



SLOVENSKI STANDARD

SIST EN 16668:2016

01-julij-2016

Industrijski ventili - Zahteve in preskušanje kovinskih ventilov kot tlačnega pribora

Industrial valves - Requirements and testing for metallic valves as pressure accessories

Industriearmaturen - Anforderungen und Prüfungen für Metallarmaturen als drucktragende Ausrüstungsteile

Robinetterie industrielle - Exigences et essai pour appareils de robinetterie métalliques tels que les accessoires sous pression

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Industrial valves - Requirements and testing for metallic valves as pressure accessories

Robinetterie industrielle - Exigences et essais pour appareils de robinetterie métalliques utilisés comme accessoires sous pression

Industriearmaturen - Anforderungen und Prüfungen für Metallarmaturen als drucktragende Ausrüstungsteile

This European Standard was approved by CEN on 23 January 2016.

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EN 16668:2016 (E)

European foreword

This document (EN 16668:2016) has been prepared by Technical Committee CEN/TC 69 “Industrial valves”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2016, and conflicting national standards shall be withdrawn at the latest by October 2016.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

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

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Introduction

This European Standard is to be understood as an umbrella standard referencing European harmonized Standards for industrial metallic valves as pressure accessories for industrial applications and covers the relevant minimum requirements to meet the Essential Safety Requirements of the Pressure Equipment Directive.

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EN 16668:2016 (E)**1 Scope**

This European standard applies to metallic valves as pressure accessories for industrial applications with a maximum allowable pressure PS greater than 0,5 bar in accordance with the Pressure Equipment Directive 2014/68/EU and specifies minimum requirements applicable to design, manufacture, testing, materials and documentation.

All relevant essential safety requirements of the Pressure Equipment Directive 2014/68/EU applicable to valves have been taken into consideration and are addressed in this standard.

This standard is not applicable to:

- safety valve and bursting disc (a safety accessory),
- sight glass with its frames (component of a pressure equipment) and
- measurement chambers.

For other exclusions refer to the PED [32].

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.

EN 19:2002, *Industrial valves — Marking of metallic valves*

EN 287-1:2011,¹ *Qualification test of welders — Fusion welding — Part 1: Steels*

EN 545:2010, *Ductile iron pipes, fittings, accessories and their joints for water pipelines — Requirements and test methods*

EN 593, *Industrial valves — Metallic butterfly valves*

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

EN 764 (all parts), *Pressure equipment*

EN 764-4:2014, *Pressure equipment — Part 4: Establishment of technical delivery conditions for metallic materials*

EN 764-5:2014, *Pressure equipment — Part 5: Inspection documentation of metallic materials and compliance with the material specification*

EN 1171, *Industrial valves — Cast iron gate valves*

EN 1349:2009, *Industrial process control valves*

EN 1515-4:2009, *Flanges and their joints — Bolting — Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 97/23/EC*

1) This document was superseded with EN ISO 9606-1:2013, *Qualification testing of welders — Fusion welding — Part 1: Steels (ISO 9606-1:2012 including Cor 1:2012)*.

- EN 1561:2011, *Founding — Grey cast irons*
- EN 1982:2008, *Copper and copper alloys — Ingots and castings*
- EN 1983, *Industrial valves — Steel ball valves*
- EN 1984, *Industrial valves — Steel gate valves*
- EN 10025-2:2004, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*
- EN 10222-2:1999, *Steel forgings for pressure purposes — Part 2: Ferritic and martensitic steels with specified elevated temperature properties*
- EN 10269:2013, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*
- EN 12163:2011, *Copper and copper alloys — Rod for general purposes*
- EN 12164:2011, *Copper and copper alloys — Rod for free machining purposes*
- EN 12266-1:2012, *Industrial valves — Testing of metallic valves — Part 1: Pressure tests, test procedures and acceptance criteria — Mandatory requirements*
- EN 12266-2:2012, *Industrial valves — Testing of metallic valves — Part 2: Tests, test procedures and acceptance criteria — Supplementary requirements*
- EN 12288, *Industrial valves — Copper alloy gate valves*
- EN 12334, *Industrial valves — Cast iron check valves*
- EN 12449:2012, *Copper and copper alloys — Seamless, round tubes for general purposes*
- EN 12516-1:2014, *Industrial valves — Shell design strength — Part 1: Tabulation method for steel valve shells*
- EN 12516-2:2014, *Industrial valves — Shell design strength — Part 2: Calculation method for steel valve shells*
- EN 12516-3:2002, *Valves — Shell design strength — Part 3: Experimental method*
- EN 12516-4:2014, *Industrial valves — Shell design strength — Part 4: Calculation method for valve shells manufactured in metallic materials other than steel*
- EN 13397, *Industrial valves — Diaphragm valves made of metallic materials*
- EN 13445-2:2014, *Unfired pressure vessels — Part 2: Materials*
- EN 13445-4:2014, *Unfired pressure vessels — Part 4: Fabrication*
- EN 13445-5:2014, *Unfired pressure vessels — Part 5: Inspection and testing*
- EN 13480-2:2012, *Metallic industrial piping — Part 2: Materials*
- EN 13709, *Industrial valves — Steel globe and globe stop and check valves*

