INTERNATIONAL STANDARD

**ISO 4437-4**

Second edition
2022-11

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

## Part 4: **Valves**

*Systèmes de canalisations en plastique pour la distribution des combustibles gazeux — Polyéthylène (PE) —*

*Partie 4: Robinets*



Reference number
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# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 7, *Valves and auxiliary equipment of plastics materials*.

This second edition cancels and replaces the first edition (ISO 4437-4:2015), which has been technically revised.

The main changes are as follows:

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

— an improved description of the leaktightness test has been 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 including new methods for PE 100-RC materials.

A list of all parts in the ISO 4437 series can be found on the ISO website.

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

# Introduction

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

Requirements and test methods for material and components, other than valves, are specified in ISO 4437-1, ISO 4437-2 and ISO 4437-3.

Characteristics for fitness for purpose are covered in ISO 4437-5. CEN/TS 1555-7[2] gives guidance for assessment of conformity. Recommended practice for installation is given in ISO/TS 10839[1].

This document covers the characteristics of valves.

The ISO 4437 series covers a range of maximum operating pressures and gives requirements concerning colours. 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.

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

# Part 4: 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 unidirectional and bi-directional isolating valves with spigot ends or electrofusion sockets intended to be fused with PE pipes or fittings conforming to ISO 4437–2 and ISO 4437-3 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 ISO 4437 series, provided that they have PE connections for butt fusion or electrofusion ends, including integrated material transition joints, conforming to ISO 4437-3.

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 the ISO 4437 series, this document 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 ISO 8233, 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 ISO 4437-5.

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.

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

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*

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

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 3127, *Thermoplastics pipes — Determination of resistance to external blows — Round-the-clock method*

ISO 4437-1, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 1: General*

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

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

ISO 4437-5, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 5: Fitness for purpose of the system*

ISO 8233, *Thermoplastics valves — Torque — Test method*

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

ISO 16010, *Elastomeric seals — Material requirements for seals used in pipes and fittings carrying gaseous fuels and hydrocarbon fluids*

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

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

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

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*



## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4437-1, EN 736-1, EN 736-2 and the following apply.

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

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

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

### 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**
**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]

**3.2.2**
**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]

**3.2.3**
**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 purposes of this document, the symbols and abbreviated terms given in ISO 4437-1 apply.

## 5 Material

### 5.1 Material for polyethylene parts

The PE compound from which the valve body with spigot or electrofusion socket ends is made, shall be virgin material conforming to ISO 4437-1.

The other components of the valve made in PE shall be made only from material conforming to ISO 4437-1.

## 5.2 Material for non-polyethylene parts

### 5.2.1 General

All components shall conform to the relevant ISO standard(s). Alternative standards may be applied in cases where the suitable ISO 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 ISO 4437-2, 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 ISO 4437-3.

### 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 can 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 ISO 16010.

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 maximum operating pressure (MOP) of the valve shall be defined by the manufacturer according to the design standard dimension ratio (SDR), design coefficient 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 conform to the requirements of ISO 4437-3.

### 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 be 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 mounted in a manner 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 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 ISO 4437-3:—[2)], 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 ISO 4437-3:—, 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 ISO 5210[3].

## 8 Mechanical characteristics of assembled valves

### 8.1 General

All tests shall be carried out on valves assembled with pipe conforming to ISO 4437-2 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 ISO 4437-5.

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.



2) Under preparation. Stage at the time of publication: ISO/DIS 4437-3:2022.

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

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

[b] 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].

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

[l] This test only applies to PE 100-RC materials.

**Table 1** *(continued)*

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| | | Parameter | Value | |
| Hydrostatic strength (80 °C, 1 000 h) [g] | No failure during the test period of any test piece | Conditioning time [a] | Shall conform to ISO 1167–1 | ISO 1167–1 and ISO 1167–4 |
| | | Number of test pieces [b] | 3 | |
| | | Type of test | Water-in-water | |
| | | Circumferential (hoop) stress[i]: PE 80 | 4,0 MPa | |
| | | Circumferential (hoop) stress[i]: PE 100 or PE 100-RC | 5,0 MPa | |
| | | Test period | 1 000 h | |
| | | Test temperature | 80 °C | |
| Resistance to slow crack growth PE 100-RC<br>Strain - Hardening test (SHT)[l] | <Gp> ≥ 50 MPa | Test sample [j]<br>Test temperature<br>Thickness<br>Test speed<br>Number of test pieces | Compression moulded sheet made from regrind from valve body<br>80 °C<br>300 µm<br>Shall conform to ISO 18488<br>5 | ISO 18488 |
| Leaktightness of seat(s) and packing | No leakage during the test period | Test temperature<br>Test fluid<br>Number of test pieces [b]<br>Test pressure<br>Duration of the test | 23 °C<br>Air or nitrogen<br>1<br>25 mbar<br>1 h | Annex A |
| Leaktightness of seat(s) and packing | No leakage during the test period | Test temperature<br>Test fluid<br>Number of test pieces [b]<br>Test pressure<br>Duration of the test | 23 °C [f]<br>Air or nitrogen<br>1<br>1,5 MOP<br>30 s | Annex A |

