BS EN 1555-4:2021 — Tracked Changes

compares BS EN 1555-4:2021
with BS EN 1555-4:2011

BSI Standards Publication

Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 4: Valves

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National foreword

This British Standard is the UK implementation of EN 1555-4:2011. It supersedes BS EN 1555-4:2002 which is withdrawn.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 secretary.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2011.

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EUROPEAN STANDARD

NORME EUROPÉENNE

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BS EN 1555-4

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English Version

~~Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 4: Valves~~Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 4: Valves

~~Systèmes de canalisations en plastique pour la distribution de combustibles gazeux — Polyéthylène (PE) — Partie 4 : Robinets~~Systèmes de canalisations en plastique pour la distribution de combustibles gazeux - Polyéthylène (PE) - Partie 4 : Robinets

~~Kunststoff-Rohrleitungssysteme für die Gasversorgung — Polyethylen (PE) — Teil 4: Armaturen~~Kunststoff-Rohrleitungssysteme für die Gasversorgung - Polyethylen (PE) - Teil 4: Armaturen

This European Standard was approved by CEN on ~~17 March 2011~~7 June 2021.

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 CEN-CENELEC Management Centre or to any CEN member.

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. BS EN 1555-4: ~~2011~~2021 E

~~Foreword~~European foreword

This document (~~EN 1555-4:2011~~EN 1555-4:2021) 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 ~~November 2011~~January 2022, and conflicting national standards shall be withdrawn at the latest by ~~November 2011~~January 2022.

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

This document supersedes ~~EN 1555-4:2002~~EN 1555-4:2011.

~~It~~This document has been prepared in liaison with Technical Committee CEN/TC 234 “Gas infrastructure”.

System Standards are based on the results of the work 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 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* (this standard);

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

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

The revision of this System Standard has been carried out principally to add the PE 100-RC type materials with enhanced resistance to slow crack growth. Annex A in EN 1555-1:2021 discusses the performance of this type of material and gives additional information for non-conventional installation techniques. The diameter range for valves has been increased to 400 mm. An improved description of the leaktightness test is given. Annex B has been added to describe the leaktightness test after the tensile test, following the withdrawal of ISO 10933. In addition test methods have been updated and a new method has been added for PE 100-RC materials.

NOTE ~~EN 12007-2:2000~~EN 12007-2~~[1]~~ [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)~~ EN 1555 (all parts).

According to the CEN~~/~~-CENELEC Internal Regulations, the national standards ~~organizations~~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.

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Introduction

~~The System Standard~~This document, ~~of which this is Part 4,~~ specifies the requirements for 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, other than valves, are specified in ~~EN 1555-1~~EN 1555-1:2021, ~~EN 1555-2~~EN 1555-2:2021 and ~~EN 1555-3~~EN 1555-3:2021.

Characteristics for fitness for purpose are covered in ~~EN 1555-5~~EN 1555-5:2021. CEN/TS 1555-7. ~~CEN/TS 1555-7[2]~~ [2] gives guidance for assessment of conformity. Recommended practice for installation is given in ~~EN 12007-2:2000~~EN 12007-2:2012~~[1]~~ [1] prepared by CEN/TC 234.

This part of EN 1555 covers the characteristics of valves.

INTERNATIONAL STANDARD

1 Scope

This ~~part of~~document ~~EN 1555~~ specifies the characteristics of valves made from polyethylene (PE) for piping systems in the field of the supply of gaseous fuels.

~~NOTE 1 Valves made from other material than polyethylene designed for the supply of gaseous fuels conforming to the relevant standards are permitted to be used in PE piping system according to EN 1555 provided they have relevant PE connection for butt fusion or electrofusion ends (see EN 1555-3).~~

It is applicable to isolating unidirectional and bi-directional valves with spigot ends or electrofusion sockets intended to be fused with PE pipes or fittings conforming to EN 1555-2:2021 and EN 1555-3:2021 respectively.

Valves made from materials other than PE, designed for the supply of gaseous fuels conforming to the relevant standards can be used in PE piping systems according to EN 1555, provided that they have PE connections for butt fusion or electrofusion ends, including integrated material transition joints, conforming to EN 1555-3:2021.

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

In conjunction with Parts 1, 2, 3 and 5 of EN 1555, it is applicable to PE valves, 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 and including 10 bar[1] ~~1)~~at a reference temperature of 20 °C for design purposes;

NOTE 1 For the purpose of this document and the references to EN ISO 8233[2], MOP is considered to be nominal pressure.

~~b) an operating temperature of 20 °C as reference temperature;~~

~~NOTE 2 For other operating temperatures, derating coefficients should be used, see EN 1555-5.~~

~~c~~b) an operating temperature between −20 °C ~~and +~~to 40 °C.

NOTE 2 For operating temperatures between 20 °C and 40 °C, derating coefficients are defined in EN 1555-5.

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

NOTE 3 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 regulations and installation practices or codes.

~~It is applicable to bi-directional valves with spigot end or electrofusion socket intended to be fused with PE pipes conforming to EN 1555-2 without any fittings or with PE fittings conforming to EN 1555-3.~~

This ~~European Standard~~document covers ~~valves~~valve bodies designed for connection with pipes with a nominal outside diameter $d_n \leq$ ~~315~~ 400 mm.

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

~~1) 1 bar = 0,1 MPa.~~

2 Normative references

The following ~~referenced~~ documents are ~~indispensable for~~referred to in the ~~application~~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 682, *Elastomeric Seals - Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*

~~EN 736-1:1995~~EN 736-1:2018, *Valves - Terminology - Part 1: Definition of types of valves*

~~EN 736-2:1997~~EN 736-2:2016, *Valves - Terminology - Part 2: Definition of components of valves*

~~EN 744:1995~~EN 736-3:2008, ~~*Plastics piping and ducting systems — Thermoplastics pipes — Test method for resistance to external blows by the round-the-clock method*~~*Valves - Terminology - Part 3: Definition of terms*

~~EN 1555-1:2010~~EN 1555-1:2021, *Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 1: General*

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

~~EN 1555-3:2010~~EN 1555-3:2021, *Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 3: Fittings*

~~EN 1555-5~~EN 1555-5:2021, *Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 5: Fitness for purpose of the system*

EN 1680, *Plastics piping systems - Valves for polyethylene (PE) piping systems - Test method for leaktightness under and after bending applied to the operating mechanisms*

EN 1704, *Plastics piping systems - Thermoplastics valves - Test method for the integrity of a valve after temperature cycling under bending*

EN 1705, *Plastics piping systems - Thermoplastics valves - Test method for the integrity of a valve after an external blow*

EN 12100, *Plastics piping systems - Polyethylene (PE) valves - Test method for resistance to bending between supports*

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

EN 12119, *Plastics piping systems - Polyethylene (PE) valves - Test method for resistance to thermal cycling*

~~*EN 28233, Thermoplastic valves — Torque — Test method (ISO 8233:1988)*~~

~~EN ISO 1133~~EN ISO 1133-1, *Plastics - Determination of the melt mass-flow rate (MFR) and ~~the~~ melt volume-flow rate (MVR) of thermoplastics - Part 1: Standard method (~~ISO 1133:2005~~ISO 1133-1)*

~~EN ISO 1167-1~~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~~ISO 1167-1:2006)*

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 1167-4:2007~~ISO 1167-4)*

EN ISO 3127:2017, *Thermoplastics pipes - Determination of resistance to external blows - Round-the-clock method (ISO 3127:1994)*

EN ISO 3126, *Plastics piping systems - Plastics components - Determination of dimensions (~~ISO 3126:2005~~ISO 3126:2005)*

~~ISO 10933~~EN ISO 8233[2], ~~*Polyethylene (PE) valves for gas distribution systems*~~*Thermoplastic valves - Torque - Test method (ISO/FDIS 8233)*

~~ISO 11357-6~~EN ISO 11357-6, *Plastics - Differential scanning calorimetry (DSC) - Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT) (ISO 11357-6)*

EN ISO 17778, *Plastics piping systems - Fittings, valves and ancillaries - Determination of gaseous flow rate/pressure drop relationships (ISO 17778)*

3 Terms and definitions~~, symbols and abbreviations~~

For the purposes of this document, the terms and definitions, symbols and abbreviations given in ~~EN 1555-1:2010~~EN 1555-1:2021, ~~EN 736-1:1995~~EN 736-1:2018, ~~EN 736-2:1997~~EN 736-2:2016 and the following apply.

~~**3.1**~~
~~**external leaktightness**~~
~~leaktightness of the valve body enveloping the space containing the gas, with respect to the atmosphere~~

~~**3.2**~~
~~**internal leaktightness**~~
~~leaktightness between the inlet and the outlet of the valve, with the valve in the closed position~~

~~**3.3**~~
~~**leaktightness test**~~
~~test for both of the following characteristics:~~

~~a) the internal leaktightness of a valve's closing seat when closed and pressurized from either side;~~

~~b) the external leaktightness of a valve when half open~~

~~**3.4**~~
~~**initiating torque**~~
~~torque required to initiate movement of the obturator~~

2 Under preparation. Stage at the time of publication: FprEN ISO 8233:2021.

~~**3.5**~~
~~**running torque**~~
~~torque required to achieve full opening or closing of the valve at maximum allowable operating pressure~~

~~**3.6**~~
~~**leakage**~~
~~emission of gas from a valve body, or any component of a valve~~

~~**3.7**~~
~~**valve body**~~
~~main part of a valve which contains the obturating device (closing element, the seat, the packing seals and the operating stop), as applicable and provides the terminal ends for connection to the PE pipe/fittings~~

~~**3.8**~~
~~**operating device**~~
~~part of a valve for connection with the operating key which allows the opening and the closing of the valve~~

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

3.1 General

3.1.1
external leaktightness
leaktightness of the valve body enveloping the space containing the gas, with respect to the atmosphere

3.1.2
internal leaktightness
leaktightness between the inlet and the outlet of the valve, with the valve in the closed position

3.1.3
leakage
emission of gas from a valve body, or any component of a valve

3.1.4
valve body
main part of a valve which consists of an operating stop system and contains the obturator, seat(s), stem(s) or shaft(s) and packing seals, and provides the terminal ends for connection to the PE pipe/fittings as applicable

3.1.5
operating device
part of a valve for connection with the operating key which allows the opening and the closing of the valve

~~3.9~~3.2 Terms relating to design

3.2.1
isolating valve
valve intended for use only in the closed or fully open position

[SOURCE: EN 736-1:2018]

~~3.9.1~~3.2.2
full bore valve
valve with a flow section equal to or greater than 80 % of the section corresponding to the nominal inside diameter of the body end port

[SOURCE: EN 736-3:2008]

~~3.9.2~~3.2.3
clearway valve
valve designed to have an unobstructed flow way, which allows for the passage of a theoretical sphere with a diameter that is not less than the nominal inside diameter of the body end port

[SOURCE: EN 736-3:2008]

~~3.9.3~~3.2.4
reduced bore valve
valve with a flow section equal to or greater than 36 % of the section corresponding to the nominal inside diameter of the body end port and which does not correspond to the full bore valve

[SOURCE: EN 736-3:2008]

4 Symbols and abbreviations

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

~~4~~5 Material

~~4.1~~5.1 ~~PE compound~~Compound for valve body

The PE compound from which the valve body with spigot or electrofusion socket is made shall conform to ~~EN 1555-1. The PE components of the valve shall be made only from virgin material conforming to EN 1555-1~~EN 1555-1:2021.

