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BS EN 1591-1:2013



BSI Standards Publication

Flanges and their joints — Design rules for gasketed circular flange connections

Part 1: Calculation

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This British Standard is the UK implementation of EN 1591-1:2013. It supersedes BS EN 1591-1:2001+A1:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PSE/15/2, Flanges - Jointing materials and compounds.

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

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 1591-1:2013) 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of an identical text or by endorsement, at the latest by June 2014, and conflicting national standards shall be withdrawn at the latest by June 2014.

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 1591-1:2001+A1:2009.

The major changes in comparison with the previous edition include:

- correction of load ratio calculation for blind flanges;
- integration of spacers (washers);
- modification of bolt load ratio calculation;
- integration of lateral forces and torsion moments applied on the bolted joint;
- integration of an alternative calculation method (more precise) for the determination of the gasket effective width (informative annex);
- integration of the possibility to handle gasket creep/relaxation behaviour through additional deflection;
- integration of an informative annex concerning leakage rates conversions;
- integration of the possibility to check a bolted flange connection for a specified initial bolt load value;
- integration of the possibility to perform a calculation even when no tightness requirement is defined through basic gasket parameters (Annex G).

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).

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

EN 1591 consists of several parts:

- EN 1591-1, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 1: Calculation*
- EN 1591-2, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 2: Gasket parameters*
- CEN/TS 1591-3, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 3: Calculation method for metal to metal contact type flanged joint*
- EN 1591-4, *Flanges and their joints — Part 4: Qualification of personnel competency in the assembly of the bolted connections of critical service pressurized systems*

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— CEN/TR 1591-5, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 5: Calculation method for full face gasketed joints*

The calculation method satisfies both leak tightness and strength criteria. The behaviour of the complete flanges-bolts-gasket system is considered. Parameters taken into account include not only basic ones such as:

- fluid pressure;
- material strength values of flanges, bolts and gaskets;
- gasket compression factors;
- nominal bolt load;

but also:

- possible scatter due to bolting up procedure;
- changes in gasket force due to deformation of all components of the joint;
- influence of connected shell or pipe;
- effect of external axial and lateral forces and torsion and bending moments;
- effect of temperature difference between bolts and flange ring.

The use of this calculation method is particularly useful for joints where the bolt load is monitored when bolting up. The greater the precision of this, the more benefit can be gained from application of the calculation method.

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.

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1 Scope

This European Standard defines a calculation method for bolted, gasketed, circular flange joints. Its purpose is to ensure structural integrity and control of leak tightness. It uses gasket parameters based on definitions and test methods specified in EN 13555.

The calculation method is not applicable to joints with a metallic contact out of the sealing face or to joints whose rigidity varies appreciably across gasket width. For gaskets in incompressible materials, which permit large deformations, the results given by the calculation method can be excessively conservative (i.e. required bolting load too high, allowable pressure of the fluid too low, required flange thickness too large, etc.).

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

3 Notation

3.1 Use of figures

Figure 1 to Figure 14 illustrate the notation corresponding to the geometric parameters. They only show principles and are not intended to be practical designs. They do not illustrate all possible flange types for which the calculation method is valid.

NOTE For standard flange types, e.g as shown in EN 1092 or EN 1759, the relevant figures are the following:

Type 01	Figure 10
Type 02	Figure 12
Type 04	Figure 12
Type 05	Figure 11
Type 07	Figure 12
Type 11	Figure 6
Type 12	Figure 13
Type 13	Figure 14
Type 21	Figures 6 to 9

3.2 Subscripts and special marks

3.2.1 Subscripts

A – Additional (F_A , M_A)

B – Bolt