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Industrial valves — Check valves of thermoplastics materials

Robinetterie industrielle — Clapets de non-retour en matériaux thermoplastiques

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Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 16137 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 69, *Industrial valves,* in collaboration with ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 7, *Valves and auxiliary equipment of plastics materials*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Industrial valves — Check valves of thermoplastics materials

1 Scope

This International Standard specifies requirements for the design, functional characteristics and manufacture of check valves made of thermoplastics materials intended to allow the flow of liquid fluids through the valve in one direction only and to prevent backflow, their connection to the pipe system, the body materials and their pressure/temperature rating between − 40 °C and + 120 °C, for a lifetime of 25 years, and also specifies their tests.

This International Standard is applicable to valves to be installed in industrial pipe systems, irrespective of the field of application and the fluids to be conveyed.

NOTE 1 Industrial pipe systems also include systems for water supply for general purposes, drainage and sewerage.

NOTE 2 Special requirements can apply to pipe systems for water for human consumption.

This International Standard is concerned with the range of DN

DN 8, DN 10, DN 15, DN 20, DN 25, DN 40, DN 50, DN 65, DN 80, DN 100, DN 125, DN 150, DN 200, DN 250, DN 300, DN 350, DN 400, DN 500 and DN 600

and the range of PN and Class

PN 6, PN 10, PN 16, PN 25, and Class 150 and Class 300.

2 Normative references

The following referenced documents are indispensable for the application 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 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 228-1:2000, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 898-1:1999, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs*

ISO 8659:1989, *Thermoplastic valves — Fatigue strength — Test method*

ISO 9393-2:2005, *Thermoplastics valves for industrial applications — Pressure test methods and requirements — Part 2: Test conditions and basic requirements*

ISO/TR 10358:1993, *Plastics pipes and fittings — Combined chemical-resistance classification table*

ISO 10931:2005, *Plastics piping systems for industrial applications — Poly(vinylidene fluoride) (PVDF) — Specifications for components and the system*

ISO 12092:2000, *Fittings, valves and other piping system components, made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C) acrylonitrile-butadiene-styrene (ABS) and acrylonitrile-styrene-acrylester (ASA) for pipes under pressure — Resistance to internal pressure — Test method*

ISO 12162:1995, *Thermoplastics materials for pipes and fittings for pressure applications — Classification and designation — Overall service (design) coefficient*

ISO 15493:2003, *Plastics piping systems for industrial applications — Acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C) — Specifications for components and the system — Metric series*

ISO 15494:2003, *Plastics piping systems for industrial applications — Polybutene (PB), polyethylene (PE) and polypropylene (PP) — Specifications for components and the system — Metric series*

EN 558-1:1995, *Industrial valves — Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems — Part 1: PN-designated valves*

EN 558-2:1995, *Industrial valves — Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems — Part 2: Class-designated valves*

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

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

EN 736-3:1999, *Valves — Terminology — Part 3: Definition of terms*

EN 1092-1:2001, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1267:1999, *Valves — Test of flow resistance using water as test fluid*

EN 1759-1:2004, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 1: Steel flanges, NPS ½ to 24*

EN 12107:1997, *Plastics piping systems — Injection-moulded thermoplastics fittings, valves and ancillary equipment — Determination of the long-term hydrostatic strength of thermoplastics materials for injection moulding of piping components*

EN 12266-1:2003, *Industrial valves — Testing of valves — Part 1: Pressure tests, test procedures and acceptance criteria – Mandatory requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 736-1, EN 736-2 and EN 736-3 and the following apply.

NOTE Other terms and definitions relative to thermoplastics materials are given in ISO 15493, ISO 15494 and ISO 10931.

3.1
nominal size
DN
alphanumeric designation of size for components of a pipework system, which is used for reference purposes, comprising the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

[ISO 6708:1995, definition 2.1]

3.2
nominal pressure
PN
numerical designation relating to pressure that is a convenient round number for reference purposes

NOTE 1 It is intended that all equipment of the same nominal size (DN) designated by the same PN number have the same mating dimensions appropriate to the type of end connections.

NOTE 2 The permissible working pressure depends upon materials, design and working temperature and is to be selected from the pressure/temperature rating tables in corresponding standards.