The PE components of the valve shall be made only from virgin material conforming to EN 1555-1:2021.

~~4.2~~5.2 Material for non-polyethylene parts

~~4.2.1~~5.2.1 General

All components shall conform to the relevant EN standard(s). Alternative standards may be applied in cases where the suitable EN standard(s) do not exist ~~provided a~~. In all cases, fitness for purpose of the components shall be demonstrated.

The materials and the constituent elements used in making the valve (including elastomers, greases and any metal parts as may be used) shall be as resistant to the external and internal environments as the other elements of the piping system, and shall have ~~a life expectancy~~an expected lifetime under the following conditions at least equal to that of the PE pipes conforming to ~~EN 1555-2~~EN 1555-2:2021, with which they are intended to be used:

a) during storage;

b) under the effect of the gas conveyed therein;

c) with respect to the service environment and operating conditions.

The requirements for the level of material performance of non-polyethylene parts shall be at least as stringent as that of the PE compound for the piping system. Reworked materials shall not be used for stress bearing polymeric parts.

Other materials used in valves in contact with the PE pipe shall not adversely affect pipe performance or initiate stress cracking.

~~NOTE Metal valve bodies for PE piping systems up to 10 bars should conform to the relevant standard of CEN/TC 69 "Industrial valves".~~

The valve manufacturer shall ensure that any transition joint between polyethylene and non-polyethylene parts and the valve body fulfil the requirements of EN 1555-3:2021.

~~4.2.2~~5.2.2 Metal parts

All metal parts susceptible to corrosion shall be adequately protected, providing this is necessary for the durability and function of the system.

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

~~4.2.3~~5.2.3 ~~Elastomers~~Sealing materials

Elastomeric seals shall conform to EN 682.

~~Other~~If other sealing materials are ~~permitted if~~used they need to be proven ~~suitable~~ for gas ~~service~~supply systems.

~~4.2.4~~5.2.4 ~~Other materials~~Greases and lubricants

Greases or lubricants shall not exude onto fusion areas, and shall not affect the long-term performance of the ~~PE~~ valve ~~or valve body~~materials.

~~Other materials conforming to 4.2.1 may be used provided that it is proven that the valves conform to this standard.~~

5.2.5 Assembly

Ancillary components of valves shall be assembled according to manufacturer's procedures and any component used in the assembly shall not prevent conformity of the valve to this document.

56 General characteristics

5.16.1 Appearance of the valve

When viewed without magnification, the internal and external surfaces of valves shall be smooth, clean and free fromshall have no scoring, cavities or other surface defects to an extent that would prevent conformity to this standarddocument.

No component of the valve shall show any signs of damage, scratches, pitting, bubbles, blisters, inclusions or cracks to an extent that would prevent conformity of the valves to the requirements of this standarddocument.

5.26.2 Colour

The colour of the PE parts of valves shall be either black, yellow or orange.

5.36.3 Design

6.3.1 General

The valve shall be designed to provide the fluid flow passageway and the body ends.

The pressure resistance of the valve shall be defined by the manufacturer according to the design SDR and material classification.

6.3.2 Valve body

The valve body shall be such that it cannot be dismantled.

An operating stop system shall be provided at the fully open and closed positions.

5.3.16.3.3 GeneralValve ends

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

PE valves bodies and their PE spigot end or electrofusion socket shall have a pressure rating of at least that of the pipe to which they are assembled. PE spigotspigot ends or electrofusion sockets shall have sufficient fusion compatibility (seecomply with the requirements of EN 1555-5EN 1555-3:2021) to the pipe to which it is fused to meet the requirements of this standard.

5.3.2 Valve body

The valve body shall be such that it cannot be dismantled.

5.3.36.3.4 Operating device

The operating device shall be integral with or connected to the stem in such a way that disconnection is impossible without special equipment.

The valve shall close by turning the operating device clockwise. For a quarter-turn valve, the position of the obturator shall be clearly indicated on the top side of the operating device.

It is recommended that the position of the obturator is marked on the access point for a quarter turn valve.

Stops shall be provided at the fully open and closed positions.

~~5.3.4~~6.3.5 Seals

The seals shall be so mounted as to be resistant to normally occurring mechanical loads, see 5.2.3. Creep and cold flow effects shall be taken into account. Any mechanism that puts a loading on the seals shall be permanently locked. Line pressure shall not be used as the sole means of seal activation.

~~6~~7 Geometrical characteristics

~~6.1~~7.1 General

Each valve shall be ~~characterised~~characterized by its dimensions and associated end connections.

~~Technical data given by the manufacturer shall include at least the following information:~~

~~a) the dimensional characteristics, by working drawings;~~

~~b) the assembly instructions.~~

~~NOTE In order to prevent stress concentrations, any changes in the wall thickness of the valve body should be gradual.~~

~~6.2~~7.2 Measurement of dimensions

~~Dimensions~~The dimensions of the valve shall be measured in accordance with EN ISO 3126 ~~at (23 ± 2) °C, after being conditioned for at least 4 h~~and rounded to the next 0,1 mm. ~~The~~In case of dispute, the measurement shall not be made less than 24 h after manufacture, and after being conditioned for at least 4 h at (23 ± 2) °C.

~~NOTE —~~

Additionally, for spigot end valves provided with temporary supports, perform dimensional measurement at least 1 h after removal of the supports.

Indirect measurement at the stage of production is allowed at shorter time periods providing evidence is shown of correlation.

~~6.3~~7.3 Dimensions of spigot ends for valves

The dimensions of spigot ends shall conform to ~~EN 1555-3:2010~~EN 1555-3:2021, Table 3, up to and including d_n ~~315~~400 mm.

~~6.4~~7.4 Dimensions of valves with electrofusion sockets

The dimensions of electrofusion sockets shall conform to ~~EN 1555-3:2010~~EN 1555-3:2021, Table 1, up to and including d_n ~~315~~400 mm.

~~6.5~~7.5 Dimensions of the operating device

For a quarter-turn valve, the dimension of the operating devices shall be designed so it can be operated with a ~~(50 +0,5 0) mm~~ (50 $^{+0,5}_{0}$) mm square socket, (40 ± 2) mm depth.

NOTE For a ~~non~~multi-~~quarter-~~turn operated valve, ~~the~~ attention is drawn ~~on~~to the requirements specified in EN ISO 5210~~[3]~~ [4].

~~7~~8 Mechanical characteristics of assembled valves

~~7.1~~8.1 General

All tests shall be carried out on valves assembled with pipe ~~from the same~~conforming to EN 1555-2:2021 ~~series conforming to~~from the same ~~EN 1555-2~~SDR as the SDR of the valve spigots, in accordance with the technical instructions of the manufacturer and taking into account the extreme ~~installation~~ conditions of ~~utilisation~~utilization described in ~~EN 1555-5~~EN 1555-5:2021.

NOTE The properties of an assembled valve depend on the properties of the pipes and the valve and on the conditions of their installation (i.e. geometry, temperature, type, method of conditioning, assembly and fusion procedures).

~~The technical descriptions of the manufacturer shall include at least the following information:~~

~~a) service conditions (e.g. valve temperature limits);~~

~~b) assembly instructions;~~

~~c) for valves with electrofusion sockets, the fusion instructions (power requirements or fusion parameters with limits).~~

~~7.2~~8.2 Requirements

~~Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 ± 2) °C before testing in accordance with Table 1.~~

~~Table 1 Mechanical characteristics~~

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Hydrostatic strength (20 °C, 100 h)	No failure during the test period of any test piece	Conditioning time [a] Type of test Circumferential (hoop) stress: PE 80 PE 100 Test period	Shall conform to EN ISO 1167-1 3 Water-in-water 10,0 MPa 12,0 MPa	EN ISO 1167-1 and EN ISO 1167-4
Hydrostatic strength (80 °C, 165 h)	No failure during the test period of any test piece [c]	Conditioning time [a] Type of test Circumferential (hoop) stress: PE 80 PE 100 Test period	Shall conform to EN ISO 1167-1 3 Water-in-water 4,5 MPa 5,4 MPa 165 h	EN ISO 1167-1 and EN ISO 1167-4
Hydrostatic strength (80 °C, 1000 h)	No failure during the test period of any test piece	Conditioning time [a] Type of test Circumferential (hoop) stress: PE 80 PE 100 Test period	Shall conform to EN ISO 1167-1 3 Water-in-water 4,0 MPa 5,0 MPa 1000 h	EN ISO 1167-1 and EN ISO 1167-4
Leaktightness of seat and packing	No leakage during the test period	Type fluid Number of test pieces [b] Test pressure Duration of the test	23 °C Air or nitrogen 25 mbar 1 h	Annex A
Leaktightness of seat and packing	No leakage during the test period	Type fluid Test pressure Duration of the test	23 °C Air or nitrogen 1,5 MOP	Annex A
SAFETY PRECAUTIONS — Safety precautions need to be taken when testing with air or nitrogen up to 1,5 MOP. For testing with air or nitrogen a pressure of a maximum of 6 bar should be used. For MOP > 4 bar, testing with water should be considered, and the test conditions shall be agreed between the manufacturer and end user.				
Pressure drop	Air flow rate (value indicated by the manufacturer)	Type of test Test pressure Pressure drop for $d_n \leq 63$ mm $d_n > 63$ mm	Air 25 mbar 0,5 mbar 0,1 mbar	EN 12117