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EN 13789, *Industrial valves — Cast iron globe valves*

EN 14341, *Industrial valves — Steel check valves*

EN ISO 5817:2014, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2014)*

EN ISO 9606 (all parts), *Qualification testing of welders — Fusion welding (ISO 9606, all parts)*

EN ISO 9712:2012, *Non-destructive testing — Qualification and certification of NDT personnel (ISO 9712:2012)*

EN ISO 14732:2013, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732:2013)*

EN ISO 15609-1:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1:2004)*

EN ISO 15613:2004, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test (ISO 15613:2004)*

EN ISO 15614-1:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)*

EN ISO 15614-2:2005, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 2: Arc welding of aluminium and its alloys (ISO 15614-2:2005)*

EN ISO 15614-5:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 5: Arc welding of titanium, zirconium and their alloys (ISO 15614-5:2004)*

EN ISO 15614-6:2006, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 6: Arc and gas welding of copper and its alloys (ISO 15614-6:2006)*

EN ISO 17635:2010, *Non-destructive testing of welds — General rules for metallic materials (ISO 17635:2010)*

3 Terms and definitions

For the purposes of this document, the terms and definitions of EN 736-1, EN 764 (all parts) and the following apply.

3.1 valve

pipng component which influences the fluid flow by opening, closing or partially obstructing the passage of the fluid flow or by diverting or mixing the fluid flow

Note 1 to entry Typical valves are gate valves, globe valves, control valves, check valves, diaphragm valves, butterfly valves, plug and ball valves as well as non-standard valves either manual or actuator operated and steam traps, usually covered by a product standard.

[SOURCE: EN 736-1:1995, modified — The Note 1 to entry was added here.]

3.2**production welding**

welding carried out during manufacturing before final delivery to the purchaser including joint welding and finishing welding

3.2.1**joint welding**

welding used to weld components in order to obtain an integral unit

3.2.2**finishing welding**

welding carried out in order to ensure the agreed quality of the casting

[SOURCE: EN ISO 11970:2007, 3.1.2]

3.3**repair welding**

welding carried out after delivery to the end user, i.e. after the casting has been in service

[SOURCE: EN ISO 11970:2007, 3.2, modified — The article "any" was deleted at the beginning of the definition.]

3.4**sample**

set of one or more units taken from a batch and intended to provide information on the batch

Note 1 to entry: This definition is based on ISO 2859-1.

3.5**material manufacturer**

person or organization (like founder, forge-, welding shop) which provides material to the responsible valve manufacturer

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4 Category of valves**4.1 Classification of valves**

A classification under the use of DN and PS and fluid groups 1 and 2 leads to maximum category III. For respective results see Annex A.

4.2 Sound engineering practice

Valves classified in Article 3 (3), PED, are excluded from conformance to requirements of this standard but shall meet the "sound engineering practice" by conformity to the relevant product standard.

5 Requirements**5.1 Design****5.1.1 General**

Valves shall meet the design requirements of this standard and the ones referenced in Annex ZA of their relevant European harmonized standards.

NOTE Annex D contains a summary of European harmonized Standard for valves.

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The manufacturer shall conduct a hazard analysis for the intended use and for the reasonably foreseeable conditions.

It is recommended to have this hazard analysis documented.

If the manufacturer identifies hazards which apply to the valve the manufacturer shall take account of his analysis by appropriate measures in order to reduce or eliminate the hazard identified.