[ISO 7268:1983, Clause 2]

3.3
Class
alphanumeric designation used for reference purposes related to a combination of mechanical and dimensional characteristics of a component of a pipework system, which comprises the word “Class” followed by a dimensionless whole number

NOTE The number following the word “Class” does not represent a measurable value and is not intended to be used for calculation purposes except where specified in the relevant standard.

3.4
allowable maximum operating pressure
PMA
maximum pressure occurring from time to time, including surge, that a component is capable of withstanding in service

[EN 805:2000, definition 3.1.1]

NOTE EU Directive 97/23/EC (PED) designates PS (maximum allowable pressure) irrespective of temperature. The values of PMA and PS are identical at 20 °C.

3.5
trim
inside parts of the valve in contact with the fluid

NOTE Adapted from EN 736-2:1997, definition 3.2.

3.6
rating factor
f_r
rating factor used in the relationship between PMA and PN or Class and to calculate the PMA at temperatures other than 20 °C

4 Requirements

4.1 Design

4.1.1 Valve function

Check valves in accordance with this International Standard shall be suitable to prevent backflow.

Check valves will not always operate in all installation positions. See 4.5.

4.1.2 Design characteristics

Check valves shall have the following design characteristics:

a) an automatic valve opening by the hydraulic forces of the flow in the direction of the arrow marked on the valve body; see Table 2, item 10;

b) an automatic valve obturation by the reverse flow in the direction opposite to this arrow marking.

The hydraulic forces may be assisted by spring operation.

All other design characteristics shall be the responsibility of the manufacturer.

4.1.3 Types of valve end connection

The types of valve end connection can be chosen from the following alternatives:

— butt fusion ends;

— spigot ends for cementing or for welding;

— socket ends for electro-fusion;

— socket ends for heated tool welding;

— socket ends for cementing;

— socket ends for/with elastomeric seal rings;

— flanged ends;

— wafer type ends;

— threaded ends;

— union ends.

Other types of end connection are possible.

All valve ends shall be an integral part of, or threaded onto, the valve body. Different types of end connection on one body are possible.

4.2 Materials

4.2.1 Materials for the shell

The valve body and bonnet/cover materials may be selected from ISO 15493 or ISO 15494 or ISO 10931, and shall be in accordance with the requirements of the relevant above International Standard:

— ABS;

— PE;

— PP;

— PVC-C;

— PVC-U;

— PVDF.

If other body and bonnet/cover materials are used, the manufacturer shall ensure that these materials fulfil adequate requirements (such as those contained in the above International Standards for the above materials).

The bolting material between body and bonnet/cover shall be selected according to ISO 898-1.

4.2.2 Materials for other valve components

The choice of the materials for the obturator and all other internal components shall be the responsibility of the manufacturer. Design of these components shall ensure the mechanical integrity of the valve and shall be tested as specified in 5.2. A component failing any test according to 5.2 is not in conformity with the requirements of this International Standard.

4.3 Pressure/temperature rating

The valve body shall be designed in accordance with the MRS values as defined in ISO 12162 for the material specified in 4.2.1, and rated for PN 6, PN 10, PN 16, PN 25 or Class 150 and Class 300.

The PMA, in relation to the working temperature of the complete valve, depends not only on the pressure/temperature (p/t) rating of the valve body material, but also on the valve design, and can be different from the p/t rating of the shell material. The PMA for thermoplastics valves shall be determined using a rating factor f_r as follows:

$$\text{PMA} = f_r \times \text{PN}\ \text{[in bar}\ ^{1)}\text{]}\ \text{or PMA} = f_r \times \text{Class [in psi}\ ^{2)}\text{]}$$

The minimum values for the rating factor f_r for valves shall be as specified in Table 1 and are valid for

— the relevant body material,

— a lifetime of 25 years, and

— fluids without any effect on the physical and chemical characteristics of the valve parts in contact with the fluid.

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

2) Pounds per square inch.

NOTE For applications with lifetimes other than 25 years and/or with fluids with any effect on the physical and/or chemical characteristics of the valve material of the valve body, the rating factor f_r is usually established by the manufacturer.

Table 1 gives the minimum rating factors and the allowable temperature range for the valve body materials.

