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SIST EN 1591-2:2008

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Prirobnice in prirobnični spoji - Pravila za konstruiranje prirobničnih spojev, sestavljenih iz okroglih prirobnic in tesnil - 2. del: Parametri tesnil

Flanges and their joints - Design rules for gasketed circular flange connec-tions - Part 2: Gasket parameters

Flansche und ihre Verbindungen - Regeln für die Auslegung von Flanschverbindungen mit runden Flanschen und Dichtung - Teil 2: Dichtungskennwerte

Brides et leurs assemblages - Regles de calcul des assemblages a brides circulaires avec joint - Partie 2: Parametres de joint

Ta slovenski standard je istoveten z: **EN 1591-2:2008**

ICS:

23.040.60	Prirobnice, oglavki in spojni elementi	Flanges, couplings and joints

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English Version

Flanges and their joints - Design rules for gasketed circular flange connections - Part 2: Gasket parameters

Brides et leurs assemblages - Règles de calcul des assemblages à brides circulaires avec joint - Partie 2: Paramètres de joint

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This European Standard was approved by CEN on 8 May 2008.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 1591-2:2008) has been prepared by Technical Committee CEN/TC 74 "Flanges and their joints", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by December 2008, and conflicting national standards shall be withdrawn at the latest by December 2008.

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 ENV 1591-2:2001.

EN 1591 *"Flanges and their joints — Design rules for gasketed flange connections"* consists of the following three parts:

— *Part 1: Calculation method*

— *Part 2: Gasket parameters*

— *Part 3: Calculation method for metal to metal contact type flanged joint (CEN/TS)*

The data values given in this European Standard were all determined by the test methods given in EN 13555. The data given was obtained during the PERL Project[1)] during which the test methods of EN 13555 were assessed for practicability & repeatability by the test laboratories at MPA & CETIM,(see footnotes 2 & 3 of Table A.1). The materials selected for evaluation during that project were those suggested by the organisations taking part in the PERL project. The materials tested in that project, and therefore the data given in this document, must be seen as just a selection of the total range of commercial gasket offerings that are available from the various gasket manufacturers and distributors. The data presented in this document is intended to assist engineers using EN 1591-1 during their preliminary calculations. Other public sources of reliable data are given in Annex B. In all cases it is expected that engineers will obtain from the manufacturer of their choice the data for the gasket intended to be used in the application in hand. The website of the European Sealing Association, www.europeansealing.com, contains links to their members throughout Europe.

The importance of using the data for the exact style, make and thickness of gasket intended to be used can be seen from the dispersion of the results between gasket makes within a style and thickness in this document.

NOTE The objective for the Publication of this version of EN 1591-2 is to present and make available during the standardization work of CEN/TC 54/TC 74/TC 267/TC 69/TC 269/JWG tables of values (results of tests) more reliable than those specified in the experimental standard ENV 1591-2:2001. This EN 1591-2 is therefore dedicated to be amended somehow in accordance with the revision in progress carried out by the Joint Working Group on EN 1591-1.

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1) PERL, *Pressure Equipment, Reduction of Leak rate: Gasket parameters measurement, RTD Project in the Framework of the "Competitive & Sustainable Growth" Programme*

1 Scope

This European Standard details generic gasket parameters for use in EN 1591-1 during preliminary calculations during which the type of gasket to be used in an application is to be decided. Once the gasket type has been decided the parameters for gaskets of that type from the different potential commercial suppliers should be used in further calculations as within a gasket type there will be differences depending upon the supplier.

WARNING — For the final calculations using the method given in EN 1591-1 the reader is directed to obtain gasket parameters for the selected generic type of gasket from the intended gasket manufacturer. This is because the data for a generic gasket type will vary between manufacturers. This variation can be seen in the tables of data which are embodied in this document.

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.

EN 1591-1:2001, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 1: Calculation method*

EN 13555:2004, *Flanges and their joints — Gasket parameters and test procedures relevant to the design rules for gasketed circular flange connections*

3 Symbols and definitions

For the purposes of this document, the symbols and definitions given in EN 1591-1:2001 and EN 13555:2004 apply.

4 Typical gasket parameters for various gasket styles

4.1 General

It shall be noted that the data given in the following tables is only intended to be used in preliminary calculations using EN 1591-1. The data was obtained using the test methods given in EN 13555 during the testing of a selection of a few of the many styles and makes of commercial gasket that are on offer in Europe. For final calculations the user of EN 1591-1 shall contact the gasket supplier of choice and obtain the data for the style and thickness of the gasket intended to be used.

A group of end users has derived a pre-calculation method of use of EN 1591-1 that allows gasket selection without any further calculation. This is outlined in Annex C.

