,5	—	—	—	—
32	32,0	—	32,3	0,5	25	25	44	14,6	—	—	—	—
40	40,0	—	40,4	0,6	31	25	49	17	—	—	—	—
50	50,0	—	50,4	0,8	39	25	55	20	—	—	—	—
63	63,0	—	63,4	0,9	49	25	63	24	1,5	5	16	5
75	75,0	—	75,5	1,2	59	25	70	25	1,6	6	19	6
90	90,0	—	90,6	1,4	71	28	79	28	1,8	6	22	6
110	110,0	—	110,7	1,7	87	32	82	32	2,2	8	28	8
125	125,0	—	125,8	1,9	99	35	87	35	2,5	8	32	8
140	140,0	—	140,9	2,1	111	38	92	—	2,8	8	35	8
160	160,0	—	161,0	2,4	127	42	98	—	3,2	8	40	8
180	180,0	—	181,1	2,7	143	46	105	—	3,6	8	45	8
200	200,0	—	201,2	3,0	159	50	112	—	4,0	8	50	8
225	225,0	—	226,4	3,4	179	55	120	—	4,5	10	55	10
250	250,0	—	251,5	3,8	199	60	130	—	5,0	10	60	10
280	280,0	282,6	281,7	4,2	223	75	139	—	9,8	10	70	10
315	315,0	317,9	316,9	4,8	251	75	150	—	11,1	10	80	10
355	355,0	358,2	357,2	5,4	283	75	165	—	12,5	10	90	12
400	400,0	403,6	402,4	6,0	319	75	180	—	14,0	10	95	12
450	450,0	454,1	452,7	6,8	359	100	195	—	15,6	15	60	15
500	500,0	504,5	503,0	7,5	399	100	215	—	17,5	20	60	15
560	560,0	565,0	563,4	8,4	447	100	235	—	19,6	20	60	15
630	630,0	635,7	633,8	9,5	503	100	255	—	22,1	20	60	20

[a] Tolerance grades A and B are in accordance with ISO 11922-1[6].

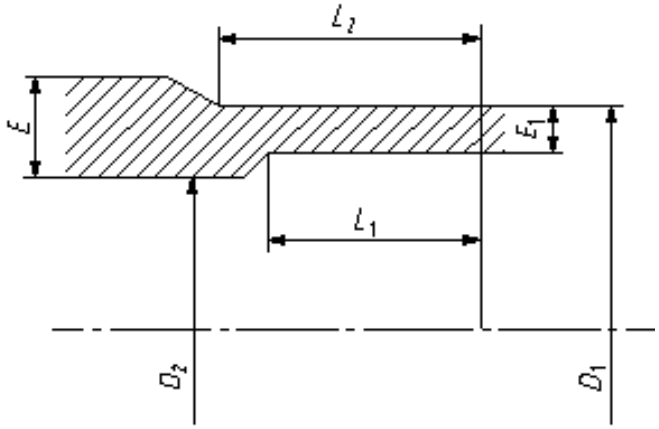
[b] The values of L_2 (electrofusion) are based on the following equations:

for $d_n \leq 90$, $L_2 = 0{,}6d_n + 25$ mm;

for $d_n \geq 110$, $L_2 = d_n/3 + 45$ mm.

[c] Used by preference.

[d] Used for fittings fabricated in the factory.



Key

D_1 is the "mean outside diameter" of the fusion end piece, measured in any plane parallel to the plane of the entrance face at a distance not greater than L_2 (tubular length) from that plane;

D_2 is the "minimum bore" which comprises the minimum diameter of the flow channel through the body of the fitting. The measurement of the diameter does not include the fusion pad if any;

E is the "body wall thickness of the fitting", which comprises the thickness measured at any point of the wall of the fitting;

E_1 is the "fusion face wall thickness" measured at any point at a maximum distance of L_1 (cut back length) from the entrance face; and shall be equal to the pipe wall thickness and tolerance to which it is intended to be butt fused as specified in Table 2 of EN 12201-2:2003;

L_1 is the "cut back length" of the fusion end piece, which comprises the initial depth of the spigot end, which is necessary to butt fusion or reweld. This length may be obtained by joining a length of pipe to the spigot end of the fitting provided that the wall thickness of the pipe is equal to E_1 for its whole length;

L_2 is the "tubular length" of the fusion end piece, which comprises the initial length of the fusion end piece. This tubular length must allow (in any combination):

a) the use of clamps required in the case of butt fusion;
b) the assembly with an electrofusion fitting;
c) the assembly with a socket fusion fitting;
d) the use of a mechanical scraper.