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Operating torque [d]	Torque range: - For $d_n \leq 63$ mm 5 Nm < $M \leq$ 35 Nm - For 63 mm < $d_n \leq$ 125mm 10 Nm < $M \leq$ 70 Nm - For 125 mm < $d_n \leq$ 315 mm 10 Nm < $M \leq$ 150 Nm	Test temperatures	−20 °C and +23 °C and +40 °C	EN 28233
Stop resistance	a) No failure at stops, and b) No leakage at seat and packing	Torque	−20 °C and +40 °C 2 times the value of the maximum measured operating torque with minimum 150 Nm, during 15 s	a) EN 28233 followed by b) Annex A
Actuation mechanism resistance	Maximum value: 1,5 times the value of the maximum measured operating torque (see this table)	Pressure	6 bar 23 °C	EN 28233
Resistance to bending between supports	No leakage and maximum value for operating torque (see examination of operating torque)	Load applied for: 63 mm < $d_n \leq$ 125 mm 125 mm < $d_n \leq$ 315 mm	3,0 kN 6,0 kN	EN 12100
Thermal cycling resistance d_n > 63 mm	No leakage and maximum value for operating torque (see examination of operating torque)	Number of test pieces [b]	1	EN 12119
Leaktightness under bending with thermal cycling $d_n \leq$ 63 mm	No leakage	Number of cycles Temperature of cycling	50 −20 °C to +40 °C	EN 1704
Leaktightness under tensile load	No leakage and maximum value for operating torque (see examination of operating torque)	Test pressure	23 °C 25 mbar	ISO 10933

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Leaktightness under and after bending applied to the operating mechanism	No leakage	Number of test pieces [b]	1	EN 1680
Impact loading resistance	No leakage and maximum value for operating torque (see examination of operating torque)	Position of test piece Drop height Mass of the striker Type of the striker	Vertical, see Figure 1 2 m 2,5 kg d 90 conforming to EN 744:1995 –20 °C	EN 1705
Multiple test [e]				
1) Resistance to long-term internal pressure loading	The test piece shall fulfil the requirements of the following characteristics:	Conditioning time [a] Type of test Test pressure for: PE 80 PE 100 Test period	Shall conform to EN ISO 1167-1 Water-in-water 16,0 bar 20,0 bar 1 000 h	EN ISO 1167-1 and EN ISO 1167-4
2) Leaktightness of seat and packing	No leakage during the test period	Type fluid Test pressure Duration of the test	23 °C Air or nitrogen 25 mbar 1 h	Annex A
3) Leaktightness of seat and packing	No leakage during the test period	Type fluid Test pressure Duration of the test	23 °C Air or nitrogen 1,5 MOP	Annex A
SAFETY PRECAUTIONS — Safety precautions need to be taken when testing with air or nitrogen up to 1,5 MOP. For testing with air or nitrogen a pressure of a maximum of 6 bar should be used. For MOP > 4 bar, testing with water should be considered, and the test conditions shall be agreed between the manufacturer and end user.				
4) Operating torque [d]	Torque range: - For $d_n \leq 63$ mm 5 Nm < $M \leq$ 35 Mn - For 63 mm < $d_n \leq$ 125mm 10 Nm < $M \leq$ 70 Nm - For 125 mm < $d_n \leq$ 315 mm 10 Nm < $M \leq$ 150 Nm	Test temperatures	–20 °C and +23 °C and +40 °C	EN 28233

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
5) Impact loading resistance	No leakage and maximum value for operating torque (see examination of operating torque)	Position of sample Drop height Mass of the striker Type of the striker	Vertical, see Figure 1 2 m 2,5 kg d90 conforming to EN 744:1995 −20 °C	EN 1705

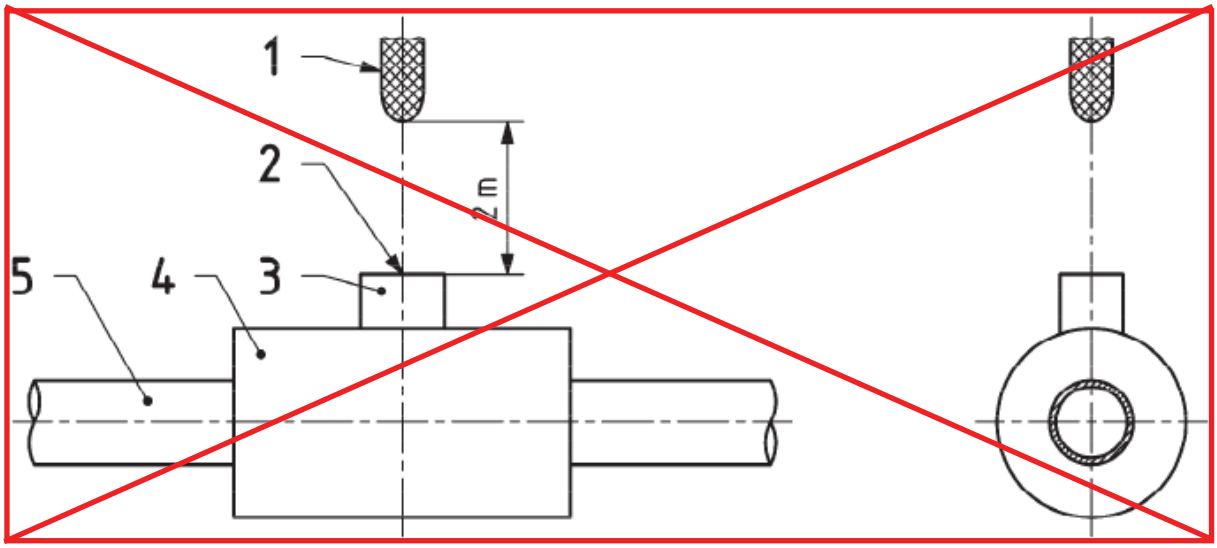
[b] The numbers of test pieces given indicate the numbers required to establish a value for the characteristic described in the table. The numbers of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan. For guidance see CEN/TS 1555-7[2].

[d] The initiating torque and the running torque shall be within the torque range given in the this table.

[e] As soon as possible after the completion of the internal pressure test the other four tests shall be carried out on the valve in the order stated.

Table 2 Circumferential (hoop) stress at 80 °C and associated minimum test period

PE 80		PE 100	
Stress	Minimum test period	Stress	Minimum test period
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	--	--



Key

1	striker
2	impact point
3	operating device

4	valve body
5	valve outlet

Figure 1 Position of the test piece for the impact loading test

8.2.1 General

When tested in accordance with the test methods as specified in Table 1 using the indicated parameters, the valves shall have mechanical characteristics conforming to the requirements given in Table 1.

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 ± 2) °C before testing in accordance with Table 1.

Table 1 Mechanical characteristics

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Hydrostatic strength (20 °C, 100 h) [g]	No failure during the test period of any test piece	Conditioning time [a] Number of test pieces [b] Type of test Circumferential (hoop) stress [I]: PE 80 PE 100 and PE 100-RC Test periodTest temperature	Shall conform to EN ISO 1167-1:2006 3Water-in-water 10,0 MPa12,0 MPa 100 h 20 °C	EN ISO 1167-1:2006 and EN ISO 1167-4
Hydrostatic strength (80 °C, 165 h) [g]	No failure during the test period of any test piece [c]	Conditioning time [a] Number of test pieces [b] Type of test Circumferential (hoop) stress [I]: PE 80 PE 100 and PE 100-RC Test periodTest temperature	Shall conform to EN ISO 1167-1:2006 3 Water-in-water 4,5 MPa5,4 MPa 165 h80 °C	EN ISO 1167-1:2006 and EN ISO 1167-4
Hydrostatic strength (80 °C, 1 000 h) [g]	No failure during the test period of any test piece	Conditioning time [a] Number of test pieces [b] Type of test Circumferential (hoop) stress [i]: PE 80 PE 100 and PE 100-RC Test periodTest temperature	Shall conform to EN ISO 1167-1:2006 3Water-in-water 4,0 MPa 5,0 MPa 1 000 h80 °C	EN ISO 1167-1:2006 and EN ISO 1167-4

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Resistance to slow crack growth PE 100-RC Strain - Hardening test	<Gp> ≥ 50 MPa	Test sample [f]Test temperatureThickness Test speedNumber of test pieces	Compression moulded sheet made from regrind from valve body 80 °C 300 µm Shall conform to ISO 18488-5	ISO 18488
Leaktightness of seat(s) and packing	No leakage during the test period	Test temperatureTest fluid Number of test pieces [b] Test pressureDuration of the test	23 °CAir or nitrogen1 25 mbar1 h	Annex A
Leaktightness of seat(s) and packing	No leakage during the test period	Test temperatureTest fluid Number of test pieces [b] Test pressureDuration of the test	23 °C [f] Air or nitrogen 11,5 MOP 30 s	Annex A
SAFETY PRECAUTIONS — Safety precautions need to be taken when testing with air or nitrogen up to 1,5 MOP. For testing with air or nitrogen a pressure of a maximum of 6 bar should be used. For MOP > 4 bar, testing with water should be considered, and the test conditions shall be agreed between the manufacturer and end user.				
Operating torque [d]	Torque range: For d_n < 63 mm 5 Nm < M ≤ 35 Nm For 63 mm < d_n ≤ 125mm 10 Nm < M ≤ 70 Nm For 125 mm < d_n ≤ 400 mm 10 Nm < M ≤ 150 Nm	Test temperaturesNumber of test pieces [b]	- 20 °C + 23 °C [f] and + 40 °C 1	EN ISO 8233[2]
Stop resistance	a) No failure at stops in closing and opening position Followed by: b) No leakage at seat(s) and packing	Test temperature Number of test pieces [b] Torque Duration	-20 °C and + 40 °C1150 Nm or 2 times the value of the maximum measured operating torque whichever the greater 30 s 15 s	EN ISO 8233[2]
		Test temperature Test fluid Number of test pieces [b] Test pressure Duration	23 °C Air or nitrogen 1 1,5 MOP 30 s	Annex A