EN 13555 permits the testing of gaskets sized for either DN40/PN40 or NPS 4 CLASS 300 flanges. All the data values given in this document were obtained from DN40/PN 40 gaskets.

It should be noted that the rules of EN 13555 regarding Q_{Smax} have been adhered to in that where no collapse was found during the Q_{Smax} test then the value of Q_{Smax} is taken to be that of the surface pressure, Q_{i} , used during the P_{QR} test with the highest surface pressure tabulated.

The data in the following sets of tables is presented in three gasket parameter groupings, $Q_{\mathrm{min[L]}}$ and $Q_{\mathrm{Smin[L]}}$ in the 4.2 set of tables followed by Q_{Smax} and P_{QR} in the 4.3 set and then E_{G} in the 4.4 set to allow easy appreciation of how the parameter varies with gasket type. A brief explanation of the parameters in the grouping is given at the start of each set. For more information about the gasket parameters or test methods EN 13555 should be consulted.

Data generated in accordance with EN 13555 should be used together with EN 1591-1 to ensure that a flanged joint is as safe and as tight as required results. It will never be possible for the gasket parameters to be tabulated at all values of the controlling parameters so results at the next “worse” values of those controlling parameters should be used to ensure that the result is conservative.

The various parameters that are obtained from gaskets by the tests detailed in EN 13555 are inter-related in complex ways and the guidance given below is in some respects simplistic in view of those inter-relationships. If further guidance is required it is recommended that the favoured suppliers or manufacturers should be consulted as they will be able to provide all the necessary guidance that is required to aid the selection of an optimised solution for any sealing application.

$Q_{\mathrm{Smin[L]}}$ is influenced by Q_{A}, the higher the level of Q_{A} achieved on assembly the better.

Q_{A} will be limited by either the maximum bolt load available, the maximum flange loading that can be permitted or the maximum gasket loading, Q_{Smax}, that can be withstood.

High values of Q_{Smax} are desirable. Where a value of Q_{Smax} is not tabulated at the temperature and gasket thickness of interest then the value for Q_{Smax} at the next higher values should be used.

For secure achievement of a given level of tightness, L, the lower the values of $Q_{\mathrm{min[L]}}$ and $Q_{\mathrm{Smin[L]}}$ the better. Where data is tabulated for more than one helium pressure then interpolation to deduce a value for the pressure of interest is permitted. Where data is not available for the thickness of interest then data for the next higher available thickness should be used.

Low values of $Q_{\mathrm{min[L]}}$ and $Q_{\mathrm{Smin[L]}}$ are desirable. A low difference between the $Q_{\mathrm{Smin[L]}}$ values for successive values of L is also desirable as this indicates a low sensitivity to off-loading in service.

Within a gasket type, high values of P_{QR} are desirable. Where a P_{QR} value is not tabulated at exactly the required level of temperature, stiffness and surface pressure then the value of P_{QR} at the next level above those required should be used.

Low values of E_{G} are desirable. Where a value of E_{G} is not tabulated at exactly the required level of temperature, surface pressure and thickness then the value of E_{G} at the next level above those required should be used.

The data in the following sets of tables was generated as the test methods of EN 13555 were evolving. As a consequence the data for some tested gaskets does not in all respects comply with the rules subsequently derived and given in EN 13555. An instance of this is given by P_{QR} in the 4.3 set of tables as values are only given for a stiffness of 500 kN/mm whereas the standard calls for P_{QR} values for a range of stiffness to be determined.

The notes at the end of the 4.3 set of tables of Q_{Smax} and P_{QR} give important guidance in the use of the data in that set of tables.

For relation between the gasket types and the codes used in the tables see Annex A.

4.2 $Q_{min[L]}$, $Q_{Smin[L]}$

$Q_{min[L]}$ is the minimum gasket surface pressure on assembly required at ambient temperature in order to seat the gasket into the flange facing roughness and close the internal leakage channels so that the tightness class is to the required level L for the internal test pressure.

$Q_{Smin[L]}$ is the minimum gasket surface pressure required under the service pressure conditions, i.e. after off loading and at the service temperature, so that the required tightness class L is maintained for the internal test pressure. In the case of the data in Tables 2 to 15 then only values at ambient temperature are given.

L is defined in terms of specific leakage rates in Table 1. Additional better tightness classes are introduced as required by continuing the series.

Table 1 — Tightness classes

Tightness Class	Specific Leakage Rate mg/(sm)
$L_{1,0}$	≤ 1,0
$L_{0,1}$	≤ 0,1
$L_{0,01}$	≤ 0,01

For the Tables 2 to 15 the following marking applies:

$Q_{min[L]}$ or $Q_{Smin[L]}$ values for 40 bar without underlining;

$Q_{min[L]}$ or $Q_{Smin[L]}$ figures for 10 bar are marked by a dashed line;

$Q_{min[L]}$ or $Q_{Smin[L]}$ figures for 80 bar are underlined;

$Q_{min[L]}$ or $Q_{Smin[L]}$ figures for 160 bar are double underlined .