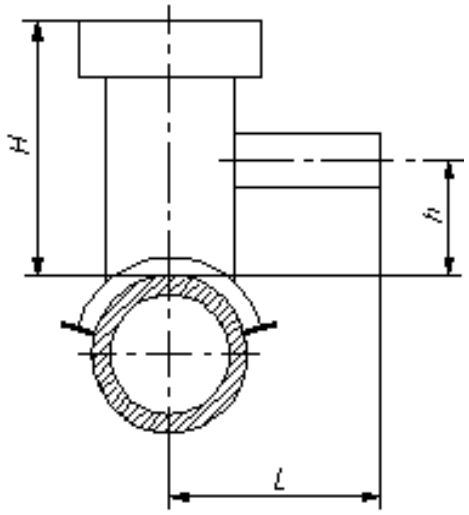
Figure 2 — Dimensions of spigotted fittings

6.4 Dimensions of socket fusion fittings

For the description and dimensions of these types of fittings, see annex A.

6.5 Dimensions of electrofusion saddle fittings

Outlets from tapping tees and branch saddles shall have spigots in accordance with 6.3 or an electrofusion socket in accordance with 6.2. The manufacturer shall declare the overall characteristic dimension of the fitting in the technical file. These dimensions shall include the maximum height of the saddle, *H*, and the height of the service pipe measured from the top of the main, *h*, as shown in Figure 3.



Key
H is the height of the saddle, i.e. the distance from the top of the main to the top of the tapping tee;
h is the "height of service pipe", i.e. the distance between the top 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 pipe and the plane of the mouth of the service tee.

Figure 3 — Dimensions of tapping tees

6.6 Dimensions of mechanical fittings

Mechanical fittings manufactured substantially from PE and intended for part fusion to PE pipe and part mechanical jointing to other pipe components, e.g. adapters, shall in at least one joint conform to the geometrical characteristics of the PE jointing system to be used.

NOTE Mechanical fittings not manufactured substantially from PE should conform to the requirements specified in the relevant standard(s).

6.7 Dimensions of loose backing flanges and flange adapters

Dimensions of loose backing flanges and flange adapters shall be in accordance with ISO 9624.

7 Mechanical characteristics

7.1 General

A fitting shall be tested assembled with pipe or as a part of an assembly of more than one fitting fused to pipe conforming to EN 12201-2:2003.

Each assembly shall be prepared from components (pipes and fittings) of the same pressure class and material classification.

7.2 Conditioning

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 ± 2) °C before testing in accordance with Table 4.

7.3 Requirements

When tested in accordance with the test methods as specified in Table 4 using the parameters given in Table 4, the fitting shall have mechanical characteristics conforming to the requirements given in Table 4.

Table 4 — Mechanical characteristics

Characteristics	Requirements	Test parameters		Test method
		Parameters	Value	
Hydrostatic strength at 20 °C	No failure during test period of any test pieces	End caps Conditioning period Number of test pieces[b] Type of test Test temperature Test period Circumferential (hoop) stress[c] for: PE 40 PE 63 PE 80 PE 100	Type a) [a] Shall conform to EN 921:1994 3 Water- in- water 20 °C 100 h 7,0 MPa 8,0 MPa 10,0 MPa 12,4 MPa	EN 921:1994
Hydrostatic strength at 80 °C	No failure during test period of any test pieces	End caps Conditioning period Number of test pieces[b] Type of test Test temperature Test period Circumferential (hoop) stress[c] for: PE 40 PE 63 PE 80 PE 100	Type a) [a] Shall conform to EN 921:1994 3 Water-in-water 80 °C 165 h [d] 2,5 MPa 3,5 MPa 4,5 MPa 5,4 MPa	EN 921:1994
Hydrostatic strength at 80 °C	No failure during test period of any test pieces	End caps Conditioning period Type of test Test temperature Number of test pieces[b] Test period Circumferential (hoop) stress [c] for: PE 40 PE 63 PE 80 PE 100	Type a) [a] Shall conform to EN 921:1994 Water-in-water 80 °C 3 1000 h 2,0 MPa 3,2 MPa 4,0 MPa 5,0 MPa	EN 921:1994

[a] Type b) end caps may be used for batch release tests for diameters ≥ 500 mm.

