

საქართველოს სტანდარტი

კონსტრუქციის კორპუსის საანგარიშო სიმტკიცე-ნაწილი 1: ტაბულირების
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English Version

Industrial valves - Shell design strength - Part 1: Tabulation method for steel valve shells

Robinetterie industrielle - Résistance mécanique des
enveloppes - Partie 1: Méthode tabulaire relative aux
enveloppes d'appareils de robinetterie en acier

Industriearmaturen - Gehäusefestigkeit - Teil 1:
Tabellenverfahren für drucktragende Gehäuse von
Armaturen aus Stahl

This European Standard was approved by CEN on 9 August 2014.

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Contents

Page

Foreword.....	5
Introduction	7
1 Scope	9
2 Normative references	9
3 Terms and definitions	10
4 Symbols and units	11
5 Material groups and material temperature limitations	12
6 Pressure/temperature (p/t) ratings	12
6.1 General.....	12
6.2 Standard rating	12
6.3 Special Class	12
6.4 Limited Class.....	12
6.5 Intermediate ratings	12
6.6 Flanged ratings	12
7 Temperature effects	13
7.1 Temperature limits.....	13
7.2 Fluid thermal expansion	13
8 Dimensions.....	13
8.1 Minimum wall thickness.....	13
8.2 Inside diameter.....	13
8.3 Valve body necks.....	13
8.4 Local areas	16
8.5 Contours at body ends.....	16
8.5.1 Butt welding ends	16
8.5.2 Socket welding and threaded ends.....	16
8.6 Additional metal thickness	17
8.7 Bonnets, cover and connections	17
8.8 Wafer or flangeless valves.....	17
9 Auxiliary connections	19
9.1 General.....	19
9.2 Pipe thread tapping	19
9.3 Socket welding.....	19
9.4 Butt welding	20
9.5 Bosses	20
10 End dimensions	21
10.1 Flanged ends.....	21
10.2 Butt welding ends	21
10.3 Socket welding ends	21
10.4 Threaded ends	21
10.5 Intermediate rated socket welding and threaded ends.....	21
11 Marking	21
11.1 Standard rating valves	21
11.2 Special Class valves.....	21
11.3 Limited Class valves	22
11.4 Intermediate rating valves	22

Annex A (normative) Methods used for establishing pressure/temperature ratings	72
A.1 Minimum wall thickness	72
A.2 Material properties	73
A.3 Pressure/temperature ratings	73
A.3.1 General	73
A.3.2 Selected stress values for steels from group 3E0 to 9E1	75
A.3.3 Selected stress values for steels from group 10E0 to 16E0	75
A.3.4 Maximum ratings	75
Annex B (normative) Material groups	76
Annex C (informative) Special Class	78
C.1 General	78
C.2 Required examination	78
C.2.1 Castings	78
C.2.2 Forgings, bars, plates and tubular products	80
C.2.3 Drop forgings	81
C.2.4 Welded fabrication	81
C.2.5 Defect removal and repair — Repair by welding	81
C.3 Method for establishing Special rating	87
C.3.1 Methods for all materials	87
C.3.2 Special ratings	88
Annex D (informative) Radiographic procedure and acceptance standards	108
D.1 Radiographic procedure	108
D.2 Acceptance standards	109
Annex E (informative) Magnetic particle examination procedure and acceptance standards	110
E.1 General	110
E.2 Acceptance standards	110
E.2.1 Castings	110
E.2.2 Forgings and rolled or wrought material and drop forgings	110
Annex F (informative) Liquid penetrant examination procedure and acceptance standards	112
F.1 Procedure	112
F.2 Acceptance criteria	112
F.2.1 Castings	112
F.2.2 Forgings, rolled or wrought material and drop forgings	112
Annex G (informative) Ultrasonic examination procedure and acceptance standards	113
G.1 Procedure for forgings and rolled or wrought material	113
G.1.1 General	113
G.1.2 Extent of examination	113
G.1.3 Acceptance standards	113
G.2 Procedure for castings	113
G.2.1 General	113
G.2.2 Extent of examination	113
G.2.3 Acceptance standards	113
Annex H (informative) Requirement for Limited Class valves in sizes DN 65 and smaller	114
H.1 General	114
H.2 Limited Class rating method	114
H.3 Dimensions	115
H.3.1 General	115
H.3.2 Inside diameter	115
H.3.3 Wall thickness	115
H.3.4 Valve body necks	115
H.3.5 Contours for body run transitions	115
H.3.6 Additional metal thickness	115
H.3.7 Welded fabrication	116

Annex I (informative) ASTM/ASME material	117
I.1 General.....	117
I.2 Material groups	117
I.3 Minimum wall thickness.....	118
I.4 Material properties.....	118
I.5 Pressure/temperature ratings.....	118
I.5.1 Standard rating	118
I.5.2 Special rating	118
Annex J (informative) Relationship between DN, NPS, pipe inside diameter D_{ni}, pipe outside diameter OD.....	197
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC (Pressure Equipment Directive)	201
Bibliography.....	202

Foreword

This document (EN 12516-1:2014) 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 2015 and conflicting national standards shall be withdrawn at the latest by April 2015.

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 supersedes EN 12516-1:2005.

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 97/23/EC (Pressure Equipment Directive).

For relationship with EU Directive 97/23/EC, see informative Annex ZA, which is an integral part of this document.

