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Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing —

Part 4: Valves

Systèmes de canalisations en matières plastiques pour la distribution de combustibles gazeux — Systèmes de canalisations en polyamide non plastifié (PA-U) avec assemblages par soudage et assemblages mécaniques —

Partie 4: Robinets

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Contents

Page

Foreword

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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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 138 *Plastics pipes, fittings and valves for the transport of fluids,* Subcommittee SC 7 *Valves and auxiliary equipment of plastics materials*.

ISO 16486 consists of the following parts, under the general title *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing:*

— *Part 1: General*

— *Part 2: Pipes*

— *Part 3: Fittings*

— *Part 4: Valves*

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

— *Part 6: Code of practice for design, handling and installation*

Introduction

Thin wall thickness unplasticized polyamide (PA-U) pipes and solvent cement joints are used typically for low pressures, while thicker wall thickness pipes and butt fusion, electrofusion, or mechanical joints are typically used for high pressures.

For technical and safety reasons, it is not possible to mix the components of the two types of piping system (thin wall thickness pipes cannot be jointed by butt fusion or mechanical joints and vice versa). In particular, solvent cement joints shall not be used for jointing for high pressure piping systems.

So for the time being, the standardization programme dealing with unplasticized polyamide (PA-U) piping systems for the supply of gaseous fuels is split into two series of International Standards, with one series (ISO 17467) covering piping systems the components of which are connected by solvent cement jointing and the other (ISO 16486), the components of which are connected by fusion jointing and/or mechanical jointing. When more experience will be gained from the field, it might be reasonable to merge ISO 17467 series and ISO 16486 series in one single series applicable to PA-U piping systems.

Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing —

Part 4: Valves

1 Scope

This part of ISO 16486 specifies the characteristics of valves made from unplasticized polyamide (PA-U) in accordance with ISO 16486-1, intended to be buried and used for the supply of gaseous fuels.

Valves made from other material than unplasticized polyamide designed for the supply of gaseous fuels conforming to the relevant standards are permitted to be used in PA-U piping system according to ISO 16486 provided they have relevant PA-U connections for butt fusion or electrofusion ends (see ISO 16486-3). The component, i.e. the complete valve, shall fulfil the requirements of this part of ISO 16486.

It also specifies the test parameters for the test methods referred to in this part of ISO 16486.

It is applicable to bi-directional valves with spigot end or electrofusion socket intended to be jointed with PA-U pipes conforming to ISO 16486-2 without any fittings or with PA-U fittings conforming to ISO 16486-3.

This part of ISO 16486 covers valves for pipes with a nominal outside diameter, d_n, ≤250 mm.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 307, *Plastics — Polyamides — Determination of viscosity number*

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*

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 8233, *Thermoplastics valves — Torque — Test method*

ISO 9393-1:2004, *Thermoplastics valves for industrial applications — Pressure test methods and requirements — Part 1: General*

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

ISO 16486-1, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing — Part 1: General*

ISO 16486-2, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing — Part 2: Pipes*

ISO 16486-3:2012, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing — Part 3: Fittings*

ISO 16486-5, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing — Part 5: Fitness for purpose of the system*

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 16486-1, EN 736-1, EN 736-2 and the following apply.

3.1
external leaktightness
leaktightness (3.3) of the *valve body* (3.6) enveloping the space containing the gas, with respect to the atmosphere

3.2
internal leaktightness
leaktightness (3.3) 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* (3.2) of a valve's closing seat when closed and pressurized from either side;

b) the *external leaktightness* (3.1) of a valve when half open

3.4
initiating torque
torque required to initiate movement of the obturator

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* (3.6) 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 PA-U 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

3.9 Terms relating to design

3.9.1
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]

3.9.2
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]

3.9.3
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* (3.9.1)

4 Material

4.1 PA-U compound

The valves shall be made from virgin material.

The compound from which the valves are made shall be in accordance with ISO 16486-1.

4.2 Material for non-unplasticized polyamide parts

4.2.1 General

The materials and constituent elements used in making the valve shall be resistant to the external and internal environments in which they are intended to be used

a) during storage,

b) under the effect of the fluids being conveyed, and

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

Valves materials, including elastomers, greases, and lubricants in contact with the PA-U pipe, shall not adversely affect pipe performance or initiate stress cracking.