[b] The number of test pieces given indicate the quantity required to establish a value for the characteristic described in the table. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan (for guidance see prCEN/TS 12201-7[7]).

[c] The stress shall be calculated using the dimensions of the pipe used in the test assembly.

[d] Premature ductile failures are not taken into account. For retest procedure see 7.4.

7.4 Retest in case of failure at 80 °C

A fracture in a brittle mode in less than 165 h shall constitute a failure, however if a sample in the 165 h test fails in a ductile mode in less than 165 h, a retest shall be performed at a selected lower stress in order to achieve the minimum required time for the selected stress obtained from the line through the stress/time points given in Table 5.

Table 5 — Test parameters for the retest of the hydrostatic strength at 80 °C

PE 40		PE 63		PE 80		PE 100	
Stress	**Test period**	**Stress**	**Test period**	**Stress**	**Test period**	**Stress**	**Test period**
MPa	h	MPa	h	MPa	h	MPa	h
2,5	165	3,5	165	4,5	165	5,4	165
2,4	230	3,4	295	4,4	233	5,3	256
2,3	323	3,3	538	4,3	331	5,2	399
2,2	463	3,2	1 000	4,2	474	5,1	629
2,1	675			4,1	685	5,0	1 000
2,0	1 000			4,0	1 000		

7.5 Pressure drop

If required, the manufacturer shall declare the pressure drop of a fitting for sizes up to 63 when determined in accordance with ISO 4059:1978.

8 Physical characteristics

8.1 Conditioning

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 ± 2) °C before testing in accordance with Table 6.

8.2 Requirements

When tested in accordance with the test methods as specified in Table 6 using the indicated parameters, the fittings shall have physical characteristics conforming to the requirements given in Table 6.

Table 6 — Physical characteristics

Characteristics	Requirements	Test parameters		Test method
		Parameters	Value	
Melt mass-flow rate (MFR) for PE 40	Change of MFR by processing ± 20 % [b)]	Load Test temperature Test period Number of test pieces[a]	2,16 kg 190 °C 10 min Shall conform to EN ISO 1133:1999	EN ISO1133:1999, condition D
Melt mass-flow rate (MFR) for PE 63, PE 80, and PE 100	Change of MFR by processing ± 20 % [b]	Load Test temperature Test period Number of test pieces[a]	5 kg 190 °C 10 min Shall conform to EN ISO 1133:1999	EN ISO1133:1999, condition T
Oxidation induction time	≥ 20 min	Test temperature Number of test pieces[a]	200 °C [c] 3	EN 728
Cohesive resistance for electrofusion socket fittings	Length of initiation rupture ≤ L_2/3 in brittle failure	Test temperature Number of test pieces[a]	23 °C Shall conform to ISO 13954:1997	ISO 13954:1997
		OR		
		Test temperature Number of test pieces[a]	23 °C Shall conform to ISO 13955:1997	ISO 13955:1997
Cohesive resistance for electrofusion saddle fittings	Surface rupture: ≤ 25 %, brittle failure	Test temperature Number of test pieces[a]	23 °C As specified in ISO/DIS 13956:1996	ISO/DIS 13956:1996
Tensile strength for butt fusion fittings - spigoted fittings	Test to failure: ductile: pass brittle: fail	Test temperature Number of test pieces[a)]	23 °C As specified in ISO 13953:2001	ISO 13953:2001
Impact resistance of tapping tees	No failure, no leaks	Test temperature Mass of striker Height Conditioning period: in air in liquid	(0 ± 2) °C (2 500 ± 20) g (2 000 ± 10) mm 4 h 2 h	EN 1716
Effect on water quality [d]	National regulations apply			

[a] The number of test pieces given indicate the quantity required to establish a value for the characteristic described in the table. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan for guidance see prCEN/TS 12201-7[7].

[b] Value as measured on the fitting relative to the value measured on the compound used.