EN 12516 consists of four parts:

- EN 12516-1, *Industrial valves — Shell design strength — Part 1: Tabulation method for steel valve shells* (the present document);
- EN 12516-2, *Industrial valves — Shell design strength — Part 2: Calculation method for steel valve shells*;
- EN 12516-3, *Valves — Shell design strength — Part 3: Experimental method*;
- EN 12516-4, *Industrial valves — Shell design strength — Part 4: Calculation method for valve shells manufactured from metallic material other than steel*.

The main changes with respect to the previous edition are listed below:

- a) addition of new PN values PN 160, PN 250, PN 320, PN 400;
- b) B designation rating have been replaced by the PN designation;
- c) B20 rating values have been replaced by Class 150 and use of the calculation method given in ASME B16.34;
- d) new PN values have been added to Table 7 for the valve body minimum wall thickness values;
- e) material tables have been updated to be in line with EN 1092-1 for the EN materials;
- f) materials 1.0345 and 1.4458 have been deleted;
- g) Annex B material groups has been updated and made normative;
- h) special Class in EN material have been moved to an informative Annex C;
- i) EN materials properties for pressure temperature calculation have been modified ($R_m/3,5$) to be consistent with the new ASME rules, and using $R_{p1} \%$ for stainless steel consistent with EN 12516-2;

- j) ASTM material properties used for rating calculation have been updated to the new ASME B16.34 rules;
- k) in the pressure-temperature calculation formula the stress factor S has been changed to 120,7 MPa in order to get a Ps of 775,7 bar which is the ceiling pressure when calculating the Special Class 4 500;
- l) pressure/temperature ratings have been recalculated. For PN values they are now limited to the PN number; this has been done by increasing the Pc value in the pressure rating calculation method consequently the wall thickness for the PN designation has been increased;
- m) Annexes D, E, F, G for NDE have been updated to the new EN standards and made informative;
- n) Annex H limited Class has been made informative;
- o) ASTM/ASME materials have been moved to an informative Annex I;
- p) an informative Annex J on the relationship between DN, NPS, pipe inside diameter and outside diameter has been added;
- q) Annex ZA has been updated.

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.

Introduction

EN 12516, *Industrial valves — Shell design strength*, is in four parts. EN 12516-1 and EN 12516-2 specify methods for determining the thickness of steel valve shells by tabulation or calculation methods respectively. EN 12516-3 establishes an experimental method for assessing the strength of valve shells in steel, cast iron and copper alloy as a type test by applying an elevated hydrostatic pressure at ambient temperature. EN 12516-4 specifies method for calculating the thickness for valve shells in metallic material other than steel.

The tabulation method, EN 12516-1, is similar in approach to ASME B16.34 in that the designer can look up the required minimum wall thickness dimension of the valve body from a table. The internal diameter of the inlet bore of the valve, gives the reference dimension from which the tabulated wall thickness of the body are calculated. It applies only to valve bodies, bonnets and covers with essentially circular cross-section. For valve shells with oval or rectangular shapes and for additional loads, EN 12516-2 should be used (see 8.6).

The calculation method, EN 12516-2 is similar in approach to the former DIN 3840 where the designer is required to calculate the wall thickness for each point on the pressure temperature curve using the allowable stress at that temperature for the material he has chosen. The allowable stress is calculated from the material properties using the safety factors that are defined in EN 12516-2. The formulae in EN 12516-2 consider the valve as a pressure vessel and ensure that there will be no excessive deformation or plastic instability.

EN 12516-1 specifies Standard and Special pressure/temperature ratings for valve shells with bodies having the tabulated thickness.

The tabulation method gives one thickness for the body for each PN (see 3.1) or Class designation depending only on the inside diameter, D_i , of the body at the point where the thickness is to be determined.

The thicknesses are calculated using the thin cylinder formula that is also used in EN 12516-2. The allowable stress used in the formula is equal to 120,7 MPa and the calculation pressure P_c varies according PN and Class designation.

For the Class designations, the rules for determining the pressure/temperature ratings are the same for both valve shells and flanges.

For PN designations rules for determining the pressure /temperature ratings are different for flanges and for valves, but this revision of the standard has adjusted the rules to get at room temperature the same pressure. The change of pressure in temperature needs to be taken into account by the piping/assembler.

The main reasons for the differences are due to the treatment of ceiling values. In PN flanges, a constant ceiling stress of 140 MPa at room temperature is applied. In PN and Class designations, the EN 12516-1 ceiling criteria apply, which are temperature dependent.

The reason for the down rating of Standard rating values relative to Special rating is that the Standard rating body is not subject to the specified non-destructive examination procedures and acceptance levels.

The thicknesses for all designations are approximately proportional to the Class 4 500 thickness in the ratio of the pressures.

This standard tabulates the commonly used ratings. It is possible to design shells to suit particular applications or markets using intermediate ratings. This data can be obtained using linear interpolation of the tabulated data in EN 12516-1.

A merit of the tabulation method, which has a fixed set of shell dimensions irrespective of the material of the shell, is that it is possible to have common patterns and forging dies. The allowable pressure/temperature rating for each material group varies proportional to the selected stresses of the material group to which the material belong.

A merit of the calculation method is that it allows the most efficient design for a specific application using the allowable stresses for the actual material selected for the application.

The two methods are based on different assumptions, and as a consequence the detail analysis is different. Both methods offer a safe and proven method of designing pressure-bearing components of valve shells.