SLOVENSKI STANDARD
oSIST prEN 13555:2019

01-november-2019

Prirobnice in prirobnični spoji - Preskusni postopki za določanje parametrov tesnil, ki so potrebni za konstruiranje prirobničnih spojev, sestavljenih iz okroglih prirobnic in tesnil

Flanges and their joints - Gasket parameters and test procedures relevant to the design rules for gasketed circular flange connections

Flansche und ihre Verbindungen - Dichtungskennwerte und Prüfverfahren für die Anwendung der Regeln für die Auslegung von Flanschverbindungen mit runden Flanschen und Dichtungen

Brides et leurs assemblages - Paramètres de joints et procédures d'essai relatives aux règles de calcul des assemblages à brides circulaires avec joint

Ta slovenski standard je istoveten z: **prEN 13555**

ICS:

23.040.60	Prirobnice, oglavki in spojni elementi	Flanges, couplings and joints
23.040.80	Tesnila za cevne zveze	Seals for pipe and hose assemblies

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EUROPEAN STANDARD

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ICS 23.040.60; 23.040.80

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English Version

Flanges and their joints - Gasket parameters and test procedures relevant to the design rules for gasketed circular flange connections

Brides et leurs assemblages - Paramètres de joints et procédures d'essai relatives aux règles de calcul des assemblages à brides circulaires avec joint

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 74.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 13555:2019) has been prepared by Technical Committee CEN/TC 74 “Flanges and their joints”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13555:2014.

In comparison with the previous edition, the following technical modifications have been made:

a) in Clause 3 the list of definitions has been revised;

b) in Clause 4 the list of symbols has been revised;

c) a new subclause 6.3 with testing requirements for metal foils has been added;

d) subclause 6.4 on surface finish has been revised;

e) subclauses 7.2 and 7.3 on test gaskets have been revised;

f) Clause 8 including Figure 1) to Figure 8 on testing procedures has been completely revised;

g) in Clause 9 the report details have been revised;

h) Annex F on relationship of gasket parameters in EN 13555 with those from PVRC method has been revised;

i) a new informative Annex G on determination of the sealing characteristics of strip sealing materials available in coil form has been added;

j) a new informative Annex H on the proposed method for the determination of the coefficient of static friction of gaskets has been added.

Introduction

This document provides the test procedures to allow the generation of the gasket parameters to enable the design equations established in EN 1591-1 to be employed. The same test procedures may be used for “Type Testing” of gaskets and gasket materials. These procedures are not for routine quality control purposes.

1 Scope

This document specifies the gasket parameters required by EN 1591-1 and provides the test procedures for establishing the values of these parameters.

Gaskets which are wholly based upon elastomers, or based upon elastomers with only the inclusion of particulate fillers or particulate reinforcement, as opposed to gaskets combining elastomers, fillers and fibrous reinforcement, are beyond the scope of this document.

NOTE The testing procedures given might be applicable to gaskets of other shapes and dimensions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1092 (all parts), *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated*

EN 1514-1, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 1: Non-metallic flat gaskets with or without inserts*

EN 1514-2, *Flanges and their joints — Gaskets for PN-designated flanges — Part 2: Spiral wound gaskets for use with steel flanges*

EN 1514-3, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 3: Non-metallic PTFE envelope gaskets*

EN 1514-4, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 4: Corrugated, flat or grooved metallic and filled metallic gaskets for use with steel flanges*

EN 1514-6, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 6: Covered serrated metal gaskets for use with steel flanges*

EN 1514-7, *Flanges and their joints — Gaskets for PN-designated flanges — Part 7: Covered metal jacketed gaskets for use with steel flanges*

EN 1591-1:2013, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 1: Calculation*

EN 1759 (all parts), *Flanges and their joint — Circular flanges for pipes, valves, fittings and accessories, Class designated*

EN 1779, *Non-destructive testing — Leak testing — Criteria for method and technique selection*

EN 12560-1, *Flanges and their joints — Gaskets for Class-designated flanges — Part 1: Non-metallic flat gaskets with or without inserts*

EN 12560-2, *Flanges and their joints — Dimensions of gaskets for Class-designated flanges — Part 2: Spiral wound gaskets for use with steel flanges*

EN 12560-3, *Flanges and their joints — Gaskets for Class-designated flanges — Part 3: Non-metallic PTFE envelope gaskets*

EN 12560-4, *Flanges and their joints — Gaskets for Class-designated flantes — Part 4: Corrugated, flat or grooved metallic and filled metallic gaskets for use with steel flanges*

