BS EN 1555-5:2021

BSI Standards Publication

Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE)

Part 5: Fitness for purpose of the system

bsi.

National foreword

This British Standard is the UK implementation of EN 1555-5:2021. It supersedes BS EN 1555-5:2010, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/88/2, Plastics piping for pressure applications.

A list of organizations represented on this committee can be obtained on request to its committee manager.

NOTE 1 There is no Part 6 in the EN 1555 series. Users of this standard should refer to BS EN 12007-2, *Gas infrastructure – Pipelines for maximum operating pressure up to and including 16 bar – Part 2: Specific functional requirements for polyethylene (MOP up to and including 10 bar)*. Users of this standard are also referred to the guidance issued by Cadent, for example T/PR/ML/4, *Work procedure for pipe system construction Module 4 – PE main laying up to and including 630 mm diameter at pressures up to and including 2 bar*.

NOTE 2 Part 7 of the EN 1555 series is under development as a CEN Technical Specification to allow further development. CEN/TS 1555-7 is not mandatory under the Public Procurement Directives (2004/18/EC and 2004/17/EC).

Users should be aware of any appropriate safety precautions related to pipework for combustible gas (see T/PR/ML/4). It is assumed in the drafting of a standard that the execution of its provisions is entrusted to appropriately qualified and competent people.

National Annex NA, which is appended at the back of this document, provides additional information on the selection and installation of piping systems and components in the UK.

Attention is drawn to the statutory legislation the Health and Safety at Work etc. Act 1974 and subsequent regulations.

The UK committee emphasizes that compliance with this British Standard does not necessarily mean that products are fit for the purpose of conveying gaseous fuels in the UK. The EN 1555 series of standards are not fully compatible with existing UK practice in terms of applicable pressure tiers, preferred colours for gas pipe recognition, jointing and installation methods.

The requirements contained in the EN 1555 series of standards are not necessarily indicative of all the performance requirements, or the suitability of pipework for the service conditions, likely to be encountered in the UK.

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Kunststoff-Rohrleitungssysteme für die Gasversorgung - Polyethylen (PE) - Teil 5: Gebrauchstauglichkeit des Systems

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European foreword

This document (EN 1555-5:2021) 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 January 2022, and conflicting national standards shall be withdrawn at the latest by January 2022.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1555-5:2010.

In comparison with the previous version, the following technical modifications have been introduced:

— PE 100-RC type materials with enhanced resistance to slow crack growth have been added.

— Annex A in EN 1555 1:2021 now discusses the performance of this type of material and gives additional information for non-conventional installation techniques.

— Test methods have been updated.

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

The System Standards are consistent with general standards on functional requirements and on recommended practice for installation.

EN 1555 consists of the following parts:

— EN 1555-1, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 1: General;*

— EN 1555-2, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE)* — Part 2: Pipes;

— EN 1555-3, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 3: Fittings;*

— EN 1555-4, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 4: Valves;*

— EN 1555-5, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 5: Fitness for purpose of the system (this standard);*

— CEN/TS 1555-7, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 7: Guidance for assessment of conformity.*

NOTE EN 12007-2 [1], prepared by CEN/TC 234 “Gas infrastructure”, deals with the recommended practice for installation of plastics pipes system in accordance with EN 1555 (all parts).

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document specifies the requirements of a piping system and its components made from polyethylene (PE) and which is intended to be used for the supply of gaseous fuels.

Requirements and test methods for material and components are specified in EN 1555-1:2021, EN 1555-2:2021, EN 1555-3:2021 and EN 1555-4:2021.

CEN/TS 1555-7 [2] gives guidance for assessment of conformity. Recommended practice for installation is given in EN 12007-2 [1] prepared by CEN/TC 234.

This part of EN 1555 covers the characteristics of fitness for purpose of the system.

1 Scope

This document specifies the requirements of fitness for purpose of the polyethylene (PE) piping system in the field of the supply of gaseous fuels.

It specifies the requirements for electrofusion, butt fusion and mechanical joints.

It specifies the method of preparation of test piece joints, and the tests to be carried out on these joints for assessing the fitness for purpose of the system under normal and extreme conditions.

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

NOTE 1 This document is intended only to be used by the product manufacturer to assess the performance of components according to EN 1555-2, EN 1555-3:2021, and EN 1555-4:2021 when joined together under normal and extreme conditions in accordance with this document. It is not intended for on-site testing of pipe systems.