Metal valve bodies for PA-U piping systems up to 20 bar should conform to the relevant standard of ISO/TC 153"Valves".

4.2.2 Metal parts

All 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 Elastomers

Elastomeric materials used for the manufacture of seals shall be in accordance with ISO 16010.

Other sealing materials are permitted if proven suitable for gas service.

4.2.4 Other materials

Greases and lubricants shall not exude on to the fusion areas and shall not affect the long-term performance of the pipe/valve.

Other materials conforming to 4.2.1 may be used provided that it is proven that the valves conform to this part of ISO 16486.

5 General characteristics

5.1 Appearance of the valve

When viewed without magnification, the internal and external surfaces of valves shall be smooth, clean, and free from scoring, cavities, or other surface defects to an extent that would prevent conformity to this part of ISO 16486.

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 this part of ISO 16486.

5.2 Colour

The colour of the PA-U parts of valves shall be either black or yellow.

5.3 Design

5.3.1 General

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

PA-U valves bodies and their PA-U spigot ends or electrofusion sockets shall have a pressure rating of at least that of the pipe to which they are jointed.

5.3.2 Valve body

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

5.3.3 Operating device

The operating device shall be integral with or connected to the stem in such a way that disconnection is not possible during normal operation.

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.

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

5.3.4 Seals

The seals, which elastomeric materials are conforming to 4.2.3, shall be so mounted as to be resistant to normally occurring mechanical loads. 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.

5.4 Fusion compatibility

Components made from PA-U 11 shall be heat fusion jointed only to components made from PA-U 11.

Components made from PA-U 12 shall be heat fusion jointed only to components made from PA-U 12.

Components made from PA-U are not fusion compatible with components made from other polymers.

6 Geometrical characteristics

6.1 General

Each valve shall be 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.

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

6.2 Measurement of dimensions

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

6.3 Dimensions of spigot ends for valves

The dimensions of spigot ends shall conform to ISO 16486-3:2012, Table 4, up to and including d_n 250 mm.

6.4 Dimensions of valves with electrofusion sockets

The dimensions of electrofusion sockets shall conform to ISO 16486-3:2012, Table 1, up to and including d_n 250 mm.

6.5 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 non-quarter-turn operated valve, the attention is drawn on the requirements specified in ISO 5210.

7 Mechanical characteristics of assembled valves

7.1 General

All tests shall be carried out on valves assembled with pipe from the same series conforming to ISO 16486-2, in accordance with the technical instructions and the extreme installation conditions of utilization described in ISO 16486-5.

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).

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 Conditioning

Unless otherwise specified in the applicable test method, the test pieces shall be conditioned for at least 16 h at 23 °C and 50 % relative humidity in accordance with ISO 291 before testing in accordance with Table 1.

7.3 Requirements

The test pieces shall be tested in accordance with Table 1. When tested using the test method and parameters specified therein, the valves shall have mechanical characteristics conforming to the requirements of Table 1.

Table 1 — Mechanical characteristics of valves

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Hydrostatic strength (20 °C, 1 000 h)	No failure during the test period of any test piece	Conditioning period[a]	6 h	ISO 1167-1 ISO 1167-4
		Type of test	Water-in-water	
		Test temperature	20 °C	
		Test period	100 h	
		Circumferential (hoop) stress PA-U 11 and PA-U 12 160[b] PA-U 11 and PA-U 12 180[b]	19,0 MPa 20,0 MPa	
Hydrostatic strength (80 °C, 165 h)	No failure during the test period of any test piece	Conditioning period[a]	6 h	ISO 1167-1 ISO 1167-4
		Type of test	Water-in-water	
		Test temperature	80 °C	
		Test period	165 h	
		Circumferential (hoop) stress PA-U 11 and PA-U 12 160[b] PA-U 11 and PA-U 12 180[b]	10,0 MPa 11,5 MPa	
Leaktightness of seat and packing	No leakage during the test period	Test temperature Type fluid 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	Test temperature Type fluid Test pressure Duration of the test	23 °C Air or nitrogen 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.				
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	ISO 17778

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

[b] For material classification and designation, see ISO 16486-1:2012, 5.4.

