



BSI Standards Publication

Industrial valves – Shell design strength

Part 4: Calculation method for valve shells manufactured
in metallic materials other than steel

National foreword

This British Standard is the UK implementation of EN 12516-4:2014+A1:2018. It supersedes BS EN 12516-4:2014, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee PSE/18/1, Industrial valves, steam traps, actuators and safety devices against excessive pressure - Valves - Basic standards.

A list of organizations represented on this committee can be obtained on request to its secretary.

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© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 580 95110 7

ICS 23.060.01

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2014.

Amendments/corrigenda issued since publication

Date	Text affected
31 October 2018	Implementation of CEN amendment A1:2018

English Version

Industrial valves - Shell design strength - Part 4: Calculation method for valve shells manufactured in metallic materials other than steel

Robinetterie industrielle - Résistance mécanique des
enveloppes - Partie 4 : Méthode de calcul relative aux
enveloppes d'appareils de robinetterie en matériaux
métalliques autres que l'acier

Industriearmaturen - Gehäusefestigkeit - Teil 4:
Berechnungsverfahren für drucktragende Gehäuse von
Armaturen aus anderen metallischen Werkstoffen als
Stahl

This European Standard was approved by CEN on 9 August 2014 and includes Amendment 1 approved by CEN on 2 March 2018.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 12516-4:2014+A1:2018) 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 March 2019, and conflicting national standards shall be withdrawn at the latest by March 2019.

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

This document includes Amendment 1 approved by CEN on 2018-03-02.

This document supersedes A1 EN 12516-4:2014 A1.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

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 A1 European legislation for pressure equipment A1.

For relationship with A1 European legislation for pressure equipment A1, see informative Annex ZA, which is an integral part of this document.

EN 12516 comprises the following parts:

- *Industrial valves — Shell design strength — Part 1: Tabulation method for steel valve shells;*
- *Industrial valves — Shell design strength — Part 2: Calculation method for steel valve shells;*
- *Valves — Shell design strength — Part 3: Experimental method;*
- *Industrial valves — Shell design strength — Part 4: Calculation method for valve shells manufactured in metallic materials other than steel.*

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1 Scope

This European Standard specifies the calculation method for valve shells manufactured in metallic materials other than steel. The loadings to be accounted for are in accordance with EN 12516-2.

Design methods are in accordance with EN 12516-2, design by formulae according to the relevant clauses.

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 485-2:2013, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 2: Mechanical properties*

EN 586-2:1994, *Aluminium and aluminium alloys — Forgings — Part 2: Mechanical properties and additional property requirements*

EN 754-2:2013, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 2: Mechanical properties*

EN 755-2:2013, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 2: Mechanical properties*

EN 1092-2:1997 ^{A1}, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges*

EN 1092-3:2003 ^{A1}, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 3: Copper alloy flanges*

EN 1092-4:2002 ^{A1}, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 4: Aluminium alloy flanges*

EN 1561:2011, *Founding — Grey cast irons*

EN 1562:2012, *Founding — Malleable cast irons*

EN 1563:2011, *Founding — Spheroidal graphite cast irons*

EN 1653:1997, *Copper and copper alloys — Plate, sheet and circles for boilers, pressure vessels and hot water storage units*

EN 1759-3:2003 ^{A1}, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 3: Copper alloy flanges*

EN 1982:2008, *Copper and copper alloys — Ingots and castings*

EN 12163:2011, *Copper and copper alloys — Rod for general purposes*

EN 12420:2014, *Copper and copper alloys — Forgings*

EN 12449:2012, *Copper and copper alloys — Seamless, round tubes for general purposes*

EN 12516-2:2014, *Industrial valves — Shell design strength — Part 2: Calculation method for steel valve shells*

CEN/TS 13388:2013, *Copper and copper alloys — Compendium of compositions and products*

EN 13445-8:2009, *Unfired pressure vessels — Part 8: Additional requirements for pressure vessels of aluminium and aluminium alloys*

ISO 7005-3:1988 ^{A1}, *Metallic flanges — Part 3: Copper alloy and composite flanges*

3 Symbols and units

Table 1 — Symbols and units

Symbol	Characteristic	Unit
f	nominal design stress	MPa
$f_{d/t}$	nominal design stress for design conditions at temperature t °C	MPa
$f_{d/20}$	nominal design stress for design conditions at 20 °C	MPa
R_m	minimum tensile strength	MPa
$R_{m/20}$	Tensile strength at 20 °C	MPa
$R_{m/t}$	tensile strength at temperature t °C	MPa
$R_{p0,1}$	minimum 0,1 %-proof strength	MPa
$R_{p0,2}$	minimum 0,2 %-proof strength	MPa
$R_{p0,2/t}$	0,2 % — proof strength at temperature t °C	MPa
$R_{p1,0/t}$	1,0 % — proof strength at temperature t °C	MPa

4 Interrelation of thickness definitions

For interrelation of thickness definitions refer to EN 12516-2:2014, Clause 4.

5 Requirements

5.1 General

The calculation method for a valve shell in materials other than steel shall be in accordance with EN 12516-2. The choice of materials and their parameters shall be taken from the following clauses of this European Standard.

5.2 Materials — Cast iron

5.2.1 Allowable grades

Materials shall be in accordance with Table 2.

Table 2 — Allowable cast iron material types and grades

Cast iron material type	EN-standard	Designation	
		Symbol	Number
Grey cast iron	EN 1561	EN-GJL-200 ^a	5.1300
		EN-GJL-250	5.1301
Malleable cast iron	EN 1562	EN-GJMB-300-6	5.4100
		EN-GJMB-350-10	5.4101
Spheroidal graphite cast iron	EN 1563	EN-GJS-350-22-LT	5.3100
		EN-GJS-350-22-RT	5.3101
		EN-GJS-400-18-LT	5.3103
		EN-GJS-400-18-RT	5.3104
		EN-GJS-400-18	5.3105
		EN-GJS-400-15	5.3106
		EN-GJS-500-7	5.3200
		EN-GJS-600-3	5.3201
		EN-GJS-700-2	5.3300
^a Grade EN-GJL-200 shall not be used for valves with flanged connections PN 25 or above.			

Material properties shall be taken from the standards listed in Table 2.

5.2.2 Strength values

Tensile strength values for grey cast iron shall be taken from EN 1561.

For the tensile strength value of malleable iron grade EN-GJMB-300-6, to be used in the calculation, 300 MPa shall be taken.

The strength values for malleable cast iron grade EN-GJMB-350-10 shall be in accordance with Table 3.

Table 3 — Malleable cast iron — Strength values

Material designation	Strength characteristics $R_{p0,2/t}$ at calculation temperature in °C						
	20	100	150	200	250	300	350
	MPa						
EN-GJMB-350-10	200	190	180	160	150	140	120

The strength values for spheroidal graphite cast iron grades shall be in accordance with Table 4, 5 or 6.