In conjunction with Parts 1 to 4 of EN 1555, it is applicable to PE pipes, fittings, valves, their joints and to joints with components of other materials intended to be used under the following conditions:

a) a maximum operating pressure, MOP, up to and including 10 bar[1] at a reference temperature of 20 °C for design purposes;

b) an operating temperature between − 20 °C and 40 °C.

NOTE 2 For other operating temperatures between 20 °C and 40 °C, derating coefficients are defined in Annex A.

EN 1555 (all parts) covers a range of maximum operating pressures and gives requirements concerning colours.

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.

EN 1555-1:2021, *Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 1: General*

EN 1555-2:2021, *Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 2: Pipes*

EN 1555-3:2021, *Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 3: Fittings*

EN 1555-4:2021, *Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 4: Valves*

EN ISO 1167-1:2006, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure - Part 1: General method (ISO 1167-1:2006)*

EN ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure - Part 2: Preparation of pipe test pieces (ISO 1167-2)*

EN ISO 1167-4, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure - Part 4: Preparation of assemblies (ISO 1167-4)*

EN ISO 13477, *Thermoplastics pipes for the conveyance of fluids - Determination of resistance to rapid crack propagation (RCP) - Small-scale steady-state test (S4 test) (ISO 13477)*

[1] 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

EN ISO 13478, *Thermoplastics pipes for the conveyance of fluids - Determination of resistance to rapid crack propagation (RCP) - Full-scale test (FST) (ISO 13478)*

ISO 11413:2019, *Plastics pipes and fittings - Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting*

ISO 11414:2009, *Plastics pipes and fittings - Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion*

ISO 13953, *Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

ISO 13954, *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, *Plastics pipes and fittings - Crushing decohesion test for polyethylene (PE) electrofusion assemblies*

ISO 13956, *Plastics pipes and fittings - Decohesion test of polyethylene (PE) saddle fusion joints - Evaluation of ductility of fusion joint interface by tear test*

ISO 17885, *Plastics piping systems - Mechanical fittings for pressure piping systems - Specifications*

3 Terms and definitions

For the purposes of this document, the terms and definitions, symbols and abbreviations given in EN 1555-1:2021 and EN 1555-3:2021, and the following definition apply.

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

• IEC Electropedia: available at https://www.electropedia.org/

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

4 Symbols and abbreviations

For the purpose of this document the symbols and abbreviations given in EN 1555-1-2021 apply.

5 Fitness for purpose

5.1 Method of preparation of assemblies for testing

5.1.1 General

The joints shall be made by using pipes conforming to EN 1555-2, fittings conforming to EN 1555-3:2021 or valves conforming to EN 1555-4:2021.

Test pieces for pressure test shall be closed with pressure-tight, end-load-bearing end caps, plugs or flanges which shall be provided with connections for the entry of water and release of air.

The peelable layer of peelable layer pipe shall be removed in the area of the joint prior to jointing.

5.1.2 Butt fusion joints

PE pipes, spigot end fittings and valves intended to be used for jointing by butt fusion shall be prepared and assembled in accordance with ISO 11414. The conditions for the preparation of the joints are given in 5.2.2.1 for the assessment of fitness for purpose under normal conditions and in 5.2.2.2 for the assessment of fitness for purpose under extreme conditions.

5.1.3 Electrofusion jointing

PE pipes, fittings and valves intended to be used for jointing by electrofusion shall be prepared and assembled in accordance with ISO 11413. The conditions for the preparation of the joints are given in 5.2.3.1 for the assessment of fitness for purpose under normal conditions and in 5.2.3.2 for the assessment of fitness for purpose under extreme conditions.

For joints with electrofusion saddle fittings, the electrofusion saddle fitting shall be fused to the pipe, while it is pneumatically pressurized to the allowable maximum operating pressure. The pipe shall be cut immediately after the manufacturer prescribed cooling time has elapsed.

NOTE These joints with electrofusion saddle fitting are expected to take national safety regulations into consideration when being prepared.

For electrofusion coupler test joints on selected diameters out of the product range shall be prepared with a gap of $0{,}05d_n$ between the pipe end and the maximum theoretical depth of penetration of the fitting, where for diameters greater than 225 mm the adjoining pipes shall be arranged to provide the maximum angular deflection possible for the fitting, limited to 1,5 °.

5.1.4 Mechanical joints

For mechanical joints the assembly of the PE pipe and the fitting shall be prepared in accordance with ISO 17885.