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

[d] After at least 24 h after the completion of the internal pressure test, the other four tests shall be carried out on the valve in the order stated.

[e] Alternatively, for $d_n > 200$ mm, the test can also be performed in air. In case of dispute, water in water shall be used.

[f] The maximum torque manually applied to the gear or lever shall not exceed 250 Nm and the maximum diameter of the wheel or the length of the lever shall be less than 1 m.

[g] 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 the factory production control and process control should be listed in the manufacturer's quality plan.

Table 1 *(continued)*

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Operating torque[c]	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 < $d_n \leq$ 400mm M>10 Nm[f]	Test temperatures	+23 °C and –20 °C and +40 °C	ISO 8233
Stop resistance	a) no failure at stops, and b) no leakage at seat and packing	Test temperature Torque	–20 °C and +40 °C two times the value of the maximum measured operating torque with minimum 150 Nm, during 15 s	a) ISO 8233 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 Test temperature	6 bar 23 °C	ISO 8233
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 < $d_n \leq$ 250 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)			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 and after bending applied to the operating mechanism	No leakage			EN 1680

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

[b] For material classification and designation, see ISO 16486-1:2012, 5.4.

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

[d] After at least 24 h after the completion of the internal pressure test, the other four tests shall be carried out on the valve in the order stated.

[e] Alternatively, for d_n > 200 mm, the test can also be performed in air. In case of dispute, water in water shall be used.

[f] The maximum torque manually applied to the gear or lever shall not exceed 250 Nm and the maximum diameter of the wheel or the length of the lever shall be less than 1 m.

[g] 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 the factory production control and process control should be listed in the manufacturer's quality plan.

Table 1 *(continued)*

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
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	Vertical, see Figure 1 2 m 2,5 kg d90 conforming to ISO 3127 −20 °C	EN 1705
Multiple test 1				
1) Tensile loading followed by leak-tightness of seat and packing	No leakage during the test period	Test temperature Type fluid Test pressure Duration of the test	23 °C Air or nitrogen 25 mbar 1 h	Annex B
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.				
2) Operating torque after removal of tensile loading [c]	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 < $d_n \leq$ 400mm M>10 Nm [f]	Test temperatures Number of test pieces[g]	+23°C and −20°C and +40°C 1	ISO 8233
3) Leaktightness of seat and packing after removal of tensile loading	No leakage during the test period	Test temperature Type fluid Test pressure Duration of the test	23 °C Air or nitrogen 25 mbar 1 h	Annex A
Multiple test 2[d]				
1) Resistance to long-term internal pressure loading	No failure of the test piece during the test period	Conditioning period[a]	6 h	ISO 1167-1 ISO 1167-4
		Type of test	Water-in-water[e]	
		Test pressure PA-U 11 and PA-U12 160[b] PA-U 11 and PA-U 12 180[b]	32 bar 36 bar	
		Test period	1 000 h	
		Test temperature	20 °C	

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

[b] For material classification and designation, see ISO 16486-1:2012, 5.4.

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

[d] After at least 24 h after the completion of the internal pressure test, the other four tests shall be carried out on the valve in the order stated.

[e] Alternatively, for d_n > 200 mm, the test can also be performed in air. In case of dispute, water in water shall be used.

[f] The maximum torque manually applied to the gear or lever shall not exceed 250 Nm and the maximum diameter of the wheel or the length of the lever shall be less than 1 m.

[g] 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 the factory production control and process control should be listed in the manufacturer's quality plan.

Table 1 *(continued)*

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
2) Leaktightness of seat and packing	No leakage during the test period	Test temperature 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	Test temperature Type fluid Test pressure Duration of the test	23 °C Air or nitrogen 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.				
4) Operating torque[c]	Torque range: — For $d_n \leq 63$ mm 5 Nm < M ≤ 35 Nm — For 63 mm < $d_n \leq 125$mm 10 Nm < M ≤ 70 Nm — For 125 mm < $d_n \leq 400$mm M>10 Nm[f]	Test temperatures Number of test pieces [g]	+23°C and −20 °C and +40 °C 1	ISO 8233
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	Vertical, see Figure 1 2 m 2,5 kg d90 conforming to ISO 3127 −20 °C	EN 1705

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

[b] For material classification and designation, see ISO 16486-1:2012, 5.4.