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Actuation mechanism resistance [h]	For: $d_n \leq 63$ mm 1,5 × measured torque or 1,2 × 35 Nm (whichever is higher) For: 63 mm < $d_n \leq 125$ mm 1,5 × measured torque or 1,2 × 70 Nm (whichever is higher) For: 125 mm < $d_n \leq 400$ mm 1,5 × measured torque or 1,2 × 150 Nm (whichever is higher)	Test pressureTest temperature Number of test pieces [b]	6 bar23 °C1	EN ISO 8233[2]
Resistance to bending between supports	No leakage and maximum value for operating torque (see examination of operating torque)	Load applied for:63 mm < $d_n \leq 125$ mm 125 mm < $d_n \leq 400$ mm Number of test pieces [b]	3,0 kN6,0 kN 1	EN 12100
Thermal cycling resistance $d_n > 63$ mm	No leakage and maximum value for operating torque (see examination of operating torque)	Number of test pieces [b]	1	EN 12119
Leaktightness under bending with thermal cycling $d_n \leq 63$ mm	No leakage	Number of cyclesTemperature of cycling Number of test pieces [b]	50- 20 °C to + 40 °C2	EN 1704
Leaktightness after tensile load	No leakage, maximum value for operating torque (see examination of operating torque) [k]	Test temperature Test fluidTest pressure Number of test pieces [b]	23 °C Air or nitrogen25 mbar1	Annex B
Leaktightness under and after bending applied to the operating mechanism	No leakage	Number of test pieces [b]	1	EN 1680
Impact loading resistance	No leakage and maximum value for operating torque (see examination of operating torque)	Position of test pieceDrop height Mass of the striker Type of the striker Test temperature Number of test pieces [b]	Vertical, see Figure 1 2 m 2,5 kg d90 conforming to EN ISO 3127 - 20 °C1	EN 1705
Multiple tests [e]				

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
1) Resistance to long-term internal pressure loading [g]	The test piece shall fulfil the requirements of the following characteristics:	Conditioning time [a] Type of testNumber of test pieces [b] Circumferential hoop stress [i]: PE 80 PE 100 or PE 100-RC Test periodTest temperature	Shall conform to EN ISO 1167-1:2006 Water-in-water 1 8,0 MPa 10,0 MPa 1 000 h 20 °C	EN ISO 1167-1:2006 and EN ISO 1167-4
2) Leaktightness of seat(s) and packing	No leakage during the test period	Test temperatureTest fluid Number of test pieces [b] Test pressureDuration of the test	23 °C Air or nitrogen1 25 mbar1 h	Annex A
3) Leaktightness of seat(s) and packing	No leakage during the test period	Test temperatureTest fluid Number of test pieces [b] Test pressureDuration of the test	23 °CAir or nitrogen 11,5MOP 30 s	Annex A
SAFETY PRECAUTIONS — Safety precautions need to be taken when testing with air or nitrogen up to 1,5 MOP. For testing with air or nitrogen a pressure of a maximum of 6 bar should be used. For MOP > 4 bar, testing with water should be considered, and the test conditions shall be agreed between the manufacturer and end user.				
4) Operating torque [d]	Torque range: For d_n < 63 mm 5 Nm < M ≤ 35 Nm For 63 mm < d_n ≤ 125mm 10 Nm < M ≤ 70 Nm For 125 mm < d_n ≤ 400 mm 10 Nm < M ≤ 150 Nm	Test temperatures Number of test pieces [b]	-20 °C, + 23 °C, and + 40 °C1	EN ISO 8233[2]

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
5) Impact loading resistance	No leakage and maximum value for operating torque (see examination of operating torque)	Position of sample Drop height Mass of the strikerType of the striker Test temperature Number of test pieces [b]	Vertical, see Figure 1 2 m 2,5 kg d90 conforming to EN ISO 3127:2017 - 20 °C1	EN 1705

[a] The valves shall not be pressurized within 24 h after fusion.

[b] The numbers of test pieces given indicate the numbers required to establish a value for the characteristic described in the table. The numbers of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan. For guidance, see CEN/TS 1555-7 [2].

[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 2 or from a line based on the stress/time points given in Table 2.

[d] The maximum operating torque recorded at the 3 testing temperatures shall be within the torque range given in this table, i.e. opening and closing torque.

[e] The other four tests shall be carried out on the valve in the order stated, and as soon as possible after 24 h from the completion of the internal pressure test,

[f] For the purpose of factory production control the test temperature is 23 °C ($^{+8}/_{-5}$) °C and the preconditioning of opening and closing the valve is not required.

[g] The valves shall be in open or partially open position.

[h] The test shall be performed by locking the obturator.

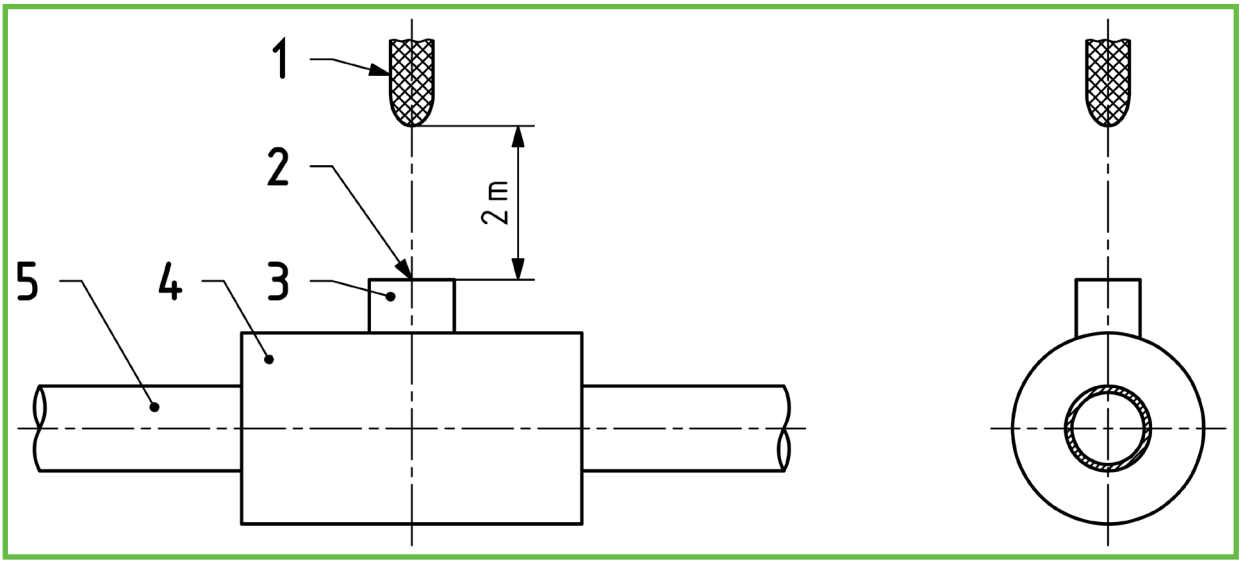
[i] The test pressure shall be calculated using the design SDR of the valve.

[j] The sample for the SHT test shall be taken across the valve body wall, or the whole circumference in case of small diameter. The outer surface shall be scraped to remove any contamination present before regrinding.

k Clause B.4.4 is not applicable to diameters > 160 mm unless requested by the end user.

Table 2 Circumferential (hoop) stress at 80 °C and associated minimum test period

PE 80		PE 100 and PE 100-RC	
Stress MPa	Minimum test period h	Stress MPa	Minimum test period 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	--	--



Key

1	striker
2	impact point
3	operating device
4	valve body
5	spigot or electrofusion ends

Figure 1 Position of the test piece for the impact loading test

8.2.2 Air flow rate

The manufacturer shall indicate in the technical documentation the value of the air flow rate for reduced bore valves. This value is determined according to EN ISO 17778 at pressure drop for $d_n \leq 63$ mm of 0,5 mbar and $d_n > 63$ mm of 0,1 mbar on 1 test piece.

~~8~~9 Physical characteristics

~~8.1~~9.1 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 3~~.~~

~~8.2~~9.2 Requirements

When tested in accordance with the test methods specified in Table 3 using the indicated parameters, the valves shall have physical characteristics conforming to the requirements given in Table 3.

Table 3 Physical characteristics

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Oxidation induction time	≥ 20 min	Test temperature Number of test pieces[a] Test environment	200 °C [b] 3 Oxygen 15 mg ± 2 mg	ISO 11357-6
Melt mass-flow rate (MFR)	After processing maximum deviation of ± 20 % of the value measured on the batch used to manufacture the valve	Loading mass Test temperature Time Number of test pieces [a]	5 kg 190 °C 10 min Shall conform to EN ISO 1133	EN ISO 1133

Characteristic	**Requirements**	**Test parameters**		**Test method**
		Parameter	**Value**	
Oxidation induction time (thermal stability)	≥ 10 min	Test temperature Number of test pieces [a]Test environment Specimen weight	210 °C [b] 3 Oxygen (15 ± 2) mg	EN ISO 11357-6
Melt mass-flow rate (MFR)	After processing maximum deviation of ± 20 % of the value measured on the batch used to manufacture the valve [c]	Loading mass Test temperature Time Number of test pieces [a]	5 kg190 °C 10 min Shall conform to EN ISO 1133-1	EN ISO 1133-1

[a] The number of test pieces given indicate the numbers 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 CEN/TS 1555-7~~[2]~~ [2].

[b] ~~Test~~Alternatively the test may be carried out at ~~210 °C or 220 °C providing there is clear correlation to the results at~~ 200 °C~~; in case of dispute the reference temperature shall be 200 °C~~ with a minimum requirement of ≥ 20 min.

[c] The value given by the material supplier can be used, but in case of dispute the measurement on granules shall be carried out by the manufacturer.

~~9~~10 Performance requirements

When valves conforming to this ~~standard~~document are assembled ~~to~~with each other or ~~to~~with components conforming to other parts of EN 1555, the joints shall conform to ~~EN 1555-5~~EN 1555-5:2021.

11 Technical file

The manufacturer of the valves shall ensure the availability of a technical description (generally confidential) containing all relevant data necessary to prove the conformity of the valves to this part of EN1555. The file shall include all results of type-testing. It shall also include all data necessary to implement a traceability system where required.

The characteristic of the fluid flow shall be such that the manufacturer will declare the valve as:

a) full bore;
b) clearway;
c) reduced bore.

The technical file given by the manufacturer shall include at least the following information:

a) dimensional characteristics, by working drawings;
b) assembly instructions;
c) service conditions (e.g. valve temperature limits);
d) for valves with electrofusion sockets, the fusion instructions (power requirements or fusion parameters with limits);
e) air flow rate value.

~~10~~12 Marking

~~10.1~~12.1 General

~~10.1.1~~**12.1.1** Unless otherwise stated in Table 4, the marking elements shall be printed or formed directly on the valve in such a way that after storage, weathering, handling and installation legibility is maintained during use of the valve.

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

~~10.1.2~~**12.1.2** Marking shall not initiate cracks or other types of defects which adversely influence the performance of the valve.

~~10.1.3~~**12.1.3** If printing is used, the colour of the printed information shall differ from the basic colour of the valve.