5.2 Requirements for fitness for purpose

5.2.1 General

When tested in accordance with the test methods as specified in Table 5 using the indicated parameters, pipes and fittings shall have mechanical characteristics conforming to the requirements given in Table 5, as applicable to the following types of joint assemblies with pipe:

— (A) electrofusion socket fittings;

— (B) electrofusion saddle fitting;

— (C) spigot end fitting;

— (D) pipes.

5.2.2 Fitness for purpose of butt fusion joints

5.2.2.1 Under normal conditions (ambient temperature 23 °C)

For the assessment of fitness for purpose under normal conditions, butt fusion joints shall have the characteristic of hydrostatic strength and tensile strength conforming to the requirement given in Table 5, using the parameters as specified in ISO 11414:2009, Annex B, Condition 1 at an ambient temperature of (23 ± 2) °C and the scheme listed in Table 1.

Table 1 — Scheme for butt-fused joints

Pipe/spigot end fitting/valve with spigot ends	Pipe	
	PE 80	PE 100 or PE 100-RC
PE 80	X	X [a]
PE 100 or PE 100-RC	X [a]	X
[a] Only when requested by the purchaser. For example, a PE100 pipe shall be tested with a PE 100 or PE 100-RC pipe. Only when requested by the purchaser a PE 80 pipe shall be incorporated in the test assembly.		

The pipe manufacturer shall declare which pipes from his own product range manufactured from different compounds conforming to EN 1555-2 are compatible to each other for butt fusion.

The fitting or valve manufacturer shall declare the SDR range and MRS values of pipes to which his spigot end fittings and/or his spigot end valves can be fused by using the same procedures (e.g. times, temperatures, fusion pressures) to conform to this document. If there is a need for deviation in fusion procedures the fitting or valve manufacturer shall state this clearly.

5.2.2.2 Under extreme conditions

For butt fusion joints, the characteristics to be examined for fitness for purpose under extreme conditions shall conform to Table 2. Extreme conditions are specified in ISO 11414:2009 Annex B.

Table 2 — Characteristics for fitness for purpose of the system

Butt fusion joint (C) (D)	Associated characteristics
Both components of the joint: same MRS and same SDR Joint: minimum and maximum condition [a]	Hydrostatic strength (80 °C, 165 h)
Both components of the joint: same MRS and same SDR Joint: minimum and maximum condition [a]	Tensile strength for butt fusion joint
[a] As specified in ISO 11414:2009, Clause 7, item a), concerning misalignment and the limit values of fusion parameters conforming to in ISO 11414:2009, Annex B, Condition 2 and 3·	

When tested in accordance with the test methods as specified in Table 5 using the indicated parameters, the joints shall have characteristics conforming to the requirements given in Table 5.

The fitting or valve manufacturer shall declare according to Table 2, as applicable, the fitness for purpose under extreme conditions of his fittings or valves.

The pipe manufacturer shall declare according to Table 2 the fitness for purpose under extreme conditions of his pipes (PE pipes, PE pipes with co-extruded layers, PE pipes with peelable layers).

5.2.3 Fitness for purpose for electrofusion joints

5.2.3.1 Under normal conditions (ambient temperature 23 °C)

For the assessment of fitness for purpose under normal conditions, electrofusion joints shall have the characteristic of decohesive resistance or cohesive strength, as applicable, conforming to the requirement given in Table 5, using the assembly as specified in ISO 11413:2019, Annex C, condition 1 at an ambient temperature of (23 ± 2) °C and the scheme listed in Table 3.

Table 3 — Scheme for electrofusion assemblies

Electrofusion fitting/valve with electrofusion socket	**Pipe** [b]	
	PE 80 [a] SDR maximum	**PE 100 or PE 100-RC** SDR minimum
PE 80	X	X
PE 100 or PE 100-RC	X	X

[a] If pipes with PE 80 SDR maximum are not available, PE 100 or PE 100-RC pipes with SDR maximum may be used.

[b] Pipe SDR maximum and pipe SDR minimum, as declared by the fitting manufacturer.

The fitting or valve manufacturer shall declare the SDR range and MRS values of pipes to which fittings and valves can be fused by using the procedures and parameters to conform to this document. If there is a need for deviation from fusion procedures and parameters, the fitting or valve manufacturer shall state this clearly.

