SLOVENSKI STANDARD
SIST EN 12516-3:2003
01-julij-2003

Ventili - Trdnost ohišja - 3. del: Eksperimentalna metoda

Valves - Shell design strength - Part 3: Experimental method

Armaturen - Gehäusefestigkeit - Teil 3: Experimentelles Verfahren

Appareils de robinetterie - Résistance mécanique des enveloppes - Partie 3: Méthode expérimentale

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Ta slovenski standard je istoveten z: EN 12516-3:2002

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23.060.01

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2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12516-3

October 2002

ICS 23.060.01

English version

Valves - Shell design strength - Part 3: Experimental method

Appareils de robinetterie - Résistance mécanique des enveloppes - Partie 3: Méthode expérimentale

Armaturen - Gehäusefestigkeit - Teil 3: Experimentelles Verfahren

This European Standard was approved by CEN on 1 August 2002.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 12516-3:2002) 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of an identical text or by endorsement, at the latest by April 2003, and conflicting national standards shall be withdrawn at the latest by April 2003.

EN 12516 consists of three parts :

— Part 1 : Tabulation method for steel valve shells ;

— Part 2 : Calculation method for steel valve shells ;

— Part 3 : Experimental method.

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).

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

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Annex A is informative

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According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This standard establishes an experimental method of assessing the strength of valve shells by applying an elevated hydrostatic pressure test at room temperature.

The experimental test factor, *C*, for use in the equation to determine the elevated hydrostatic test pressure, takes into account the ductility of the various materials. Information on the origin of the experimental test factor, *C*, is given in annex A.

This standard may be used as an alternative method to those to be specified in Part 1 (Tabulation method) or Part 2, (Calculation method) within the limits specified in the scope.

1 Scope

This standard specifies requirements for an experimental method to prove that representative samples of valve shells and their body ends, made in cast iron, steel or copper alloy materials, are designed to possess the required pressure containing capability, with an adequate margin of safety.

This standard is not applicable to valves designed on the basis of time dependent strength values (creep) or valves designed for pulsating pressure applications (fatigue).

NOTE For valves needing to comply with the EU Directive 97/23/EC (PED), the upper limit for application of this standard without calculation, is when the maximum allowable pressure at room temperature, PS_{RT}, multiplied by the DN-number is less than 3000 bar. This standard may be used to supplement the Tabulation method for steel valves, Part 1, and the Calculation method for steel valves, Part 2 without limit.

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2 Normative references

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This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

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

3 Terms and definitions

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

In this standard, the term component shall be taken to mean the body, the bonnet and the cover.

4 Symbols

The following symbols are used in this standard *:*

A is the percentage elongation after fracture, in per cent ;

C is the experimental test factor ;

C_b is the experimental test factor for the body ;

C_{bc} is the experimental test factor for the bonnet or cover ;

e_{mes} is the measured wall thickness, in millimetres ;

$e_{\min}$	is the minimum specified drawing wall thickness, in millimetres ;
K	is the factor for calculating of the experimental test pressure $p_{t,\ exp}$;
K_b	is the K for the body ;
K_{bc}	is the K for the bonnet or cover ;
p	is the design pressure, in bar ;
PS	is the maximum allowable pressure, in bar ;
PS_{RT}	is the maximum allowable pressure at room temperature, in bar ;
PS_t	is the maximum allowable pressure at temperature t, in bar ;
$p_{t,\ exp}$	is the experimental test pressure, in bar ;
$p_{t,\ exp/RT}$	is the experimental test pressure at room temperature, in bar ;
$p_{t,\ exp\ b/RT}$	is the experimental test pressure at room temperature for the body, in bar ;
$p_{t,\ exp\ bc/RT}$	is the experimental test pressure at room temperature for the bonnet or cover, in bar ;
p''	is the elevated test pressure used for type testing of series-manufactured valves, in bar ;
$R_{m/RT}$	is the tensile strength at room temperature, in Newtons per square millimetre ;
$R_{p1,0}$	is the 1,0 % proof strength, in Newtons per square millimetre ;
$R_{p0,2\ act/RT}$	is the actual 0,2 % proof strength at room temperature, in Newtons per square millimetre ;
$R_{p0,2\ min/RT}$	is the minimum 0,2 % proof strength at room temperature specified in the appropriate material standard, in Newtons per square millimetre ;
$R_{p0,2\ min/t}$	is the minimum 0,2 % proof strength at temperature t specified in the appropriate material standard, in Newtons per square millimetre ;
S	is the safety factor ;
S''	is the safety factor depending on the material ;
X	is the ratio of e_{mes} to $e_{\min}$;
$X_{b\ max}$	is the maximum value of X for the body ;
$X_{bc\ max}$	is the maximum value of X for the bonnet or cover ;
Y	is the ratio of $R_{p0,2\ act/RT}/R_{p0,2\ min/RT}$;
Y_b	is the Y for the body ;
Y_{bc}	is the Y for the bonnet or cover.