[c] Test may be carried out as an indirect test at 210 °C providing that there is clear correlation of the results to those at 200 °C: in cases of dispute the reference temperature shall be 200 °C.

[d] Test methods, parameters and requirements for all properties are under preparation. Until these European Standards are published National Regulations apply (see introduction).

9 Chemical resistance of fittings in contact with chemicals

If for a particular installation it is necessary to evaluate the chemical resistance of fittings, then the fitting shall be classified in accordance with ISO 4433-1:1997 and ISO 4433-2:1997.

NOTE Guidance for the resistance of polyethylene fittings against chemicals is given in ISO/TR 10358[8].

10 Performance requirements

When fittings conforming to this standard are assembled to each other or to components conforming to other Parts of this European Standard, the joints shall conform to the requirements given in EN 12201-5.

11 Marking

11.1 General

11.1.1 All fittings shall be permanently and legibly marked in such a way that the marking does not initiate cracks or other types of failure.

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

11.1.3 The marking shall be such that it is legible without magnification.

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

11.1.4 There shall be no marking over the minimum spigot length of the fitting.

11.2 Minimum required marking of fittings

The minimum required marking shall conform to Table 7.

NOTE Attention is drawn to the possible need to include CE marking when required for legislative purposes.

Table 7 — Minimum required marking on the fitting

Aspects	Marking or symbol
Manufacturer's name or trade mark	Name or code
Nominal diameter and pipe series/SDR	e.g. d_n 110/S 5 or d_n 110/SDR 11
Manufacturer's information	[a]
SDR fusion range	e.g. SDR 11 – SDR 26 [b]
Material and designation	e.g. PE 80 [b]
[a] In clear figures or in code providing traceability to production period within year and month and the production site if manufacturer is producing at different sites nationally and/or internationally. [b] This information may be printed on a label attached to the fitting or on an individual bag (see Table 8).	

11.3 Minimum required marking on a label

The following additional information given in Table 8 may be printed on a label, with one label attached to the fitting or to the individual bag. The label shall be of sufficient quality to be intact and legible at the time of installation.

Table 8 — Minimum required marking on the label

Aspects	Marking or symbol
Standard number	EN 12201
Material and designation	e.g. PE 80
Pressure rating in bars	e.g. PN 12,5
Tolerance (only for spigot fittings) $d_n \geq 280$ mm	e.g. Grade A
SDR fusion range	e.g SDR 11 – SDR 26 [a]
[a] This information may be printed on the fitting (see Table 7).	

11.4 Fusion system recognition

Fusion fittings should have a system, either numerical or electromechanical or self regulatory, for recognising the fusion parameters to facilitate the fusion process.

Where bar-codes are used for the numerical recognition, the bar-code label shall be stuck to the fitting and shall be protected against deterioration.

12 Packaging

The fitting shall be packaged in bulk or individually protected where necessary in order to prevent deterioration and contamination.

The packaging shall have at least one label with the manufacturer's name, type and dimensions of the part, number of units and any special storage conditions.

Annex A
(normative)

Socket fusion fittings

When applicable the dimensions of socket fusion fittings shall conform to the following tables. The diameter at the root shall not be greater than the diameter at the mouth.

Table A.1 — Socket dimensions for nominal sizes 16 to 63 inclusive

Dimensions in millimetres

Nom. size DN/OD	Nominal inside diameter of socket	Mean inside diameter of socket				Out-of-roundness	Min. bore	Socket reference length	Heated socket length [a]		Penetration of pipe into socket [b]	
		Mouth		Root								
		$D_{1,min}$	$D_{1,max}$	$D_{2,min}$	$D_{2,max}$	max.	D_3	L_{min}	$L_{2,min}$	$L_{2,max}$	$L_{3,min}$	$L_{3,max}$
16	16	15,2	15,5	15,1	15,4	0,4	9	13,3	10,8	13,3	9,8	12,3
20	20	19,2	19,5	19,0	19,3	0,4	13	14,5	12,0	14,5	11,0	13,5
25	25	24,1	24,5	23,9	24,3	0,4	18	16,0	13,5	16,0	12,5	15,0
32	32	31,1	31,5	30,9	31,3	0,5	25	18,1	15,6	18,1	14,6	17,1
40	40	39,0	39,4	38,8	39,2	0,5	31	20,5	18,0	20,5	17,0	19,5
50	50	48,9	49,4	48,7	49,2	0,6	39	23,5	21,0	23,5	20,0	22,5
63	63	62,0 [c]	62,4 [c]	61,6	62,1	0,6	49	27,4	24,9	27,4	23,9	26,4

a $L_{2,min} = (L_{min} - 2,5)$ mm; $L_{2,max} = L_{min}$ mm.

b $L_{3,min} = (L_{min} - 3,5)$ mm; $L_{3,max} = (L_{min} - 1)$ mm.