5.1.2 Shell design strength

The shell design strength shall be determined by the following:

- a) for steel valves designed by the tabulation method: according to EN 12516-1:2014;
- b) for steel valves designed by calculation: according to EN 12516-2:2014;
- c) for copper alloy, aluminium and cast iron valves: according to EN 12516-4:2014;
- d) if the shell strength resistance is validated by an experimental method: according to EN 12516-3:2002.

Appropriate calculation methods other than those specified in the relevant European harmonized standards giving same level of safety may be applied.

NOTE The valve obturator normally is no part of the shell – except if an “end of line service” is agreed between valve manufacturer and customer – in this case all PED requirements apply to the obturator as well.

WARNING — Basis of design shall comply with the PED, Annex I, 2.2.2 to 2.2.4. The use of experimental design methods without calculation is limited.

5.1.3 Protection against exceeding the allowable limits

If the hazard analysis identifies the allowable limits under reasonably foreseeable conditions could be exceeded, manufacturer shall fit the valve with a suitable protective device.

5.2 Materials**5.2.1 General requirements**

Shell materials shall be selected in EN 12516-1:2014, EN 12516-4:2014 or EN 13445-2:2014. Other metallic shell materials may be used providing they are covered by an EAM or PMA.

The inspection documents of material shall be in accordance with EN 764-5:2014.

NOTE EAM or PMA is not required for valves with $PS \leq 0,5$ bar and valves classified in Art 3 (3) of the PED.

Where relevant the requirements given in EN 764-4:2014 should be considered.

5.2.2 European harmonized standards

A summary of Harmonized European Material Standards for shell parts is given in Annex B.

5.2.3 European approval of materials (EAM)

EAM for materials are intended for repeated use. They are established in accordance with EN 764-4:2014 and apply to materials or treatment condition and product forms or dimensions not covered in a European Harmonized Standard.

Annex C contains a link to OJEU Website for European approval of materials (EAM).

5.2.4 Particular Material Appraisal (PMA)

If no material according to a harmonized European material standard is available the manufacturer is obliged to perform or obtain the required particular material appraisal (PMA).

PMA apply also as follows:

- a material or a product form or a thickness not covered by a European material Standard or EAM;
- a material specified in a European material Standard or EAM for materials for pressure equipment is intended in an exceptional case for service conditions outside its specified range of application.

Table 1 shows a selection of EN material standards covering materials for which it is required to obtain a PMA when used as shell material.

Table 1 — EN material standards for which a PMA is required

| Main material group | European Standard / Material |
|--|---|
| Steels specified in European standards | EN 10025-2:2004 (S235JR, S235JRG2 and S355J2G3) EN 10222-2:1999 (P250GH) |
| Cast irons | EN 1561:2011 EN 545:2010 |
| Copper | EN 1982:2008 EN 12449:2012 EN 12163:2011 EN 12164:2011 |

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5.2.5 Requirements for prevention of brittle fracture at low temperatures

It is the responsibility of the manufacturer to apply appropriate methods for the prevention of brittle fracture at low temperatures. Temperature limits as given in EN 12516-1:2014 and EN 12516-4:2014 shall be considered.

The methods to prevent brittle fracture at low temperatures described in EN 13480-2:2012 and EN 13445-2:2014, Annex B shall be applied.

5.2.6 Selection of bolting material

Material selection for bolting shall be in accordance to EN 10269:2013. Other bolting materials may be used providing they are covered by an EAM or PMA.

EN 1515-4:2009 provides a selection of bolting for equipment subject to the Pressure Equipment Directive 2014/68/EU.

5.2.7 Material selection for parts other than shell

Material selection for parts other than shell is the responsibility of the valve manufacturer.

The stuffing box packing shall not cause corrosion on a stem, shaft or pivot.

NOTE Asbestos materials are not allowed.

EN 16668:2016 (E)**5.3 Manufacturing****5.3.1 Welding****5.3.1.1 General requirements**

Welding of the shell itself or on components of shell shall only be undertaken if the following conditions are satisfied:

- a) a welding procedure specification is held by the manufacturer;
- b) the welding procedures selected by the manufacturer are qualified for the field of application;
- c) the welders and welding operators are qualified for the work allocated to them and their approval is valid.

Welding of high-alloy martensitic chromium steels (>13 % Cr) requires particular qualification, except casting production welds at the foundry.

NOTE The provision of the fabrication drawings with welding data (weld details, welding procedure and welding fillers) including information on type and extent of non-destructive testing of welding seams, parts lists and copies of the welding procedure qualifications may be subject to agreement between manufacturer and purchaser.