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NOTE The term maximum allowable pressure, PS, defined in EU Directive 97/23/EC (PED) is equivalent to the term allowable pressure, p_s, defined in EN 736-3.

5 Description of test

The valve body ends shall be closed using suitable sealing components e.g. flanges, threaded plugs, welded caps etc. corresponding to the type of body ends.

The test equipment shall be of such a design, that it does not subject the shell to externally applied loads and does not apply any reinforcement to the components, which may affect the results of the tests.

NOTE The test equipment can apply external loads sufficient to react to the forces resulting from the test pressure.

The test pressure shall be applied to the shell assembly or to the assembled valve. The components may be tested separately.

6 Test method

6.1 Safety aspects

Safety aspects during testing are not covered by this standard. The users of this standard should analyse the hazard resulting from the pressure and take proper safety precautions.

6.2 Wall thickness

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The shape and thickness of the metal of the component to be tested shall be in accordance with the minimum requirements as specified on the manufacturing drawing.

No component shall be used for this test which has a measured thickness that exceeds the minimum thickness specified on the drawing by the greater of 2,5 mm (if the thickness is less than 10 mm) or 25 % of the specified minimum thickness.

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The thickness e_{mes} of the component shall be measured at all locations where the thickness is specified on the drawing.

In the case where a general thickness is specified on the drawing, without reference to a specific location, the actual thickness shall be checked at a minimum of three locations. These locations shall be chosen at positions, which adequately reflect possible wall thickness variations due to the manufacturing process and possible failure zones.

Wall thicknesses measured in areas smaller than $10\sqrt{\mathrm{DN}}$ mm^2 shall not be taken into account when calculating the values of X.

NOTE This restriction prevents the use of X values which are not representative of the general wall thickness.

The measured wall thickness e_{mes} shall be divided by the minimum specified drawing wall thickness e_{min} to find the values of X from the equation :

$$X = \frac{e_{\mathrm{mes}}}{e_{\mathrm{min}}} \qquad (1)$$

The largest value for each component, $X_{b\,max}$ and $X_{bc\,max}$ shall be selected for the purpose of determining the value of K according to equations (3) and (4).

6.3 Material strength

The material test certificates for each component shall be checked to ensure that the components to be tested are in accordance with the requirements of the material specification.

Using the actual proof strength, $R_{p0,2\ act/RT}$ from the material test certificates for each component the ratio Y of actual proof strength, $R_{p0,2\ act/RT}$ divided by the minimum proof strength, $R_{p0,2\ min/RT}$ specified in the appropriate material standard shall be calculated for each component.

$$Y = \frac{R_{p0,2\ act/RT}}{R_{p0,2\ min/RT}} \quad (2)$$

For materials where other mechanical properties are specified e.g. $R_{m/RT}$ for grey iron, $R_{p1,0}$ for austenitic steels, these properties shall be used.

6.4 Experimental test pressure

Using the experimental test factor, C, specified in Table 1 for the material used, values for K_b and K_{bc} shall be calculated from the equations :

$$K_b = C_b \times X_{b\ max} \times Y_b \quad (3)$$

$$K_{bc} = C_{bc} \times X_{bc\ max} \times Y_{bc} \quad (4)$$

The experimental test pressure $p_{t,\ exp}$ shall be calculated from the equations :

— for the body, $p_{t,\ exp\ b/RT} = K_b \times PS_{RT}$ (5)

— for the bonnet/cover, $p_{t,\ exp\ bc/RT} = K_{bc} \times PS_{RT}$ (6)

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The lower of the two experimental test pressures calculated in equations (5) or (6) shall be applied. After testing at this pressure for the minimum test duration (see 6.6), the pressure shall be increased to the higher pressure calculated in equations (5) and (6). The higher pressure shall be applied for the minimum test duration.

As an alternative to testing at both pressures, the test may be conducted using the higher pressure only applied for the minimum duration.

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When a component has already been shown, according to any part of EN 12516, to have the required pressure containing capability, at an allowable pressure at least equal to that of the shell to be tested, then the experimental test pressure calculated for this component shall not be applied.

If the allowable pressure PS is given only for an elevated temperature t, then the experimental test pressure $p_{t,\ exp}$ shall be calculated from the following equations :

— for the body, $p_{t,\ exp\ b/RT} = K_b \times PS_t \times \frac{R_{p0,2\ min/RT}}{R_{p0,2\ min/t}}$ (7)

— for the bonnet/cover, $p_{t,\ exp\ bc/RT} = K_{bc} \times PS_t \times \frac{R_{p0,2\ min/RT}}{R_{p0,2\ min/t}}$ (8)