~~10.1.4~~**12.1.4** The size of the marking shall be such that it is legible without magnification.

~~10.1.5~~**12.1.5** There shall be no marking over the minimum spigot length of the valve.

~~10.2~~12.2 Minimum required marking

The minimum required marking shall conform to Table 4.

Table 4 Minimum required marking

~~Aspects~~Aspects	~~Mark or symbol~~Mark or symbol
Number of the System Standard [a]	EN 1555
Manufacturer's name and/or trademark	Name or symbol
Nominal outside diameter(s)of pipe, d_n	e.g. 110
Material and designation	e.g. PE ~~100~~ 100 PE 100-RC [a]
Design application series	e.g. SDR 11

~~Aspects~~Aspects	~~Mark or symbol~~Mark or symbol
Manufacturer's information [b]	
~~Internal fluid~~Intended use [a]	Gas
Flow direction (only for unidirectional valve)	Arrow
[a] This information may be printed on a label associated with the valve or on an individual bag.	
[b] For providing traceability, the following details shall be given:	
~~— the production period, year, month and/or week, in figures or in code;~~	
~~— a name or code for the production site if the manufacturer is producing in different sites.~~	
— the production period, year, month and/or week, in figures or in code;	
— a name or code for the production site if the manufacturer is producing in different sites.	
NOTE Traceability data can be coded and found in ISO 12176-4 [4] and ISO 12176-5 [5].	

~~10.3~~12.3 Additional marking

Valves conforming to this ~~standard~~document, which are third~~-~~party certified by a certification body, may be marked accordingly.

~~11~~13 Delivery conditions

The valves shall be packaged in bulk or individually protected where necessary in order to prevent deterioration and contamination. Whenever possible, they shall be placed in individual bags, in cardboard boxes or cartons.

~~NOTE 1 It is recommended to protect the spigot end by external caps.~~

It is recommended to protect the spigot ends, e.g. by external caps.

The cartons and/or individual bags shall bear at least one label with the manufacturer's name, type and dimensions of the ~~part~~valve, number of units in the box, and any special storage conditions and storage time limits.

~~NOTE 2 Valves should be stored in their original packing, until ready for use.~~

It is recommended that valves are stored in their original packing, until ready for installation.

Annex A
(normative)

Determination of the leaktightness of seat(s) and packing

A.1 General

This ~~annex~~Annex specifies the test method to verify the leaktightness of the seat and packing of a valve/valve body made from PE.

A.2 Test piece

The test piece shall be a complete valve with the open ends closed off by, for example, covers, plugs, flexible seals or end connectors.

The setting time of moulded or fusion-jointed components, as specified by the manufacturer, shall be completed before commencing conditioning.

A.~~2~~3 ~~Test method~~Procedure

~~Test equipment shall not subject the valve to externally applied stresses which may affect the results of the tests.~~

~~The valve shall be tested by closing the obturator in the normal manner.~~

~~The method of internal leakage testing shall result in the application of the full differential test pressure specified in Table 1 across the seat or seats in the direction for which they are designed. Tests for typical types of valves shall be as specified in Table A.1.~~

~~Any unidirectional flow valve shall be tested in the specified flow direction only. Bidirectional valve shall be tested in both flow directions.~~

~~The duration of test shall conform to the specified values specified in Table 1.~~

~~**Table A.1 Obturator tightness test methods**~~

Type of valves	Test method
Gate valves Ball valves Plug valves	The bonnet cavity shall be filled with the test fluid. Pressure shall be applied successively to each side of the closed valve and the valve shall be subsequently checked for leakage. Valves with independent double seating (such as two-piece obturator or double-seated valves) may be tested by applying pressure between the seats, and each side of the closed valve checked for leakage.
Butterfly valves Diaphragm valves	Pressure shall be applied in the most adverse direction; valves with symmetrical seating may be tested in either direction.
Check valves	Pressure shall be applied in the direction tending to close the obturator and the opposite side shall be checked for leakage.

A.3.1 Conditioning

Condition the test piece in accordance with this document, see Clause 8.2.

A.3.2 Internal Leaktightness test (fully closed valve)

Conduct the following procedure; in case of bi-directional valves, both sides of the valves shall be tested:

a) Connect one end of the test piece to the pressure line and the other end(s) to a device capable of detecting leakage;

b) Fill the closed test piece with air or nitrogen at the specified temperature;

c) Close the valve;

d) Raise the pressure progressively and smoothly in such a way that the test pressure specified in this document is attained within 30 s;

e) Maintain the pressure and temperature for the length of time specified in this document;

f) Observe and records any signs of leakage;

g) Depressurize the test piece.

Valves with independent double seating (such as two-piece obturator or double-seated valves) can be tested by applying pressure between the seats, and each side of the closed valve checked for leakage.

A.3.3 External Leaktightness test (half open valve)

Conduct the following procedure:

a) Put the valve in half open position;

b) Connect one end of the test piece to the pressure supply and close the other end;

c) Fill the test piece with air or nitrogen at the specified temperature;

d) Raise the pressure progressively and smoothly in such a way that the test pressure specified in this document, is attained within 30 s;

e) Maintain the pressure and temperature for the length of time specified in this document;

f) Observe and records any signs of external leakage;

g) Depressurize the test piece.

A.4 Test report

The test report shall include the following information:

a) full identification of the valve under test;

b) reference to this method of test, i.e. EN 1555.4:2019, Annex A;

c) test pressure(s), applied to the test piece;

d) test duration;

e) results of internal and external leaktightness testing;

f) any conditions or incidents not detailed by this test method and which might have affected the results;

g) date of test.

Annex B
(normative)

Test method for leaktightness and ease of operation after tensile loading

B.1 Apparatus

B.1.1 Tensile test machine, capable of applying to a test piece and maintaining for a specified time period t, a tensile force corresponding to a specified longitudinal tensile stress σ_x, in the walls of pipes joined to the valve, and then if relevant producing a specified rate of extension. The tensile testing machine shall be sufficiently powerful to allow tests to be carried out up to the yield point of the pipe.

B.1.2 Grips or couplings, to enable the test machine (B.1.1) to apply the appropriate force, directly or through intermediate fittings.

B.1.3 Pressurizing equipment, to enable a specified internal pressure p, to be applied via suitable connections to the test piece while it is subject to the tensile force.

B.2 Test piece

The test piece shall comprise the valve under test assembled in accordance with 8.1 between two PE pipes, each of the nominal outside diameter, d_n, and the SDR series with which the valve is designed to be used, and each pipe having a length of either $2d_n$ mm or 250 mm, whichever is the shorter.

B.3 Conditions

The valves shall be tested using the following conditions:

a) nominal longitudinal tensile stress, σ_x, in the connected pipe wall shall be 12 MPa for PE 100 or PE 100-RC, and 10 MPa for PE 80;

b) internal pressure, p, shall be 25 mbar maintained for the specified duration of the test;

c) tensile force shall be calculated using the nominal pipe dimensions;

d) time period t, for which the tensile force is maintained steady shall be 1 h;

e) rate of extension between the grips shall be 25 mm/min ± 1 mm/min.

B.4 Procedure

B.4.1 The valve shall be tested by closing the obturator in the normal manner while maintaining an ambient test temperature of (23 ± 2) °C.

Apply the specified internal pressure p, for internal leaktightness assessment before tensile testing (Annex A). In case of bi-directional valves, apply pressure to both sides. Ensure that all relevant parts of the valve are subject to the pressure.

B.4.2 After completion of the leaktightness test, mount the test piece in the tensile testing machine. Apply an increasing force smoothly until the applicable longitudinal stress, σ_x, is induced in the walls of the pipes in the test assembly.

B.4.3 Maintain the force for the specified time period *t*.

B.4.4 Apply the specified rate of extension until the valve spigot end or pipe yields, see Table 1.

NOTE Yield is defined as a visible necking and elongation or a decrease of the load during the tensile test.

B.4.5 Remove the tensile load and, without any intervening operation of the valve, submit the valve to torque testing in accordance with EN ISO 8233[2], and leaktightness testing of the seat and packing according to Annex A..

Yielded pipe test pieces can be removed in order to perform the torque and leaktightness tests.

B.5 Test report

The test report shall include the following information:

a) full identification of the valve under test;
b) reference to this method of test, i.e. EN 1555-4:2021, Annex B;
c) dimensions of the pipes used in the test piece;
d) longitudinal tensile stress, σ_x;
e) tensile force applied to the test piece;
f) internal pressure *p*, applied to the test piece;
g) time period *t*, for which the tensile force was maintained;
h) results of torque testing in accordance with EN ISO 8233[2];
i) results of leaktightness testing in accordance with Annex A;
j) any conditions or incidents not detailed by this test method and which might have affected the results;
k) date of testing.

Bibliography

[1] ~~EN 12007-2:2000~~EN 12007-2:2012, *Gas ~~supply systems — Gas pipelines~~infrastructure - Pipelines for maximum operating pressure up to and including 16 bar - Part 2: Specific functional ~~recommendations~~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] EN ISO 5210, *Industrial valves - Multi-turn valve actuator attachments (~~ISO 5210:1991~~ISO 5210)*

[4] ISO 12176-4, *Plastics pipes and fittings- Equipment for fusion jointing polyethylene systems - Part 4: Traceability coding*

[~~4~~5] ~~EN 736-3:2008~~ISO 12176-5, ~~*Valves — Terminology —*~~*Plastics pipes and fittings - Equipment for fusion jointing polyethylene systems - Part ~~3~~ 5: ~~Definition~~Two-dimensional data coding of ~~terms~~components and data exchange*

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BS EN 1555-4:2021

BSI Standards Publication

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

Part 4: Valves

bsi.

National foreword

This British Standard is the UK implementation of EN 1555-4:2021. It supersedes BS EN 1555-4:2011, 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.

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Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 4: Valves

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Kunststoff-Rohrleitungssysteme für die Gasversorgung - Polyethylen (PE) - Teil 4: Armaturen

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European foreword

This document (EN 1555-4:2021) 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 1555-4:2011.

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.

— The diameter range for valves has been increased to 400 mm.

— An improved description of the leaktightness test is given.

— Annex B has been added to describe the leaktightness test after the tensile test, following the withdrawal of ISO 10933.

— Test methods have been updated.

— A new method has been added for PE 100-RC materials.

This document has been prepared in liaison with Technical Committee CEN/TC 234 “Gas infrastructure”.