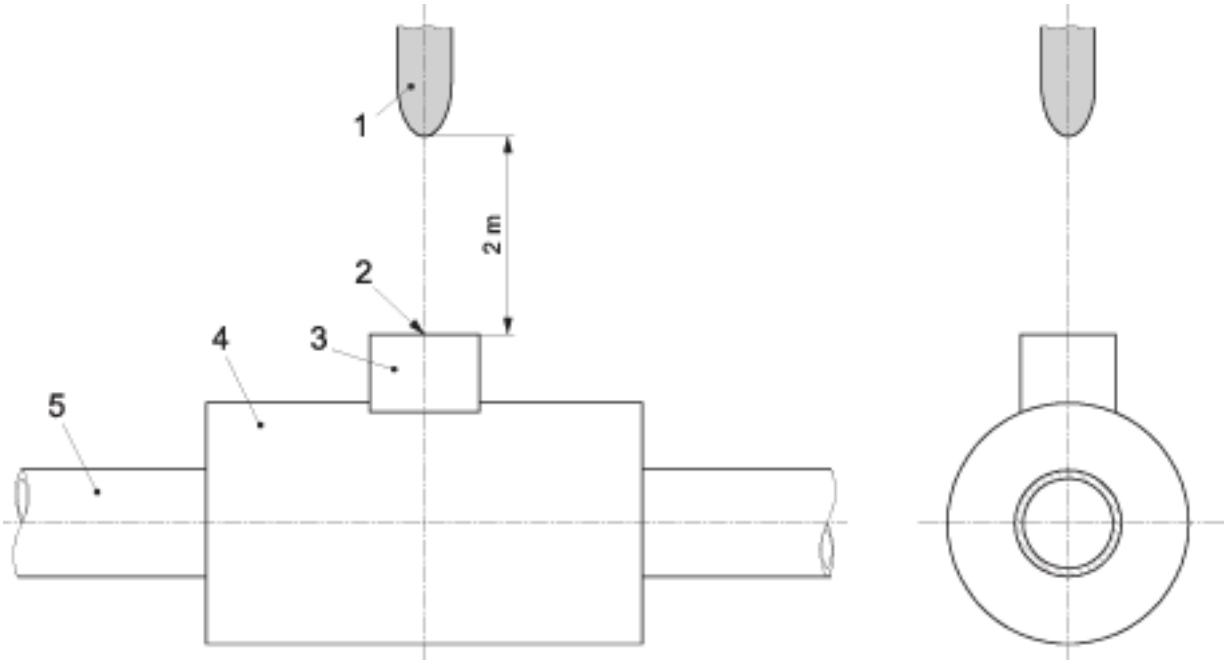
[c] The initiating torque and the running torque shall be within the torque range given in this table.

[d] After at least 24 h after the completion of the internal pressure test, the other four tests shall be carried out on the valve in the order stated.

[e] Alternatively, for $d_n > 200$ mm, the test can also be performed in air. In case of dispute, water in water shall be used.

[f] The maximum torque manually applied to the gear or lever shall not exceed 250 Nm and the maximum diameter of the wheel or the length of the lever shall be less than 1 m.

[g] 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 the factory production control and process control should be listed in the manufacturer's quality plan.



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 Physical characteristics

8.1 Conditioning

Unless otherwise specified in the applicable test method, the test pieces shall be conditioned for at least 16 h at 23 °C and 50 % relative humidity in accordance with ISO 291 before testing in accordance with Table 2.

8.2 Requirement

The test pieces shall be tested in accordance with Table 2. When tested using the test method and parameters specified therein, the valves shall have physical characteristic conforming to the requirements of Table 2.