EN 12560-5, *Flanges and their joints — Gaskets for Class-designated flanes — Part 5: Metallic ring joint gaskets for use with steel flanges*

EN 12560-6, *Flanges and their joints — Gaskets for Class-designated flanges — Part 6: Covered serrated metal gaskets for use with steel flanges*

EN 12560-7, *Flanges and their joints — Gaskets for Class-designated flanges — Part 7: Covered metal jacketed gaskets for use with steel flanges*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
Q_{smax}
maximum surface pressure that may be imposed on the gasket at the indicated temperatures without collapse or "crash", compressive failure, unacceptable intrusion into the bore or damage of the stressed area of the gasket such that failure is imminent

3.2
$Q_{min(L)}$
minimum gasket surface pressure on assembly required at the 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

3.3
$Q_{smin(L)}$
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

3.4
L_N
tightness classes are defined in Table 1 in terms of specific leak rates

Note 1 to entry: Additional, better, tightness classes can be introduced as required by continuing the series.

Table 1 — Tightness classes

Tightness class L_N	$L_{1,0}$	$L_{0,1}$	$L_{0,01}$
Specific leak rate **[mg s^{-1} m^{-1}]**	≤ 1,0	≤ 0,1	≤ 0,01

3.5
P_{QR}
factor allowing for the effect on the imposed load of the relaxation of the gasket between the completion of bolt up and long term experience of the service temperature

3.6
E_G
unloading modulus of elasticity that is determined from the thickness recovery of the gasket between the initial compression surface pressure and unloading to a third of this initial surface pressure

3.7
α_G
coefficient of thermal expansion of the gasket under the service conditions of temperature and gasket surface pressure in the axial direction

3.8
Δe_{Gc}
additional change in thickness of the gasket or sealing element due to creep between the completion of the loading and the end of the test period

3.9
μ_G
static friction factor between the gasket and the flange facing during service conditions and under external loading

4 Symbols

For the purposes of this document, the following notations apply.

Where units are applicable, they are shown in brackets. Where units are not applicable, no indication is given.

α_G	the axial coefficient of thermal expansion of gasket	$[K^{-1}]$
μ_G	the static friction factor between the gasket and the flange facing	—
e_G	gasket or sealing element thickness	[mm]
Δe_{Gc}	change in gasket or sealing element thickness due to creep	[mm]
A_G	area of gasket subjected to surface pressure	$[mm^2]$
d	internal diameter of gasket	[mm]
d_S	internal diameter of area of gasket subjected to surface pressure	[mm]
D	external diameter of gasket	[mm]
D_S	external diameter of area of gasket subjected to surface pressure	[mm]
E_G	unloading modulus of elasticity of the gasket	[MPa]
L_N	tightness class — subscript N indicates the maximum specific leakage rate for that tightness class	$[mg\ s^{-1}m^{-1}]$

P_{QR}	creep relaxation factor, the ratio of the residual and initial surface pressures	—
Q	surface pressure	[MPa]
Q_A	gasket surface pressure at assembly prior to unloading	[MPa]
$Q_{min(L)}$	the minimum level of surface pressure required for leakage rate class L on assembly	[MPa]
$Q_{smin(L)}$	the minimum level of surface pressure required for leakage rate class L after off-loading	[MPa]
Q_{smax}	the maximum surface pressure that can be safely imposed upon the gasket at the service temperature without damage	[MPa]

Concordance with EN 1591-1:

Q_A, the gasket surface pressure at assembly is the gasket stress at the load situation 0 and is defined by Q_A in EN 1591-1.

5 List of gasket parameters

The gasket parameters relevant to the calculation procedures for the design of bolted flange connections as given in EN 1591-1 are shown in Table 2 together with the test procedures applicable for determining the value of the parameter in each case.

Table 2 — Gasket parameters and test procedures

Gasket parameter	Definition Subclause	Test procedure(s) Subclause
Q_{smax}	3.1	8.5
$Q_{min(L)}$	3.2	8.8
$Q_{smin(L)}$	3.3	8.8 and 8.9
L_N	3.4	8.8 and 8.9
P_{QR}	3.5	8.7
E_G	3.6	8.6
α_G	3.7	8.10
Δe_{Gc}	3.8	8.7
μ_G	3.9	8.11

6 Test equipment

6.1 Design

Schematics of test rigs for compression, creep relaxation, and tightness measurement are shown in informative Annexes A to D, Figures A.1, B.1, C.1 and D.1. Annex A is a generalized schematic with the other figures providing further detail for specific aspects of the tests.