C Where rerounding clamps are used, the maximum diameter of 62,4 mm may be increased by 0,1 mm to 62,5 mm. Conversely, where a peeling technique is used, the minimum diameter of 62,0 mm may be reduced by 0,1 mm to 61,9 mm.

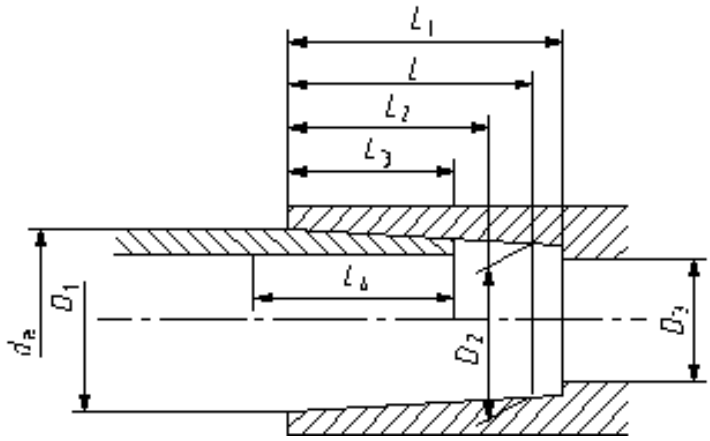
Table A.2 — Socket dimensions for fittings nominal sizes 75 to 125 inclusive

Dimensions in millimetres

Nom. size DN/OD	Mean outside diameter of pipe		Nominal inside diameter of socket	Mean inside diameter of socket				Out-of-roundness	Min. bore	Socket ref. length	Heated socket length [a]		Penetration of pipe into socket [a]	
				Mouth		Root								
	$d_{em,min}$	$d_{em,max}$	d_n	$D_{1,min}$	$D_{1,max}$	$D_{2,min}$	$D_{2,max}$		D_3	L_{min}	$L_{2,min}$	$L_{2,max}$	$L_{3,min}$	$L_{3,max}$
75	75,0	75,5	75	74,3	74,8	73,0	73,5	0,7	59	30	26	30	25	29
90	90,0	90,6	90	89,3	89,9	87,9	88,5	1,0	71	33	29	33	28	32
110	110,0	110,6	110	109,4	110,0	107,7	108,3	1,0	87	37	33	37	32	36
125	125,0	125,6	125	124,4	125,0	122,6	123,2	1,0	99	40	36	40	35	39

a $L_{2,min} = (L_{min} - 4)$ mm; $L_{2,max} = L_{min}$ mm.

b $L_{3,min} = (L_{min} - 5)$ mm; $L_{3,max} = (L_{min} - 1)$ mm.



Key

D_1 is the "mean inside mouth diameter" of the socket, i.e. the means diameter of the circle at the inter section of the extension of the socket with the plane of the socket mouth;

D_2 is the "mean inside root diameter" of the socket, i.e. the mean diameter of the circle in a plane parallel to the plane of the mouth and separated from it by a distance of *L,* which is the reference length of the socket;

D_3 is the "minimum bore", i.e. the minimum diameter of the flow channel through the body of the fitting;

L is the "reference socket length" i.e. the theoretical minimum socket length used for the purpose of calculation;

L_1 is the "actual length of the socket" from mouth to shoulder, if any;

L_2 is the "heated length of the fitting" i.e. the length of penetration of the heated tool into the socket.;

L_3 is the "insertion depth" i.e. the depth of the heated pipe end into the socket;

L_4 is the "heated length of pipe" i.e. the depth of penetration of the pipe end into the heated tool.