System Standards are based on the results of the work 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 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* (this standard);

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

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

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Introduction

This document, specifies the requirements for 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, other than valves, are specified in EN 1555-1:2021, EN 1555-2:2021 and EN 1555-3:2021.

Characteristics for fitness for purpose are covered in EN 1555-5:2021. CEN/TS 1555-7 [2] gives guidance for assessment of conformity. Recommended practice for installation is given in EN 12007-2:2012 [1] prepared by CEN/TC 234.

This part of EN 1555 covers the characteristics of valves.

1 Scope

This document specifies the characteristics of valves made from polyethylene (PE) for piping systems in the field of the supply of gaseous fuels.

It is applicable to isolating unidirectional and bi-directional valves with spigot ends or electrofusion sockets intended to be fused with PE pipes or fittings conforming to EN 1555-2:2021 and EN 1555-3:2021 respectively.

Valves made from materials other than PE, designed for the supply of gaseous fuels conforming to the relevant standards can be used in PE piping systems according to EN 1555 (all parts), provided that they have PE connections for butt fusion or electrofusion ends, including integrated material transition joints, conforming to EN 1555-3:2021.

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

In conjunction with Parts 1, 2, 3 and 5 of EN 1555, it is applicable to PE valves, 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 and including 10 bar[1] at a reference temperature of 20 °C for design purposes;

NOTE 1 For the purpose of this document and the references to EN ISO 8233[2], MOP is considered to be nominal pressure.

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

NOTE 2 For operating temperatures between 20 °C and 40 °C, derating coefficients are defined in EN 1555-5.

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

NOTE 3 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 regulations and installation practices or codes.

This document covers valve bodies designed for connection with pipes with a nominal outside diameter $d_n \leq 400$ mm.

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 682, *Elastomeric Seals - Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*

EN 736-1:2018, *Valves - Terminology - Part 1: Definition of types of valves*

EN 736-2:2016, *Valves - Terminology - Part 2: Definition of components of valves*

EN 736-3:2008, *Valves - Terminology - Part 3: Definition of terms*

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*

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

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

EN 1555-5:2021, *Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 5: Fitness for purpose of the system*

EN 1680, *Plastics piping systems - Valves for polyethylene (PE) piping systems - Test method for leaktightness under and after bending applied to the operating mechanisms*

EN 1704, *Plastics piping systems - Thermoplastics valves - Test method for the integrity of a valve after temperature cycling under bending*

EN 1705, *Plastics piping systems - Thermoplastics valves - Test method for the integrity of a valve after an external blow*

EN 12100, *Plastics piping systems - Polyethylene (PE) valves - Test method for resistance to bending between supports*

EN 12119, *Plastics piping systems - Polyethylene (PE) valves - Test method for resistance to thermal cycling*

EN ISO 1133-1, *Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 1: Standard method (ISO 1133-1)*

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 1167-4, *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 3127:2017, *Thermoplastics pipes - Determination of resistance to external blows - Round-the-clock method (ISO 3127:1994)*

EN ISO 3126, *Plastics piping systems - Plastics components - Determination of dimensions (ISO 3126)*

EN ISO 8233[2], *Thermoplastic valves - Torque - Test method (ISO/FDIS 8233)*

EN ISO 11357-6, *Plastics - Differential scanning calorimetry (DSC) - Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT) (ISO 11357-6)*

EN ISO 17778, *Plastics piping systems - Fittings, valves and ancillaries - Determination of gaseous flow rate/pressure drop relationships (ISO 17778)*

[2] Under preparation. Stage at the time of publication: FprEN ISO 8233:2021.

3 Terms and definitions

For the purposes of this document, the terms and definitions, symbols and abbreviations given in EN 1555-1:2021, EN 736-1:2018, EN 736-2:2016 and the following 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

3.1 General

3.1.1
external leaktightness
leaktightness of the valve body enveloping the space containing the gas, with respect to the atmosphere

3.1.2
internal leaktightness
leaktightness between the inlet and the outlet of the valve, with the valve in the closed position

3.1.3
leakage
emission of gas from a valve body, or any component of a valve

3.1.4
valve body
main part of a valve which consists of an operating stop system and contains the obturator, seat(s), stem(s) or shaft(s) and packing seals, and provides the terminal ends for connection to the PE pipe/fittings as applicable

3.1.5
operating device
part of a valve for connection with the operating key which allows the opening and the closing of the valve

3.2 Terms relating to design

3.2.1
isolating valve
valve intended for use only in the closed or fully open position

[SOURCE: EN 736-1:2018]

3.2.2
full bore valve
valve with a flow section equal to or greater than 80 % of the section corresponding to the nominal inside diameter of the body end port

[SOURCE: EN 736-3:2008]

3.2.3
clearway valve
valve designed to have an unobstructed flow way, which allows for the passage of a theoretical sphere with a diameter that is not less than the nominal inside diameter of the body end port

[SOURCE: EN 736-3:2008]

3.2.4
reduced bore valve
valve with a flow section equal to or greater than 36 % of the section corresponding to the nominal inside diameter of the body end port and which does not correspond to the full bore valve

[SOURCE: EN 736-3:2008]

4 Symbols and abbreviations

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

5 Material

5.1 Compound for valve body

The PE compound from which the valve body with spigot or electrofusion socket is made shall conform to EN 1555-1:2021.

The PE components of the valve shall be made only from virgin material conforming to EN 1555-1:2021.

5.2 Material for non-polyethylene parts

5.2.1 General

All components shall conform to the relevant EN standard(s). Alternative standards may be applied in cases where the suitable EN standard(s) do not exist. In all cases, fitness for purpose of the components shall be demonstrated.

The materials and the constituent elements used in making the valve (including elastomers, greases and any metal parts as may be used) shall be as resistant to the external and internal environments as the other elements of the piping system, and shall have an expected lifetime under the following conditions at least equal to that of the PE pipes conforming to EN 1555-2:2021, with which they are intended to be used:

a) during storage;

b) under the effect of the gas conveyed therein;

c) with respect to the service environment and operating conditions.

The requirements for the level of material performance of non-polyethylene parts shall be at least as stringent as that of the PE compound for the piping system. Reworked materials shall not be used for stress bearing polymeric parts.

Other materials used in valves in contact with the PE pipe shall not adversely affect pipe performance or initiate stress cracking.

The valve manufacturer shall ensure that any transition joint between polyethylene and non-polyethylene parts and the valve body fulfil the requirements of EN 1555-3:2021.

5.2.2 Metal parts

All metal parts susceptible to corrosion shall be adequately protected, providing this is necessary for the durability and function of the system.

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

5.2.3 Sealing materials

Elastomeric seals shall conform to EN 682.

If other sealing materials are used they need to be proven for gas supply systems.

5.2.4 Greases and lubricants

Greases or lubricants shall not exude onto fusion areas, and shall not affect the long term performance of the valve materials.

5.2.5 Assembly

Ancillary components of valves shall be assembled according to manufacturer's procedures and any component used in the assembly shall not prevent conformity of the valve to this document.

6 General characteristics

6.1 Appearance of the valve

When viewed without magnification, the internal and external surfaces of valves shall be smooth, clean and shall have no scoring, cavities or other surface defects to an extent that would prevent conformity to this document.

No component of the valve shall show any signs of damage, scratches, pitting, bubbles, blisters, inclusions or cracks to an extent that would prevent conformity of the valves to the requirements of this document.

6.2 Colour

The colour of the PE parts of valves shall be either black, yellow or orange.

6.3 Design

6.3.1 General

The valve shall be designed to provide the fluid flow passageway and the body ends.

The pressure resistance of the valve shall be defined by the manufacturer according to the design SDR and material classification.

6.3.2 Valve body

The valve body shall be such that it cannot be dismantled.

An operating stop system shall be provided at the fully open and closed positions.

6.3.3 Valve ends

PE spigot ends or electrofusion sockets shall comply with the requirements of EN 1555-3:2021.

6.3.4 Operating device

The operating device shall be integral with or connected to the stem in such a way that disconnection is impossible without special equipment.

The valve shall close by turning the operating device clockwise. For a quarter-turn valve, the position of the obturator shall be clearly indicated on the top side of the operating device.

It is recommended that the position of the obturator is marked on the access point for a quarter turn valve.

Stops shall be provided at the fully open and closed positions.

6.3.5 Seals

The seals shall be so mounted as to be resistant to normally occurring mechanical loads, see 5.2.3. Creep and cold flow effects shall be taken into account. Any mechanism that puts a loading on the seals shall be permanently locked. Line pressure shall not be used as the sole means of seal activation.

7 Geometrical characteristics

7.1 General

Each valve shall be characterized by its dimensions and associated end connections.

7.2 Measurement of dimensions

The dimensions of the valve shall be measured in accordance with EN ISO 3126, and rounded to the next 0,1 mm. In case of dispute, the measurement shall not be made less than 24 h after manufacture, and after being conditioned for at least 4 h at (23 ± 2) °C.

Additionally, for spigot end valves provided with temporary supports, perform dimensional measurement at least 1 h after removal of the supports.

Indirect measurement at the stage of production is allowed at shorter time periods providing evidence is shown of correlation.

7.3 Dimensions of spigot ends for valves

The dimensions of spigot ends shall conform to EN 1555-3:2021, Table 3, up to and including d_n 400 mm.

7.4 Dimensions of valves with electrofusion sockets

The dimensions of electrofusion sockets shall conform to EN 1555-3:2021, Table 1, up to and including d_n 400 mm.

7.5 Dimensions of the operating device

For a quarter-turn valve, the dimension of the operating devices shall be designed so it can be operated with a $(50\ ^{+0,5}_{0})$ mm square socket, (40 ± 2) mm depth.

NOTE For a multi-turn operated valve, attention is drawn to the requirements specified in EN ISO 5210 [4].

8 Mechanical characteristics of assembled valves

8.1 General

All tests shall be carried out on valves assembled with pipe conforming to EN 1555-2:2021 from the same SDR as the SDR of the valve spigots, in accordance with the technical instructions of the manufacturer and taking into account the extreme conditions of utilization described in EN 1555-5:2021.

NOTE The properties of an assembled valve depend on the properties of the pipes and the valve and on the conditions of their installation (i.e. geometry, temperature, type, method of conditioning, assembly and fusion procedures).

8.2 Requirements

8.2.1 General

When tested in accordance with the test methods as specified in Table 1 using the indicated parameters, the valves shall have mechanical characteristics conforming to the requirements given in Table 1.

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 ± 2) °C before testing in accordance with Table 1.