5.3.1.2 Welding procedure specification (WPS)

The manufacturer shall compile welding procedure specifications, in accordance with EN ISO 15609-1:2004 for all welds.

5.3.1.3 Qualification of welding procedure specifications (WPQR)

Welding procedure specifications to be used shall be qualified by reference to an appropriate WPQR.

For the pressure retaining welds of a shell this shall be achieved by performing welding procedure qualification tests in accordance with EN ISO 15614-1:2004, EN ISO 15614-2:2005, EN ISO 15614-5:2004, EN ISO 15614-6:2006 or by preproduction tests in accordance with EN ISO 15613:2004.

For additional requirements to be considered in course of the qualification of welding procedure qualification see EN 13445-4:2014. It is regarded as the obligation of the valve manufacturer to meet the supplementary requirements as applicable.

5.3.1.4 Approval of welders and welding operators

Welders and welding operators shall be qualified according to the applicable part of the EN ISO 9606-series, whereas qualification testing of welders for the fusion welding of steels shall be qualified according to EN 287-1:2011 until EN ISO 9606-1:2013 is published in the Official Journal (OJEU). Qualification of welding operators shall be in accordance with EN ISO 14732:2013.

In the course of the qualification welding of personnel, the additional requirements of EN 13445-4:2014 apply. It is regarded as the obligation of the valve manufacturer to meet the supplementary requirements as applicable.

5.3.1.5 Finishing welding on castings

Finishing welding is only permissible on steel castings.

When carrying out finishing welding on steel castings, the defective area shall be completely rectified; it shall be tested for freedom from inadmissible imperfections.

Finishing welding shall be performed in accordance with a written procedure specifying the requirements for defect removal, welding, heat treatment and non-destructive testing.

Undocumented finishing welding prior to PWHT is permissible provided the defect depth does not exceed 40 % of the wall thickness.

Undocumented finishing welding after PWHT is permissible, provided that the defect depth does not exceed 20 % of the wall thickness or 25 mm, whichever is the smallest value.

Depressions resulting from the removal of imperfections shall be 100 % surface tested in order to ensure the complete removal of the defect. For the surface testing, magnetic particle testing (MT) or penetrant testing (PT) shall be applied as appropriate.

5.3.1.6 Repair of joint weld defects

For requirements for repair of joint weld defects see EN 13445-4:2014, 11.2.

Repair work on the welds and NDE results to be documented and made available to the purchaser on request.

All unacceptable imperfections shall be removed, either by mechanical means (such as grinding or machining) or by thermal means (such as arc air gouging or thermal gouging) or by a combination of thermal and mechanical means. It is the responsibility of the manufacturer to decide how unacceptable imperfections shall be removed. This may be by local means or by removal of the weld from the joint followed by rewelding.

When thermal gouging/arc air gouging is used on austenitic steels, care shall be taken to remove any contamination of the remaining weld or material. Similarly when gouging with carbon electrodes is used on ferritic steels, the affected surface shall be removed by mechanical means to a minimum depth of 0,3 mm.

Thermal gouging methods may not be used for martensitic creep-resisting steel.

When unacceptable imperfections are removed and are not followed by welding, all the remaining thickness shall be greater than the minimum thickness necessary to satisfy the design unless the local area satisfies the conditions of 5.3.2. The area shall have a taper with the adjoining surfaces, and blend smoothly.

Repairs by welding shall be carried out in accordance with a WPS which has been qualified in accordance with 5.3.1.4.

This may be the same WPS as the one used for making the joint originally or a specific qualified repair procedure.

Repairs shall be carried out by qualified welders or operators in accordance with 5.3.2. Weld repaired areas shall be non-destructively examined in accordance with EN 13445-5:2014.

When repair welding is carried out after post weld heat treatment or hydraulic test these operations shall be repeated. Any further post weld heat treatment carried out in accordance with 5.3.2 shall be considered in terms of its effect on material and weld properties.

5.3.1.7 Filler metals and auxiliary materials

For requirements for Filler metals and auxiliary materials see EN 13445-4:2014, 7.5.

5.3.2 Heat treatment

Heat treatment shall be performed whenever this is required to achieve the required mechanical properties of the materials used for shell parts.

For requirements regarding post weld heat treatment (PWHT) see EN 13445-4:2014.