Table 2 — Graphite filled spiral wound gasket with outer ring

$Q_{min[L]}$, $Q_{Smin[L]}$ for 40 bar of helium, plus some data for other pressures, at ambient temperature.
Code 3-3-100-1, 4,5 mm

L mg/(sm)	$Q_{min[L]}$ MPa	Q_A MPa	20	40	60	80	100	160
		-- / Material code	$Q_{Smin[L]}$ MPa					
10^{1}	-	-	-	-	-	-	-	-
10^{0}	10 30 35	3-3-100-1	-	10 10	10 10	10 10	10 10	10 10 11
10^{-1}	49 37 57	3-3-100-1	-	-	10 43	10 11	10 10	10 10 12
10^{-2}	63 62 71	3-3-100-1	-	-	-	19 25	10 17	10 10 15
10^{-3}	74 80 87	3-3-100-1	-	-	-	80	28 32	10 19 28
10^{-4}	98 126 104	3-3-100-1	-	-	-	-	-	24 71 40
10^{-5}	-	-	-	-	-	-	-	-
10^{-7}	-	-	-	-	-	-	-	-
10^{-8}	-	-	-	-	-	-	-	-
10^{-9}	-	-	-	-	-	-	-	-

Table 3 — Graphite filled spiral wound gasket with outer and inner ring

$Q_{min[L]}$, $Q_{Smin[L]}$ for 40 bar of helium , plus some data for other pressures, at ambient temperature.
Code 3-4-104-1, 4,5 mm

L mg/(sm)	$Q_{min[L]}$ MPa	Q_A MPa	20	40	60	80	100	160	320
		-- / Material code	$Q_{Smin[L]}$ MPa						
10^{1}	-	-	-	-	-	-	-	-	
10^{0}	10 10 10	3-4-104-1	10	10	10	10	10	10 - 10	10 10
10^{-1}	16 32 20	3-4-104-1	-	10	10	10	10	10 - 10	10 10
10^{-2}	25 48 45	3-4-104-1	-	10	10	10	10	10 - 10	10 10
10^{-3}	42 81 83	3-4-104-1	-	-	16	18	17	10 - 31	10 15
10^{-4}	81 143 159	3-4-104-1	-	-	-	-	62	35 - 157	26 51
10^{-5}	181 281	3-4-104-1	-	-	-	-	-	-	83 198
10^{-6}	314	3-4-104-1	-	-	-	-	-	-	298
10^{-7}	-	-	-	-	-	-	-	-	
10^{-8}	-	-	-	-	-	-	-	-	

Table 4 — Low stress, graphite filled, spiral wound gasket with outer and inner rings

$Q_{min[L]}$, $Q_{Smin[L]}$ for 40 bar of helium , plus some data for other pressures, at ambient temperature.
Code 3-5-102-1,   4,5 mm

L mg/(sm)	$Q_{min[L]}$ MPa	Q_A MPa	20	40	60	80	100	160	320
		- Material code	$Q_{Smin[L]}$ MPa						
10^1	-	-	-	-	-	-	-	-	-
10^0	10 - 10	-	-	-	-	10 -	-	-	- 10
10^{-1}	10 10 12	3-5-102-1	10	10	10	10 10	10	10	10 10
10^{-2}	10 19 33	3-5-102-1	10	10	10	10 10	10	10	10 10
10^{-3}	2970 174	3-5-102-1	-	-	-	10 20	10	14	26 168
10^{-4}	140 231	3-5-102-1	-	-	-	-	-	82	88 230
10^{-5}	154 290	3-5-102-1	-	-	-	-	-	101	123 288
10^{-6}	167	3-5-102-1	-	-	-	-	-	-	157
10^{-7}	180	3-5-102-1	-	-	-	-	-	-	192
10^{-8}	194	3-5-102-1	-	-	-	-	-	-	258

Table 5 — PTFE filled spiral wound gasket with outer and inner rings

$Q_{min[L]}$, $Q_{Smin[L]}$ for 40 bar of helium , plus some data for other pressures, at ambient temperature.
Code G03, 5,1 mm

L mg/(sm)	$Q_{min[L]}$ MPa	Q_A MPa	60	120	180	240	300	480
		--	$Q_{Smin[L]}$ MPa					
		Material code						
10^{1}	-	-	-	-	-	-	-	-
10^{0}	-	-	-	-	-	-	-	-
10^{-1}	30 58	G03	30	30	30	30	30	30 30
10^{-2}	39 74	G03	-	30	30	30	30	30 30
10^{-3}	52 90	G03	-	30	30	30	30	30 30
10^{-4}	69 105	G03	-	43	30	30	30	30 30
10^{-5}	101 125	G03	-	-	30	30	30	30 30
10^{-6}	149 166	G03	-	-	97	47	48	35 34
10^{-7}	353 428	G03	-	-	-	-	-	132 372
10^{-8}	-	-	-	-	-	-	-	-

Table 6 — Corrugated metal core with graphite facing

$Q_{min[L]}$, $Q_{Smin[L]}$ for 40 bar of helium , plus some data for other pressures, at ambient temperature.