Table 1 — Mechanical characteristics

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Hydrostatic strength (20 °C, 100 h) [g]	No failure during the test period of any test piece	Conditioning time [a] Number of test pieces [b] Type of test Circumferential (hoop) stress [l]: PE 80 PE 100 and PE 100-RC Test period Test temperature	Shall conform to EN ISO 1167-1:2006 3 Water-in-water 10,0 MPa 12,0 MPa 100 h 20 °C	EN ISO 1167-1 :2006 and EN ISO 1167-4
Hydrostatic strength (80 °C, 165 h) [g]	No failure during the test period of any test piece [c]	Conditioning time [a] Number of test pieces [b] Type of test Circumferential (hoop) stress [l]: PE 80 PE 100 and PE 100-RC Test period Test temperature	Shall conform to EN ISO 1167-1:2006 3 Water-in-water 4,5 MPa 5,4 MPa 165 h 80 °C	EN ISO 1167-1 :2006 and EN ISO 1167-4
Hydrostatic strength (80 °C, 1 000 h) [g]	No failure during the test period of any test piece	Conditioning time [a] Number of test pieces [b] Type of test Circumferential (hoop) stress [i]: PE 80 PE 100 and PE 100-RC Test period Test temperature	Shall conform to EN ISO 1167-1:2006 3 Water-in-water 4,0 MPa 5,0 MPa 1 000 h 80 °C	EN ISO 1167-1 :2006 and EN ISO 1167-4

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Resistance to slow crack growth PE 100-RC Strain - Hardening test	<Gp> ≥ 50 MPa	Test sample [j] Test temperature Thickness Test speed Number of test pieces	Compression moulded sheet made from regrind from valve body 80 °C 300 µm Shall conform to ISO 18488 5	ISO 18488
Leaktightness of seat(s) and packing	No leakage during the test period	Test temperature Test fluid Number of test pieces [b] Test pressure Duration of the test	23 °C Air or nitrogen 1 25 mbar 1 h	Annex A
Leaktightness of seat(s) and packing	No leakage during the test period	Test temperature Test fluid Number of test pieces [b] Test pressure Duration of the test	23 °C [f] Air or nitrogen 1 1,5 MOP 30 s	Annex A
SAFETY PRECAUTIONS — Safety precautions need to be taken when testing with air or nitrogen up to 1,5 MOP. For testing with air or nitrogen a pressure of a maximum of 6 bar should be used. For MOP > 4 bar, testing with water should be considered, and the test conditions shall be agreed between the manufacturer and end user.				
Operating torque [d]	Torque range: For d_n < 63 mm 5 Nm < M ≤ 35 Nm For 63 mm < d_n ≤ 125mm 10 Nm < M ≤ 70 Nm For 125 mm < d_n ≤ 400 mm 10 Nm < M ≤ 150 Nm	Test temperatures Number of test pieces [b]	- 20 °C, + 23 °C [f] and + 40 °C 1	EN ISO 8233[2]

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Stop resistance	a) No failure at stops in closing and opening position Followed by: b) No leakage at seat(s) and packing	Test temperature Number of test pieces [b] Torque Duration	-20 °C and + 40 °C 1 150 Nm or 2 times the value of the maximum measured operating torque whichever the greater 30 s 15 s	EN ISO 8233[2]
		Test temperature Test fluid Number of test pieces [b] Test pressure Duration	23 °C Air or nitrogen 1 1,5 MOP 30 s	Annex A
Actuation mechanism resistance [h]	For: $d_n \leq 63$ mm 1,5 × measured torque or 1,2 × 35 Nm (whichever is higher) For: 63 mm < $d_n \leq 125$ mm 1,5 × measured torque or 1,2 × 70 Nm (whichever is higher) For: 125 mm < $d_n \leq 400$ mm 1,5 × measured torque or 1,2 × 150 Nm (whichever is higher)	Test pressure Test temperature Number of test pieces [b]	6 bar 23 °C 1	EN ISO 8233[2]
Resistance to bending between supports	No leakage and maximum value for operating torque (see examination of operating torque)	Load applied for: 63 mm < $d_n \leq 125$ mm 125 mm < $d_n \leq 400$ mm Number of test pieces [b]	 3,0 kN 6,0 kN 1	EN 12100
Thermal cycling resistance $d_n > 63$ mm	No leakage and maximum value for operating torque (see examination of operating torque)	Number of test pieces [b]	1	EN 12119
Leaktightness under bending with thermal cycling $d_n \leq 63$ mm	No leakage	Number of cycles Temperature of cycling Number of test pieces [b]	50 - 20 °C to + 40 °C 2	EN 1704

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Leaktightness after tensile load	No leakage, maximum value for operating torque (see examination of operating torque) [k]	Test temperature Test fluid Test pressure Number of test pieces [b]	23 °C Air or nitrogen 25 mbar 1	Annex B
Leaktightness under and after bending applied to the operating mechanism	No leakage	Number of test pieces [b]	1	EN 1680
Impact loading resistance	No leakage and maximum value for operating torque (see examination of operating torque)	Position of test piece Drop height Mass of the striker Type of the striker Test temperature Number of test pieces [b]	Vertical, see Figure 1 2 m 2,5 kg d90 conforming to EN ISO 3127 - 20 °C 1	EN 1705
Multiple tests [e]				
1) Resistance to long-term internal pressure loading [g]	The test piece shall fulfil the requirements of the following characteristics:	Conditioning time [a] Type of test Number of test pieces [b] Circumferential hoop stress [i]: PE 80 PE 100 or PE 100-RC Test period Test temperature	Shall conform to EN ISO 1167-1:2006 Water-in-water 1 8,0 MPa 10,0 MPa 1 000 h 20 °C	EN ISO 1167-1 :2006 and EN ISO 1167-4
2)Leaktightness of seat(s) and packing	No leakage during the test period	Test temperature Test fluid Number of test pieces [b] Test pressure Duration of the test	23 °C Air or nitrogen 1 25 mbar 1 h	Annex A
3)Leaktightness of seat(s) and packing	No leakage during the test period	Test temperature Test fluid Number of test pieces [b] Test pressure Duration of the test	23 °C Air or nitrogen 1 1,5MOP 30 s	Annex A
SAFETY PRECAUTIONS — Safety precautions need to be taken when testing with air or nitrogen up to 1,5 MOP. For testing with air or nitrogen a pressure of a maximum of 6 bar should be used. For MOP > 4 bar, testing with water should be considered, and the test conditions shall be agreed between the manufacturer and end user.				

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
4) Operating torque [d]	Torque range: For d_n < 63 mm 5 Nm < M ≤ 35 Nm For 63 mm < d_n ≤ 125mm 10 Nm < M ≤ 70 Nm For 125 mm < d_n ≤ 400 mm 10 Nm < M ≤ 150 Nm	Test temperatures Number of test pieces [b]	-20 °C, + 23 °C and + 40 °C 1	EN ISO 8233[2]
5) Impact loading resistance	No leakage and maximum value for operating torque (see examination of operating torque)	Position of sample Drop height Mass of the striker Type of the striker Test temperature Number of test pieces [b]	Vertical, see Figure 1 2 m 2,5 kg d90 conforming to EN ISO 3127:2017 - 20 °C 1	EN 1705

[a] The valves shall not be pressurized within 24 h after fusion.

[b] The numbers of test pieces given indicate the numbers required to establish a value for the characteristic described in the table. The numbers of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan. For guidance, see CEN/TS 1555-7 [2].

[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 2 or from a line based on the stress/time points given in Table 2.

[d] The maximum operating torque recorded at the 3 testing temperatures shall be within the torque range given in this table, i.e. opening and closing torque.

[e] The other four tests shall be carried out on the valve in the order stated, and as soon as possible after 24 h from the completion of the internal pressure test,

[f] For the purpose of factory production control the test temperature is 23 °C ($^{+8}/_{-5}$) °C and the preconditioning of opening and closing the valve is not required.

[g] The valves shall be in open or partially open position.

[h] The test shall be performed by locking the obturator.

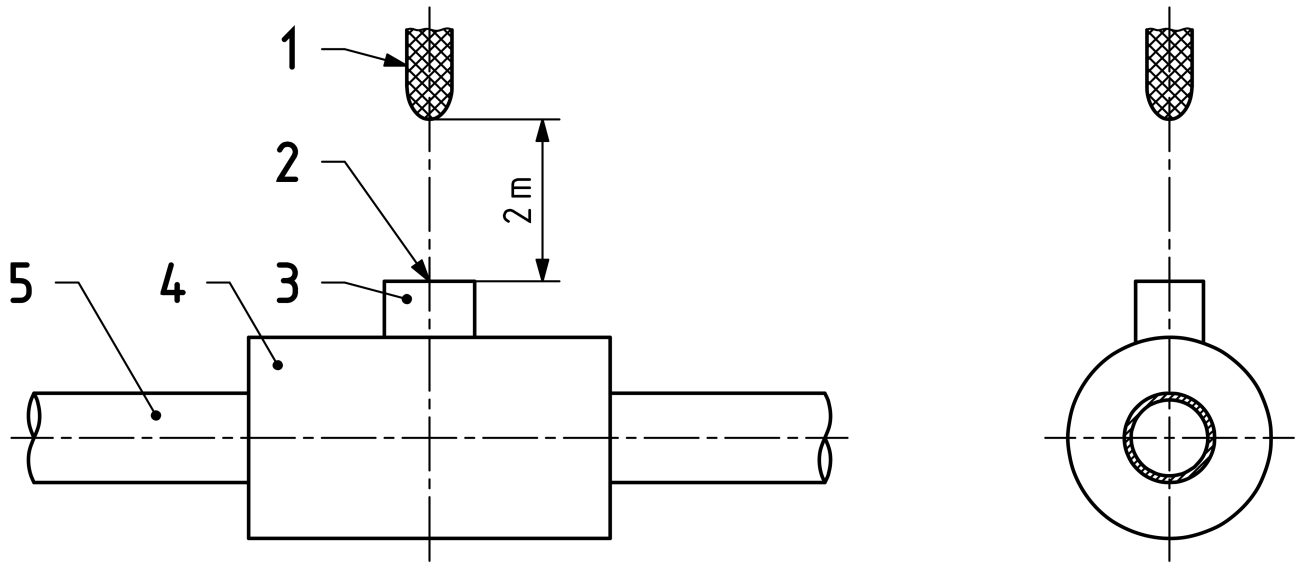
[i] The test pressure shall be calculated using the design SDR of the valve.