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

[b] 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].

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

[l] This test only applies to PE 100-RC materials.

**Table 1** *(continued)*

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| | | Parameter | Value | |
| **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:<br><br>For $d_n$ < 63 mm<br>5 Nm < $M$ ≤ 35 Nm<br>For<br>63 mm < $d_n$ ≤ 125 mm<br>10 Nm < $M$ ≤ 70 Nm<br>For<br>125 mm < $d_n$ ≤ 400 mm<br>10 Nm < $M$ ≤ 150 Nm | Test temperatures<br><br>Number of test pieces [b] | - 20 °C, + 23 °C [f] and + 40 °C<br><br>1 | ISO 8233 |
| Stop resistance | a) No failure at stops in closing and opening position<br><br>Followed by: | Test temperature<br>Number of test pieces [b]<br>Torque<br><br>Duration | −20 °C and + 40 °C<br>1<br>150 Nm or 2 times the value of the maximum measured operating torque whichever the greater<br>30 s | ISO 8233 |
| | b) No leakage at seat(s) and packing | Test temperature<br>Test fluid<br>Number of test pieces [b]<br>Test pressure<br>Duration | 23 °C<br>Air or nitrogen<br>1<br>1,5 MOP<br>30 s | Annex A |

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

[b] 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].

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

[l] This test only applies to PE 100-RC materials.

**Table 1** *(continued)*

| 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 pressure<br>Test temperature<br>Number of test pieces [b] | 6 bar<br>23 °C<br>1 | ISO 8233 |
| Resistance to bending between supports | No leakage and maximum value for operating torque (see examination of operating torque) | Load applied for:<br>63 mm < $d_n \leq 125$ mm<br>125 mm < $d_n \leq 400$ mm<br>Number of test pieces [b] | <br>3,0 kN<br>6,0 kN<br>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<br>Temperature of cycling<br>Number of test pieces [b] | 50<br>−20 °C to +40 °C<br>2 | EN 1704 |

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

[b] 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].

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

[l] This test only applies to PE 100-RC materials.

**Table 1** *(continued)*

| 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<br>Test fluid<br>Test pressure<br>Number of test pieces [b] | 23 °C<br>Air or nitrogen<br>25 mbar<br>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<br>Drop height<br>Mass of the striker<br>Type of the striker<br>Test temperature<br>Number of test pieces [b] | Vertical, see Figure 1<br>2 m<br>2,5 kg<br>d90 conforming to ISO 3127<br>−20 °C<br>1 | EN 1705 |
| **Multiple tests** | | | | |
| 1) Resistance to long-term internal pressure loading [e, g] | No failure during the test period | Conditioning time [a] | Shall conform to ISO 1167–1 | ISO 1167-1 and ISO 1167–4 |
| | | Type of test | Water-in-water | |
| | | Number of test pieces [b] | 1 | |
| | | Circumferential hoop stress[i]: PE 80 | 8,0 MPa | |
| | | Circumferential hoop stress[i]: PE 100 or PE 100-RC | 10,0 MPa | |
| | | Test period | 1 000 h | |
| | | Test temperature | 20 °C | |

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

[b] 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].

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

[l] This test only applies to PE 100-RC materials.