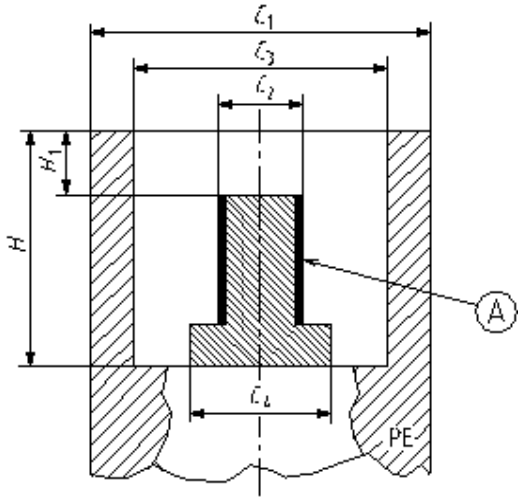
Figure A.1 — Socket and pipe - Symbols for dimensions

Annex B
(informative)

Examples of typical terminal connection for electrofusion fittings

Figures B.1 and B.2 illustrate examples of terminal connections suitable for use with voltages less than or equal to 48 V (types A and B).

Dimensions in millimetres

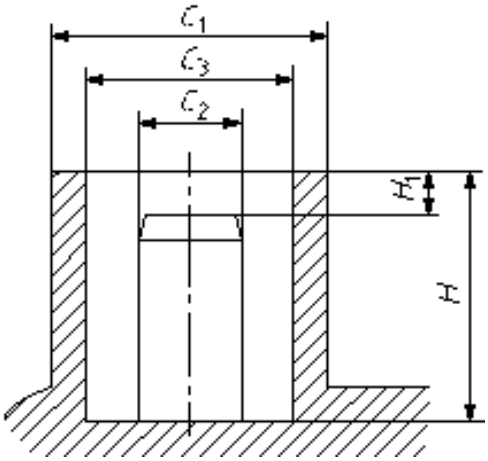


Key

A	is active zone	
C_1	outside diameter of the terminal shroud	$C_1 \geq 11{,}8$
C_2	diameter of the active part of the terminal	$C_2 = 4{,}0 \pm 0{,}03$
C_3	internal diameter of the terminal shroud	$C_3 = 9{,}5 \pm 1{,}0$
C_4	maximum overall diameter of the base	$C_4 \leq 6{,}0$
H	internal depth of the terminal shroud	$H \geq 12{,}0$
H_1	distance between the upper part of the terminal and the active part	$H_1 = 3{,}2 \pm 0{,}5$

Figure B.1 — Typical type A connection

Dimensions in millimetres



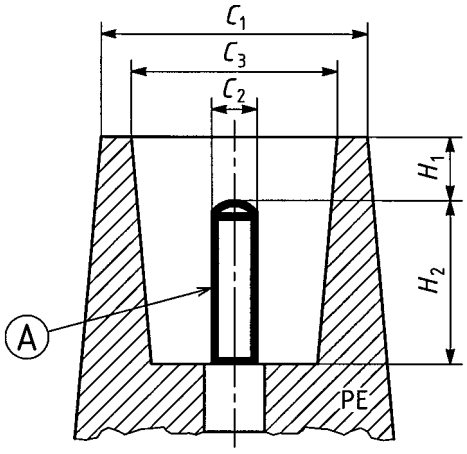
Key

C_1	outside diameter of the terminal shroud	$C_1 = 13{,}0 \pm 0{,}05$
C_2	diameter of the active part of the terminal	$C_2 = 4{,}7 \pm 0{,}03$
C_3	internal diameter of the terminal shroud	$C_3 = 10{,}0\ ^{0{,}5}_{0}$
H	internal depth of the terminal shroud	$H \geq 15{,}5$
H_1	distance between the upper part of the terminal shroud and the active part	$H_1 = 4{,}5 \pm 0{,}5$

Figure B.2 — Typical type B connection

Figure B.3 illustrates an example of a typical electrofusion terminal connection suitable for use with voltages up to 250 V (type C).