Table 2 — Physical characteristics

Characteristic	Requirement	Test parameters		Test method
Viscosity number	≥180 ml/g	Solvent	m-Cresol	ISO 307

9 Performance requirements

When valves conforming to this part of ISO 16486 are assembled to each other or to components conforming to other parts of ISO 16486, the joints shall conform to the requirements given in ISO 16486-5.

10 Marking

10.1 General

All valves shall be permanently and legibly marked in such a way that the marking does not initiate cracks or other types of defects which adversely influence the performance 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.

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

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

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

10.2 Minimum required marking of valves

The minimum required marking shall conform to Table 3.

Table 3 — Minimum required marking on valve

Aspects	Marking
Manufacturer's identification	Name or code
Manufacturer's information	[a]
Nominal diameter/SDR	e.g. 110/SDR 11
Material and designation	e.g. PA-U 12 160[b]
Flow direction (only for unidirectional valve)	Arrow

[a] In clear figures or in code providing traceability to the production period within year and month and, if the manufacturer is producing at different sites.

[b] For material classification and designation, see ISO 16486-1:2012, 5.4.

10.3 Additional information required on valve or label

The additional information as specified in Table 4 shall be either marked on the valve or printed on a label attached to the valve or to its individual bag. The label shall be of sufficient quality to be intact and legible at the time of installation.

Table 4 — Additional information required on the valve or label

Aspects	Marking
Reference to this part of ISO 16486	ISO 16486-4
Internal fluid	Gas

10.4 Fusion system recognition

Fusion fittings should have a system, either numerical, electromechanical, or self-regulatory, for recognizing the fusion parameters and facilitating the fusion process.

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

11 Packaging

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

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

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

It is recommended that fittings be stored in their original packaging until ready for installation.

Annex A
(normative)

Determination of the leaktightness of seat and packing

A.1 General

Annex A specifies the test method to verify the leaktightness of the seat and packing of a valve/valve body made from PA-U.

A.2 Test method

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

The valve shall be tested in accordance with ISO 9393-1:2004, 7.4.2 and 7.4.3, maintaining an ambient test temperature of (23 ± 2) °C.

Referring to the details given in ISO 9393-1:2004, 7.4.2 and 7.4.3, consider that the pressure shall be progressively and smoothly risen in such a way that the test pressure specified in Table 1, is attained as rapidly as possible, but not in less than 30 s. Maintain the pressure and temperature for the length of time specified in Table 1.

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 body 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.

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 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 producing a specified rate of extension until the test piece yields or breaks.

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

B.1.3 Pressurising 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 7.1 between two PA 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 $2d_n$ or 250 mm, whichever is the shorter.

B.3 Test conditions

The valves shall be tested using the following conditions:

a) the longitudinal tensile stress, σ_x, in the connected pipe wall shall be 12 MPa;

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

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

d) the rate of extension between the grips shall be (25 ± 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.

Mount the test piece in the tensile testing machine and apply the specified internal pressure, p, for the leaktightness assessment before tensile testing. 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 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 test period, t, then close the pressure inlet and check the leaktightness for 30 s.

B.4.4 Remove the tensile load and, without any intervening operation of the valve, submit the valve

a) to torque testing according to ISO 8233 using the test parameters given in Table 1, and

b) to testing of leaktightness of the seat and packing according to Annex A using the test parameters given in Table 1.

Record the results obtained.

B.5 Test report

The test report shall include the following information:

a) a reference to this part of ISO 16486, i.e. ISO 16486-4:2016;

b) the details necessary for complete identification of the valve under test;

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

d) the longitudinal tensile stress, σ_x;

e) the tensile force applied to the test piece;

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

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

h) the results of torque testing in accordance with ISO 8233;

i) the results of testing of leaktightness of seat and packing, in accordance with Annex A;

j) any factor that could have affected the results, such as incident or operating detail not specified in Annex B;

k) the date of test.

Bibliography

[1] ISO 5210, *Industrial valves — Multi-turn valve actuator attachments*

[2] ISO 16486-6, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing — Part 6: Code of practice for design, handling and installation*

[3] EN 736 3:2008, *Valves — Terminology — Part 3: Definition of terms*

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