Code 7-01-104-1, 3,2 mm

Code K04, 2,3 mm

L mg/(sm)	$Q_{min[L]}$ MPa	Q_A MPa	20	40	60	80	100	160	320
		--	$Q_{Smin[L]}$ MPa						
		Material code							
10^1	-	-	-	-	-	-	-	-	-
10^0	-	-	-	-	-	-	-	-	-
10^{-1}	10	7-01-104-1	10	10	10	10	10	10	10
	10	K04	-	-	-	-	-	-	-
10^{-2}	11	7-01-104-1	10	10	10	10	10	10	17
	11	K04	10	10	10	10	10	10	-
10^{-3}	17 10 20	7-01-104-1	10	10	10	10	10	10 - 10	24 10
	10 22	K04	10	10	10	10	10	10 10	-
10^{-4}	21 75 30	7-01-104-1	-	33	13	17	27	24 - 20	32 10
	14 28	K04	-	10	10	10	10	11 10	10
10^{-5}	45 104 40	7-01-104-1	-		18	27	46	36 - 28	37 33
	41 35	K04	-	25	10	10	10	20 10	
10^{-6}	52 165 95	7-01-104-1	-	-	32	36	66	68 - 35	116 74
	84 68	K04	-	-	-	10	10	10	-
10^{-7}	57 295 152	7-01-104-1	-	-	-	73	86	159 - 95	165 243
	100 80	K04	-	-	-	-	44	10	-
10^{-8}	306	7-01-104-1	-	-	-	-	-	-	305

Table 7 — Metal jacketed gasket with graphite filler

$Q_{min[L]}$, $Q_{Smin[L]}$ for 40 bar of helium , plus some data for other pressures, at ambient temperature.

Code 6-4-103-1, 3,2 mm

No sealing data for H02

L mg/(sm)	$Q_{min[L]}$ MPa	Q_A MPa	20	40	60	80	100	160	320
		-- / Material code	$Q_{Smin[L]}$ MPa						
10^1	34	6-4-103-1	-	10	10	10	10	10	10 20
10^0	55 63 120	6-4-103-1	-	-	26	23	21	10	10 20
10^{-1}	96 187	6-4-103-1	-	-	-	-	-	56	14 20
10^{-2}	171 287	6-4-103-1	-	-	-	-	-	-	35 40
10^{-3}	253	6-4-103-1	-	-	-	-	-	-	133
10^{-4}	-	-	-	-	-	-	-	-	-
10^{-5}	-	-	-	-	-	-	-	-	-
10^{-6}	-	-	-	-	-	-	-	-	-
10^{-7}	-	-	-	-	-	-	-	-	-
10^{-8}	-	-	-	-	-	-	-	-	-

Table 8 — Graphite covered metal jacketed gasket with graphite filler and outer ring

$Q_{min[L]}$, $Q_{Smin[L]}$ for 40 bar of helium , plus some data for other pressures, at ambient temperature.

Code 5-5-103-1, 4,5 mm

Code H01, 4,8 mm

L mg/(sm)	***Q*** $Q_{min[L]}$ MPa	Q_A MPa	20	40	60	80	100	160	320
		-- / Material code	$Q_{Smin[L]}$ MPa						
10^1	-	-	-	-	-	-	-	-	-
10^0	-	-	-	-	-	-	-	-	-
10^{-1}	- 13 28	5-5-103-1	10	10	10	10	10	10 - 20	10 10
10^{-2}	14 32 73	5-5-103-1	10	10	10	10	10	10 - 32	10 10
10^{-3}	10	H01	10	10	10	10	10	10	-
	60 69	5-5-103-1	-	-	-	33	25	24	22 34
10^{-4}	10 15	H01	10	10	10	10	10	10	-
	218	5-5-103-1	-	-	-	-	-	-	131
10^{-5}	14 23	H01	-	10	10	10	10	10	-
10^{-6}	20 33	H01	-	15	10	10	10	10 10	-
10^{-7}	31 60	H01	-	-	-	38	32	14 28	-
10^{-8}	50 -	-	-	-	-	-	-	127 -	-