5.2.3.2 Under extreme conditions

For electrofusion joints the characteristics to be examined for fitness for purpose under extreme conditions shall conform to Table 4. Extreme conditions are specified in ISO 11413:2019.

When tested in accordance with the test methods as specified in Table 5 using the indicated parameters, the joints shall have characteristics conforming to the requirements given in Table 5.

Table 4 — Relation between the joints and fitness for purpose characteristics

Electrofusion joint including socket fitting [a] **(A)**	**Electrofusion joint including saddle fitting** [a] **(B)**	**Associated characteristics**
Pipe: MRS maximum [b] SDR minimum [b] Joint conditions: 2,2 and 3,2 [c]		Decohesive resistance
	Pipe: MRS maximum b SDR minimum b Joint conditions: 2,2 and 3,2 [c]	Evaluation of ductility of fusion joint interface

[a] If accepted by the purchaser, the minimum and maximum energy conditions 2,2 and 3,2 can be replaced by a nominal energy at a given ambient temperature T_a defined by the fitting manufacturer (see ISO 11413:2019, subclause 4.3).

[b] As declared by the fitting manufacturer according to subclause 5.2.3.1.

[c] As specified in ISO 11413:2019, Annex C with T_{min} and T_{max} as stated in the fitting manufacturer's technical specification.

The fitting or valve manufacturer shall declare according to Table 4, column(s) A, or B, as applicable, the fitness for purpose under extreme conditions of his fittings or valves with the type of pipe being specified.

5.2.4 Fitness for purpose for mechanical joints

For fitness for purpose of mechanical joints the performances of the joints shall conform to ISO 17885.

For testing mechanical fittings according to ISO 17885, the nominal pressure is determined by the MOP declared by the manufacturer multiplied by 1,6.

5.3 Conditioning

The test pieces shall be conditioned at (23 ± 2) °C before testing, unless otherwise specified by the applicable test method as specified in Table 5.

5.4 Requirements

The requirements for characteristics of fitness for purpose are given in Table 5.

Table 5 — Characteristics for fitness for purpose of the system

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Hydrostatic strength (80 °C, 165 h) (C) (D)	No failure during the test period	End caps Orientation Conditioning time Number of test pieces [b] Type of test Circumferential (hoop) Stress [d] for: PE 80 PE 100 or PE 100-RC Test period [c] Test temperature	Type A [a] Free Shall conform to EN ISO 1167-1:2006 3 Water-in water [e] 4,5 MPa 5,4 MPa 165 h 80 °C	EN ISO 1167-1:2006 together with EN ISO 1167-2, or EN ISO 1167-4, as applicable
Decohesive resistance (A)	Length of initiation rupture ≤ L/3 in brittle failure [f]	Test temperature Number of test pieces [b]	23 °C Shall conform to ISO 13954	ISO 13954 [g]
		Test temperature Number of test pieces [b g]	23 °C Shall conform to ISO 13955	ISO 13955 [g]
Evaluation of ductility of fusion joint interface (B)	Ld ≤ 50 % and Ad ≤ 25 % [i] Brittle failure	Test temperature Number of test pieces [b]	23 °C Shall conform to ISO 13956	ISO 13956 [g]
Tensile strength for butt fusion [j] (C) (D)	Test to failure: ductile: pass brittle: fail	Test temperature Number of test pieces [b]	23 °C Shall conform to ISO 13953	ISO 13953

[a] Type B end caps may be used for tests for diameters ≥ 500 mm.

[b] The number of test pieces given indicates the number required to establish a value for the characteristic described in Table 5. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan. Guidance on assessment of conformity can be found in CEN/TS 1555-7 [1].

[c] Only brittle failures shall be taken into account. If a ductile failure occurs before 165 h, the test may be repeated at a lower stress. The stress and the associated minimum test period shall be selected from Table 6 or from a line based on the stress/time points given in Table 6.

[d] For testing assemblies with fittings the test pressure shall be calculated using the design standard dimension ratio of the fitting. Test pressure for pipe shall be calculated using nominal dimensions.

[e] Alternatively, for d_n > 450 mm, the test can also be performed water in air. In case of dispute, water-in-water shall be used.

[f] Longest length of brittle failure in any of the test samples, with L being the nominal length of the fusion zone of the electrofusion socket fitting.

[g] Test sample can be mechanically reduced in wall thickness for testing purpose of large diameter fittings by keeping a minimum of 15 mm wall thickness of each component.

[h] For type A and type B fittings, alternatively the Strip-bend test according to ISO 21751 [3] can be used.