If the choice of materials of the trim parts (e.g. obturator, seals) limits the maximum allowable pressure and/or the maximum allowable temperature of the complete valve to less than the values given in Table 1, then this limitation shall be marked as specified in item 8 of Table 2.

The p/t rating factor for each valve type and each body material shall be declared by the manufacturer.

Table 1 — Minimum values for rating factor f_r for a lifetime up to 25 years

Temperature °C	Minimum rating factor f_r for body material					
	ABS	PE	PP	PVC-C	PVC-U	PVDF
− 40	1,0	1,0	—	—	—	a
− 30	1,0	1,0	—	—	—	a
− 20	1,0	1,0	—	—	—	1,0
− 10	1,0	1,0	—	—	—	1,0
0	1,0	1,0	—	—	—	1,0
+ 5	1,0	1,0	1,0	—	—	1,0
10	1,0	1,0	1,0	1,0	1,0	1,0
20	1,0	1,0	1,0	1,0	1,0	1,0
25	1,0	1,0	1,0	1,0	1,0	1,0
30	0,8	0,76	0,85	0,85	0,80	0,9
40	0,6	0,53	0,70	0,65	0,60	0,8
50	0,4	0,35	0,55	0,50	0,35	0,71
60	0,2	0,24	0,40	0,35	0,15	0,63
70	—	—	0,27	0,25	—	0,54
80	—	—	0,15	0,15	—	0,47
90	—	—	0,08	a	—	0,36
100	—	—	a	—	—	0,25
110	—	—	—	—	—	0,17
120	—	—	—	—	—	0,12
130	—	—	—	—	—	a
140	—	—	—	—	—	a

NOTE These values do not coincide with the relevant factors for pipes and fittings.

a A rating factor for this temperature may be declared by the manufacturer.

4.4 Dimensions

4.4.1 Face-to-face dimensions

The face-to-face dimensions of valves for use in flanged pipe systems shall be selected from

— EN 558-1 for PN designated flanges,

— EN 558-2 for Class designated flanges.

For all other types of end connection, the face-to-face dimensions shall be the responsibility of the manufacturer.

4.4.2 Joint dimensions of the valve end connections

The joint dimensions for use in flanged pipe systems shall be in accordance with

— EN 1092-1 for PN designated flanges,

— EN 1759-1 for Class designated flanges.

The joint dimensions of valves to be connected by threaded ends shall be in accordance with ISO 7-1 or ISO 228-1.

The joint dimensions for other end connections shall be, as applicable, in accordance with ISO 15493, ISO 15494 and ISO 10931. If end connections not defined in the above standards but specified in 4.1.3 are selected, the manufacturer shall declare the joint dimensions.

4.5 Operation

The operation of a check valve shall be automatic:

a) the valve starts to open under differential pressure in arrow direction and then the obturator opens dependent on the hydraulic forces of the fluid velocity;

b) the valve closes by the hydraulic forces or spring-assisted hydraulic forces of the backflow in the opposite direction.

Check valves need a minimum flow rate to achieve the fully open position. The manufacturer shall declare this minimum flow rate in his documentation; see Table 2, item 9.

WARNING — For check valve application which may involve potentially dangerous hydraulic forces the manufacturer should be consulted.

If the tight obturation in this direction depends on a minimum back-pressure of the fluid, then this shall be declared by the manufacturer in his documentation, see Table 2, item 9.

Check valves do not always operate in all installation positions. When restricted, correct valve orientation(s) in the pipework shall be declared by the manufacturer, see Table 2, item 11.

4.6 Functional characteristics

4.6.1 Design strength

For each valve body material, the shell design strength shall conform to ISO 9393-2:2005,

— Clause 5, for the shell test, and

— Clause 6, for the long-term behaviour test of the complete valve.

4.6.2 Flow characteristics

The manufacturer shall specify the k_V values according to EN 1267 for the fully open position.

4.6.3 Seat and shell leaktightness

The shell leaktightness shall be in accordance with the requirements of ISO 9393-2:2005, Clause 7.

The seat leaktightness shall be in accordance with the requirements of EN 12266-1. The leakage rate shall be not greater than rate F in EN 12266-1:2003, Table A.5.