Dimensions in millimetres



Key

C_1	outside diameter of the terminal	$C_1 \geq C_3 + 2{,}0$
C_2	diameter of the active part of the terminal	$C_2 \geq 2{,}0$
C_3	internal diameter of the terminal	$C_3 \geq C_2 + 4{,}0$
H_1	distance between the upper part of the terminal and the active part	H_1 sufficient to ensure a degree of protection of I P 2 × as defined in EN 60947-1[9])
H_2	is the height of the active part	$H_2 \geq 7{,}0$

Figure B.3 — Typical type C connection

Bibliography

[1] EN 60335-1, *Safety of household and similar electrical appliances — Part 1: General requirements (IEC 60335-1:1991, modified).*

[2] IEC 60364-1, *Electrical installations of buildings - Part 1: Fundamental principles, assessment of general characteristics, definitions.*

[3] IEC 60449, *Voltage bands for electrical installations of building.*

[4] EN 60529, *Degree of protection provided by enclosures (IP Code) (IEC 60529:1989).*

[5] ISO 8085-3, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels –Metric series – Specifications – Part 3: Electrofusion fittings.*

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

[7] prCEN/TS 12201-7, *Plastics piping systems for water supply — Polyethylene (PE) — Part 7: Guidance for the assessment of conformity*.

[8] ISO/TR 10358, *Plastics pipes and fittings — Combined chemical-resistance classification table.*

[9] EN 60947-1, *Low-voltage switchgear and control gear — Part 1: General rules (IEC 60947-1:1999, modified).*

National Annex NA (informative)
Additional information on the selection and installation of piping systems and components in the UK

The responsible UK committee gives the following advice concerning the selection and installation of piping systems and components conforming to this British Standard.

a) Water supply companies and other entities deemed to be within the scope of the Public Procurement Directive (PPD) are obliged to use EN 12201-1, EN 12201-2, EN 12201-3, EN 12201-4 and EN 12201-5 produced under EC/U mandate, if they wish to purchase PE pipe systems or components within its scope.

b) Where there are options, care should be taken to ensure that agreement is established between suppliers and purchasers, e.g. in terms of colour, size, physical characteristics, effect on water quality and quality assurance.

c) It is the practice of UK water companies to use blue coloured PE pipes and fittings as specified in WIS 4-32-14 [1] to facilitate identification of buried potable water pipelines in accordance with the recommendations of the National Joint Utilities Group (NJUG) concerning the colour coding of pipelines and other services.

d) Attention is drawn to Note a to Table 1 concerning fusion zone lengths. For applications within the UK water industry suitable minimum fusion lengths are specified in WIS 4-32-14 [1].

e) The use of pipes and components manufactured in PE 40 and PE 63 materials is not established practice in the UK.

f) It has been UK practice to specify a test to guard against leakage or contamination as a result of biodegradation of elastomeric sealing rings or gaskets used in piping systems. This requirement is specifically excluded from the scope of BS EN 681-1. For manufacturers wishing to demonstrate resistance of such products to biodegradation, a test is contained in BS 7874.

g) The minimum lengths of spigots specified in Table 3 do not allow for the use of mechanical scrapers. Spigot lengths which do allow for this are specified in WIS 4-32-15 [2].

h) With reference to **4.2.1**, in those cases where there is no relevant European standard, an appropriate specification for use in the UK for component parts made from thermoplastic materials other than PE is provided in WIS 4-32-11 (Issue 2) [3].

i) The electrical characteristics for electrofusion fittings are loosely specified in **5.4**. It is current UK practice to specify 4.7 mm diameter electrofusion terminal pins in association with an applied voltage of 39 V to 40 V and with a maximum power requirement for the 40 V fittings of 2.5 kW (this aligns with WIS 4-32-14 [1]).

National bibliography

Standards publications

BS 7874:1998, *Method of test for microbiological deterioration of elastomeric seals for joints in pipework and pipelines.*

BS EN 681-1:1996, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber.*

Other publications

[1] WRc. WIS 4-32-14, *Specification for PE 80 and PE 100 electrofusion fittings for nominal sizes up to and including 630*. Swindon: WRc, 1995.

[2] WRc. WIS 4-32-15, *Specification for PE 80 and PE 100 spigot fittings and drawn bends for nominal sizes up to and including 1000*. Swindon: WRc, 1995.

[3] WRc. WIS 4-32-11 (Issue 2), *Specification for thermoplastic end-load resistant mechanical joints for polyethylene pipes of nominal size ≤ 63*. Swindon: WRc, 1999.

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