[j] The sample for the SHT test shall be taken across the valve body wall, or the whole circumference in case of small diameter. The outer surface shall be scraped to remove any contamination present before regrinding.

[k] Clause B.4.4 is not applicable to diameters > 160 mm unless requested by the end user.

Table 2 — Circumferential (hoop) stress at 80 °C and associated minimum test period

PE 80		PE 100 and PE 100-RC	
Stress **MPa**	**Minimum test period** h	**Stress** MPa	**Minimum test period** 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	—	—



Key

1 striker
2 impact point
3 operating device
4 valve body
5 spigot or electrofusion ends

Figure 1 — Position of the test piece for the impact loading test

8.2.2 Air flow rate

The manufacturer shall indicate in the technical documentation the value of the air flow rate for reduced bore valves. This value is determined according to EN ISO 17778 at pressure drop for $d_n \leq 63$ mm of 0,5 mbar and $d_n > 63$ mm of 0,1 mbar on 1 test piece.

9 Physical characteristics

9.1 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 3

9.2 Requirements

When tested in accordance with the test methods specified in Table 3 using the indicated parameters, the valves shall have physical characteristics conforming to the requirements given in Table 3.

Table 3 — Physical characteristics

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Oxidation induction time (thermal stability)	≥ 10 min	Test temperature Number of test pieces [a] Test environment Specimen weight	210 °C [b] 3 Oxygen (15 ± 2) mg	EN ISO 11357-6
Melt mass-flow rate (MFR)	After processing maximum deviation of ± 20 % of the value measured on the batch used to manufacture the valve [c]	Loading mass Test temperature Time Number of test pieces [a]	5 kg 190 °C 10 min Shall conform to EN ISO 1133-1	EN ISO 1133-1

[a] The number of test pieces given indicate the numbers 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 CEN/TS 1555-7 [2].

[b] Alternatively the test may be carried out at 200 °C with a minimum requirement of ≥ 20 min.

[c] The value given by the material supplier can be used, but in case of dispute the measurement on granules shall be carried out by the manufacturer.

10 Performance requirements

When valves conforming to this document are assembled with each other or with components conforming to other parts of EN 1555, the joints shall conform to EN 1555-5:2021.

11 Technical file

The manufacturer of the valves shall ensure the availability of a technical description (generally confidential) containing all relevant data necessary to prove the conformity of the valves to this part of EN1555. The file shall include all results of type-testing. It shall also include all data necessary to implement a traceability system where required.

The characteristic of the fluid flow shall be such that the manufacturer will declare the valve as:

a) full bore;

b) clearway;

c) reduced bore.

The technical file given by the manufacturer shall include at least the following information:

d) dimensional characteristics, by working drawings;

e) assembly instructions;

f) service conditions (e.g. valve temperature limits);

g) for valves with electrofusion sockets, the fusion instructions (power requirements or fusion parameters with limits);

h) air flow rate value.

12 Marking

12.1 General

12.1.1 Unless otherwise stated in Table 4, the marking elements shall be printed or formed directly on the valve in such a way that after storage, weathering, handling and installation legibility is maintained during use of the valve.

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

12.1.2 Marking shall not initiate cracks or other types of defects which adversely influence the performance of the valve.

12.1.3 If printing is used, the colour of the printed information shall differ from the basic colour of the valve.

12.1.4 The size of the marking shall be such that it is legible without magnification.

12.1.5 There shall be no marking over the minimum spigot length of the valve.

12.2 Minimum required marking

The minimum required marking shall conform to Table 4.

Table 4 — Minimum required marking

Aspects	Mark or symbol
Number of the system standard [a]	EN 1555
Manufacturer's name and/or trademark	Name or symbol
Nominal outside diameter(s)of pipe, d_n	e.g. 110
Material and designation	e.g. PE 100 PE 100-RC [a]
Design application series	e.g. SDR 11
Manufacturer's information [b]	
Intended use [a]	Gas
Flow direction (only for unidirectional valve)	Arrow
[a] This information may be printed on a label associated with the valve or on an individual bag. [b] For providing traceability, the following details shall be given: — the production period, year, month and/or week, in figures or in code; — a name or code for the production site if the manufacturer is producing in different sites.	
NOTE Traceability data can be coded and found in ISO 12176-4 [4] and ISO 12176-5 [5].	

12.3 Additional marking

Valves conforming to this document, which are third-party certified by a certification body, may be marked accordingly.

13 Delivery conditions

The valves shall be packaged in bulk or individually protected where necessary in order to prevent deterioration and contamination. Whenever possible, they shall be placed in individual bags, in cardboard boxes or cartons.

It is recommended to protect the spigot ends, e.g. by external caps.

The cartons and/or individual bags shall bear at least one label with the manufacturer's name, type and dimensions of the valve, number of units in the box, and any special storage conditions and storage time limits.

It is recommended that valves are stored in their original packing, until ready for installation.

Annex A
(normative)

Determination of the leaktightness of seat(s) and packing

A.1 General

This Annex specifies the test method to verify the leaktightness of the seat and packing of a valve/valve body made from PE.

A.2 Test piece

The test piece shall be a complete valve with the open ends closed off by, for example, covers, plugs, flexible seals or end connectors.

The setting time of moulded or fusion-jointed components, as specified by the manufacturer, shall be completed before commencing conditioning.

A.3 Procedure

A.3.1 Conditioning

Condition the test piece in accordance with this document, see Clause 8.2.

A.3.2 Internal Leaktightness test (fully closed valve)

Conduct the following procedure; in case of bi-directional valves, both sides of the valves shall be tested:

a) Connect one end of the test piece to the pressure line and the other end(s) to a device capable of detecting leakage;

b) Fill the closed test piece with air or nitrogen at the specified temperature;

c) Close the valve;

d) Raise the pressure progressively and smoothly in such a way that the test pressure specified in this document is attained within 30 s;

e) Maintain the pressure and temperature for the length of time specified in this document;

f) Observe and records any signs of leakage;

g) Depressurize the test piece.

Valves with independent double seating (such as two-piece obturator or double-seated valves) can be tested by applying pressure between the seats, and each side of the closed valve checked for leakage.

A.3.3 External Leaktightness test (half open valve)

Conduct the following procedure:

a) Put the valve in half open position;

b) Connect one end of the test piece to the pressure supply and close the other end;

c) Fill the test piece with air or nitrogen at the specified temperature;

d) Raise the pressure progressively and smoothly in such a way that the test pressure specified in this document, is attained within 30 s;

e) Maintain the pressure and temperature for the length of time specified in this document;

f) Observe and records any signs of external leakage;

g) Depressurize the test piece.

A.4 Test report

The test report shall include the following information:

a) full identification of the valve under test;

b) reference to this method of test, i.e. EN 1555-4:2021, Annex A;

c) test pressure(s), applied to the test piece;

d) test duration;

e) results of internal and external leaktightness testing;

f) any conditions or incidents not detailed by this test method and which might have affected the results;

g) date of test.

Annex B
(normative)

Test method for leaktightness and ease of operation after tensile loading

B.1 Apparatus

B.1.1 Tensile test machine, capable of applying to a test piece and maintaining for a specified time period t, a tensile force corresponding to a specified longitudinal tensile stress σ_x, in the walls of pipes joined to the valve, and then if relevant producing a specified rate of extension. The tensile testing machine shall be sufficiently powerful to allow tests to be carried out up to the yield point of the pipe.

B.1.2 Grips or couplings, to enable the test machine (B.1.1) to apply the appropriate force, directly or through intermediate fittings.

B.1.3 Pressurizing equipment, to enable a specified internal pressure p, to be applied via suitable connections to the test piece while it is subject to the tensile force.

B.2 Test piece

The test piece shall comprise the valve under test assembled in accordance with 8.1 between two PE pipes, each of the nominal outside diameter, d_n, and the SDR series with which the valve is designed to be used, and each pipe having a length of either $2d_n$ mm or 250 mm, whichever is the shorter.

B.3 Conditions

The valves shall be tested using the following conditions:

a) nominal longitudinal tensile stress, σ_x, in the connected pipe wall shall be 12 MPa for PE 100 or PE 100-RC, and 10 MPa for PE 80;

b) internal pressure, p, shall be 25 mbar maintained for the specified duration of the test;

c) tensile force shall be calculated using the nominal pipe dimensions;

d) time period t, for which the tensile force is maintained steady shall be 1 h;

e) rate of extension between the grips shall be 25 mm/min ± 1 mm/min.

B.4 Procedure

B.4.1 The valve shall be tested by closing the obturator in the normal manner while maintaining an ambient test temperature of (23 ± 2) °C.

Apply the specified internal pressure p, for internal leaktightness assessment before tensile testing (Annex A). In case of bi-directional valves, apply pressure to both sides. Ensure that all relevant parts of the valve are subject to the pressure.

B.4.2 After completion of the leaktightness test, mount the test piece in the tensile testing machine. Apply an increasing force smoothly until the applicable longitudinal stress, σ_x, is induced in the walls of the pipes in the test assembly.

B.4.3 Maintain the force for the specified time period *t*.

B.4.4 Apply the specified rate of extension until the valve spigot end or pipe yields, see Table 1.

NOTE Yield is defined as a visible necking and elongation or a decrease of the load during the tensile test.

B.4.5 Remove the tensile load and, without any intervening operation of the valve, submit the valve to torque testing in accordance with EN ISO 8233[2], and leaktightness testing of the seat and packing according to Annex A.

Yielded pipe test pieces can be removed in order to perform the torque and leaktightness tests.

B.5 Test report

The test report shall include the following information:

a) full identification of the valve under test;

b) reference to this method of test, i.e. EN 1555-4:2021, Annex B;

c) dimensions of the pipes used in the test piece;

d) longitudinal tensile stress, σ_x;

e) tensile force applied to the test piece;

f) internal pressure *p*, applied to the test piece;

g) time period *t*, for which the tensile force was maintained;

h) results of torque testing in accordance with EN ISO 8233[2];

i) results of leaktightness testing in accordance with Annex A;

j) any conditions or incidents not detailed by this test method and which might have affected the results;

k) date of testing.

Bibliography

[1] EN 12007-2:2012, *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] EN ISO 5210, *Industrial valves - Multi-turn valve actuator attachments (ISO 5210)*

[4] ISO 12176-4, *Plastics pipes and fittings- Equipment for fusion jointing polyethylene systems - Part 4: Traceability coding*

[5] ISO 12176-5, *Plastics pipes and fittings - Equipment for fusion jointing polyethylene systems - Part 5: Two-dimensional data coding of components and data exchange*

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