[i] In case of use of the Strip-bend test according to ISO 21751 [3] only the Ld requirement of ≤ 50 % shall be considered.

[j] Applicable to d_n ≥ 90 mm.

Table 6 — Circumferential (hoop) stress at 80 °C and associated minimum test period

PE 80		PE 100 and PE 100-RC	
Stress	**Minimum test time**	**Stress**	**Minimum test time**
MPa	h	MPa	h
4,5	165	5,4	165
4,4	233	5,3	256
4,3	331	5,2	399
4,2	474	5,1	629
4,1	685	5,0	1 000
4,0	1 000	—	—

5.5 Testing of pipe with coextruded layers

There shall be no evidence of delamination of layers during or after testing of coextruded pipe.

6 Design coefficient

The minimum value of the design coefficient, C, for pipes, fittings and valves for the supply of gaseous fuels shall be at least 2.

To this value other coefficients may be applied taking into account different aspects such as:

a) operating temperature range;

NOTE 1 For information about derating coefficients for other operating temperatures, see Annex A.

b) specific material aspects, for instance Rapid Crack Propagation (RCP);

NOTE 2 For information about RCP resistance at temperatures less than 0 °C, see Annex B.

c) storage and laying conditions.

Annex A
(informative)

Derating coefficients for operating temperatures

Derating factor (DF) is a coefficient used in the calculation of the maximum operating pressure (MOP), which takes into account the influence of operating temperature.

Table A.1 gives derating coefficients for various operating temperatures.

Table A.1 — Temperature derating coefficients

Temperature	Derating coefficient (DF)
20 °C	1,0
30 °C	1,1
40 °C	1,3

For other temperatures between each step, linear interpolation is permitted.

The calculation of MOP for a given operating temperature is based on the following equation:

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

in which the value of the design coefficient, C, shall not be less than 2 in accordance with Clause 5.

Annex B
(normative)

Rapid crack propagation (RCP) resistance of pipe at temperature less than 0 °C

Pipes intended for the distribution of gas at temperature less than 0 °C, e.g. liquid petroleum gas (LPG) systems and in use downstream of pressure reduction stations, shall be subjected to additional rapid crack propagation (RCP) evaluation in accordance with EN ISO 13477 or EN ISO 13478, to determine the critical pressure pc at the minimum expected operating temperature; see EN 1555-1.

NOTE More information can be found in EN 12007-2 [1].

Bibliography

[1] EN 12007-2, *Gas infrastructure - Pipelines for maximum operating pressure up to and including 16 bar - Part 2: Specific functional requirements for polyethylene (MOP up to and including 10 bar)*

[2] CEN/TS 1555-7, *Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 7: Guidance for the assessment of conformity*

[3] ISO 21751, *Plastics pipes and fittings - Decohesion test of electrofusion assemblies - Strip-bend test*

National Annex NA
(informative)

Additional information on the selection and installation of piping systems and components in the UK

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

a) CE marking against the Construction Products Directive and the Pressure Equipment Directive does not apply to pipes and fittings within the scope of BS EN 1555-1, BS EN 1555-2 and BS EN 1555-3. However, CE marking might apply to valves within the scope of BS EN 1555-4. For England, Scotland and Wales, the UKCA (UK Conformity Assessed) mark covers most goods that previously required the CE mark. For Northern Ireland, either the CE mark or the UKNI mark applies. For information on using the UKCA mark, see www.gov.uk/guidance/using-the-ukca-marking.

b) Attention is drawn to Subclause 5.1.1 of this standard and to the requirements that joints be made by using pipes conforming to EN 1555-2, fittings conforming to EN 1555-3 or valves conforming to EN 1555-4. The tests within these standards confirm the compatibility of components and the efficacy and fitness for purpose of pipes, jointing systems and assemblies of components in withstanding variations in assembly conditions and the operating pressures and temperatures generated within gas distribution systems.

c) Attention is also drawn to the necessity of following the manufacturer's instructions on correct jointing procedure. Butt-welding parameters for welding pipe to pipe are the responsibility of the pipe manufacturer. Butt-welding parameters for welding pipes to spigot fittings are the responsibility of the fitting manufacturer. Electrofusion welding parameters are the responsibility of the fitting manufacturer. In particular, the need to scrape the pipe or remove the layer from pipe with a peelable skin prior to electrofusion jointing should be established with the manufacturer of the electrofusion fittings.

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