6.2 Test platens

The test platens, and heater assembly where appropriate, shall be sufficiently rigid so that any load imposed on the gasket can be withstood and so that there is no platen deformation which results in gasket surface pressure variation. This rigidity aspect can also be important when gasket elastic recovery is being investigated.

The dimensions of the test platen raised faces shall be as given in EN 1092-1 for a DN 40/PN 40 gasket and EN 1759-1 for an NPS 4 CLASS 300 gasket.

For testing in tongue and groove geometries the test platens should be in accordance with EN 1092-1, Form C and Form D or EN 1759-1.

6.3 Metal Foils

Experience has shown that during hot compression tests, that is the P_{QR}, Q_{smax} and elevated temperature tightness tests, some gasket materials are likely to adhere badly enough to the test platens during the test to cause difficulty in the removal of the gasket after the completion of the test and damage the platen surface finish.

To avoid such damage, stainless steel foils or shims of thickness of 0,05 mm placed between the test gasket and the platens during P_{QR} and Q_{smax} tests may be used.

Where foils or shims are used the fact of their use shall be included in the test report.

Foils or shims shall not be re-used or used in tightness tests at any temperature nor in the Coefficient of Static Friction determination defined in 8.11 and provisionally detailed in Annex H.

NOTE A formal investigation into the effect of the use of foils during P_{QR} and Q_{smax} testing is planned to be carried out and, as a result, the next revision of this document might not continue to allow the use of foils or shims.

6.4 Surface finish

The platen surface finish shall be within the range specified by the relevant flange standards in the EN 1092 series and EN 1759 series. For sheet materials where the standards are EN 1092-1 and EN 1759-1 the finish should be as specified below.

The surface finish of the test platens shall conform to the following:

$$3{,}2\ \mu m < R_a < 6{,}3\ \mu m$$

Exceptions to this range are acceptable where the gasket is intended for use with a surface finish outside of this range. In this case the surface finish used shall be recorded.

Before each test, the freedom from debris from the previous test and from scratch and impact damage to the surface finish of the platens shall be checked visually.

6.5 Measurement of gasket thickness

For those procedures where the gasket thickness shall be monitored during the test there shall be either three displacement transducers at 120° spacing around the circumference of the platens or one displacement transducer placed on the central line.

However, for a leak test, the use of an axial transducer is not recommended as it introduces a sealing complication to the rig design.

6.6 Loading

Any loading means may be used that allows the gasket to be loaded and unloaded at a required and consistent rate. The rate of loading and unloading to be used is fixed as:

0,5 MPa/s for all types of gasket except for PTFE based gaskets when 0,1 MPa/s shall be used.

The loading shall be recorded as a function of time.

6.7 Temperature

The rate of increase of temperature in all elevated temperature tests shall be 2 K/min.

6.8 Leakage measurement

EN 1779 gives the limits that can be achieved by various method of leakage measurement. The information given in that document shall be taken into account when selecting a measurement system.

For modern, high performance, sealing materials and gasket styles, the most appropriate method of measurement is very likely to be mass spectrometry.

7 Test gaskets

7.1 Number of gaskets

At least two gaskets for each type of test shall be tested.

NOTE More rigorous guidance on the number of repeat tests required for each test type will be available for the next revision of this document.

7.2 Procurement and identification of gaskets

The gaskets to be tested shall be selected at random from production gaskets or shall be cut from sheet representative of normal production. Prior to selection for test the gaskets or sheet shall have been stored in accordance with the recommendations of the manufacturer and the time since manufacture should be within any time limit set by the manufacturer.

Some basic checks shall be made in order to ensure that the gaskets or sheet are acceptable by the normal quality assurance criteria before the tests to this document are carried out. The results of these checks shall be recorded.

In all cases, full traceability to production shall be maintained.

7.3 Pre-conditioning of the gaskets

For every gasket type where the sealing element is not solid metal the gasket shall be conditioned as indicated below before any of the tests of this document are carried out.

The test gasket shall be held for at least 48 hours in air with a relative humidity of (50 ± 6) % at ambient temperature.

The required relative humidity can for example be generated and maintained by the use of a saturated solution of magnesium nitrate hexahydrate, $Mg(NO_3)_2\ 6H_2O$. The test gaskets that are to be held at the required relative humidity should be stored above a saturated solution of the salt, containing an excess of the solid salt, in a glass container fitted with a ground glass lid and held in an area at ambient temperature.

The test gaskets shall be removed from the conditioning atmosphere no more than 30 min before the test is carried out.

7.4 Dimensions of test gaskets

The test gasket dimensions shall be either of those specified in Table 3.