**Table 1** *(continued)*

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| | | Parameter | Value | |
| 2) Leaktightness of seat(s) and packing | No leakage during the test period | Test temperature<br>Test fluid<br>Number of test pieces [b]<br>Test pressure<br>Duration of the test | 23 °C<br>Air or nitrogen<br>1<br>25 mbar<br>1 h | Annex A |
| 3) Leaktightness of seat(s) and packing | No leakage during the test period | Test temperature<br>Test fluid<br>Number of test pieces [b]<br>Test pressure<br>Duration of the test | 23 °C<br>Air or nitrogen<br>1<br>1,5MOP<br>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:<br>For $d_n \leq 63$ mm<br>5 Nm < $M \leq$ 35 Nm<br>For<br>63 mm < $d_n \leq$ 125mm<br>10 Nm < $M \leq$ 70 Nm<br>For<br>125 mm < $d_n \leq$ 400 mm<br>10 Nm < $M \leq$ 150 Nm | Test temperatures<br>Number of test pieces [b] | –20 °C, +23 °C and +40 °C<br>1 | ISO 8233 |
| 5) Impact loading resistance | No leakage and maximum value for operating torque (see examination of operating torque) | Position of sample<br>Drop height<br>Mass of the striker<br>Type of the striker<br>Test temperature<br>Number of test pieces [b] | Vertical, see Figure 1<br>2 m<br>2,5 kg<br>d90 conforming to ISO 3127<br>–20 °C<br>1 | EN 1705 |

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

[b] 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].

[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.

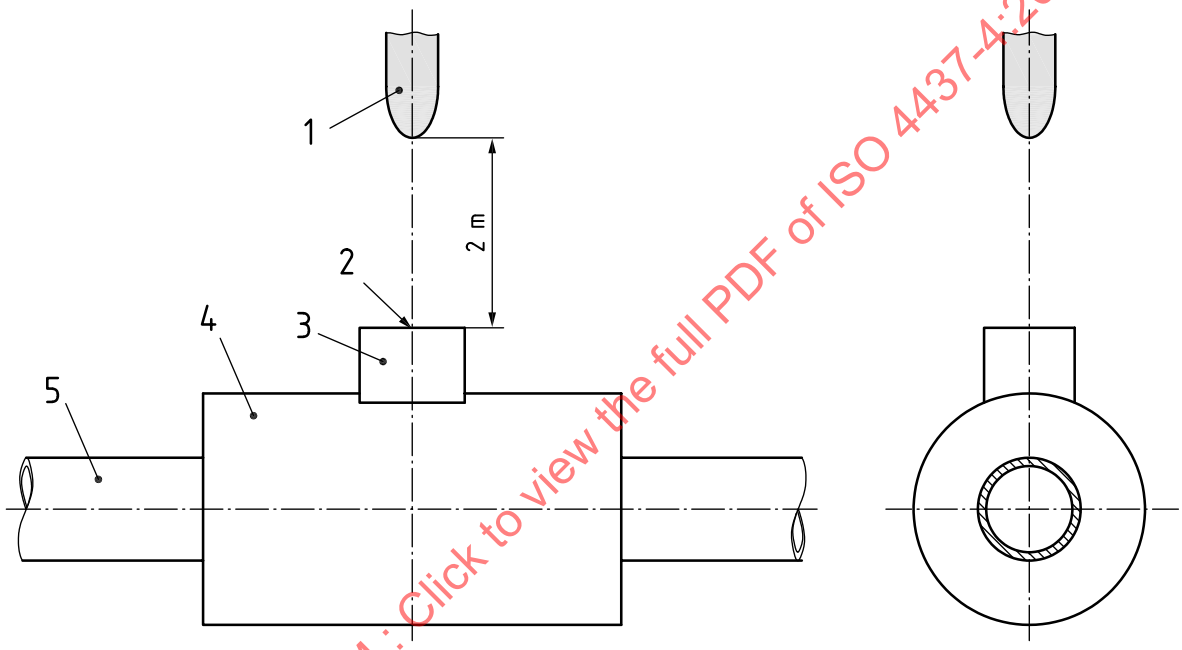
[j] The sample for the SHT test shall be taken across the valve body wall, or the whole circumference in case of small diameter. The outer surface shall be scraped to remove any contamination present before regrinding.

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

[l] This test only applies to PE 100-RC materials.

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

| PE 80 | | PE 100 and PE 100-RC | |
|---|---|---|---|
| **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 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 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<br>(thermal stability) | ≥ 10 min | Test temperature<br>Number of test pieces [a]<br>Test environment<br>Specimen weight | 210 °C [b]<br>3<br>Oxygen<br>(15 ± 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 [c] | Loading mass<br>Test temperature<br>Time<br>Number of test pieces [a] | 5 kg<br>190 °C<br>10 min<br>Shall conform to ISO 1133-1 | 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 the ISO 4437 series, the joints shall conform to ISO 4437-5.

## 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 document. 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:

a) full bore valve;

b) clearway valve;

c) reduced bore valve.

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.

# 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 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 tubular 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] | ISO 4437 |
| 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 (i.e. design SDR) | 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 to store valves in their original packing, until ready for installation.