

# SLOVENSKI STANDARD

## SIST EN 1591-4:2013

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Nadomešča:

SIST-TS CEN/TS 1591-4:2007

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### Prirobnice in prirobnični spoji - 4. del: Usposabljanje osebja za montažo vijačnih spojev na sistemih pod tlakom v kritičnih primerih

Flanges and their joints - Part 4: Qualification of personnel competency in the assembly of the bolted connections of critical service pressurized systems

Flansche und ihre Verbindungen - Teil 4: Qualifizierung der Befähigung von Personal zur Montage von Schraubverbindungen in druckbeaufschlagten Systemen im kritischen Einsatz

Brides et leurs assemblages - Partie 4: Qualification des compétences du personnel en charge du montage des assemblages boulonnés sur des systèmes sous pression en service critique

**Ta slovenski standard je istoveten z: EN 1591-4:2013**

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#### **ICS:**

03.100.30	Vodenje ljudi	Management of human resources
23.040.60	Prirobnice, oglavki in spojni elementi	Flanges, couplings and joints

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 1591-4**

August 2013

ICS 03.100.30; 23.040.60

Supersedes CEN/TS 1591-4:2007

English Version

**Flanges and their joints - Part 4: Qualification of personnel  
competency in the assembly of the bolted connections of critical  
service pressurized systems**

Brides et leurs assemblages - Partie 4: Qualification des  
compétences du personnel en charge du montage des  
assemblages boulonnés sur des systèmes sous pression  
en service critique

Flansche und ihre Verbindungen - Teil 4: Qualifizierung der  
Befähigung von Personal zur Montage von  
Schraubverbindungen in druckbeaufschlagten Systemen im  
kritischen Einsatz

This European Standard was approved by CEN on 22 June 2013.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.



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## Foreword

This document (EN 1591-4:2013) 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 February 2014, and conflicting national standards shall be withdrawn at the latest by February 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 CEN/TS 1591-4:2007.

The detailed changes that have been made in converting CEN/TS 1591-4: 2007, a guidance document, to EN 1591-4: 2013, a European Standard containing requirements to be met, are too numerous to describe in detail. It is recommended that users of CEN/TS 1591-4:2007 study EN 1591-4:2013 in full in order to understand the differences between the two documents.

EN 1591, *Flanges and their joints*, consists of the following parts:

- EN 1591-1, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 1: Calculation method*
- 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* (the present document)
- CEN/TR 1591-5, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 5: Calculation method for full face gasketed joints*

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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.

**EN 1591-4:2013 (E)****Introduction**

The competence of the bolting technicians is a key factor in the safe operation of a system containing pressurised bolted connections and in the achievement of the highest performance from a pressurised bolted connection. Design codes for pressurised bolted connections such as EN 1591-1 require controlled bolt tightening. Therefore, competent bolting technicians are needed so that the specified bolt load tolerances can be met and, where appropriate, the specified tightness requirement can be achieved.

Training and competence, experience and knowledge are often confused with each other. Training is no guarantor of competence, nor is experience a guarantor of knowledge and understanding. Training, experience, and assessment of the ability to apply knowledge are all required to achieve competence.

The essential elements needed to achieve competency are:

- a) theoretical knowledge combined with practical experience gained on site or by simulated workshop activities;
- b) assessment by a competent assessor to verify that the required knowledge, skill and ability has been gained and can be applied in accordance with an operating procedure.

These elements may be achieved through formal education and training, or experiential, work-based learning, or a combination of the two. Nevertheless, competency can only be demonstrated by the method indicated in this document. It sets out the training syllabi for not only the bolting technicians, who actually disassemble, assemble and tighten bolted joints that in service will be pressurised, but also the syllabi for the personnel who supervise those technicians, the responsible engineers.

Competency in the analysis of pressurised bolted connection failures is not required beyond use of knowledge gained during training.

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A correctly assembled and tightened pressurised bolted connection that fails in service requires specialist knowledge to understand why the failure occurred and is outside the scope of this European Standard.

## 1 Scope

This European Standard is applicable to the bolting technicians, and their supervisors, the responsible engineers, who disassemble, assemble and tighten the bolted connections of whatever shape of critical service pressurised systems. A failure of a connection in such a system would endanger personnel, plant or the environment. A route for achieving competency in the skills required to safely and successfully disassemble, assemble and tighten pressurised bolted joints of any shape to a design bolt load using documented work instructions is given in this document. The aim is the establishment of a joint capable of maintaining a leak-free status throughout its' service life.

This European Standard provides a modular training syllabus and an assessment process that can be used to determine the competency of personnel who disassemble, assemble and tighten bolted connections, whatever their shape, fitted to pressurised equipment containing a medium at any combination of temperature and pressure.

Bolting technicians have to assemble bolted connections of different levels of complexity. For this reason, training matrices dealing with bolted connections of various levels of complexity and for different types of pressurised bolted connections are given in this document. The modular structure created allows a bolting technician, once competency in the foundation level has been achieved, to obtain competency in higher levels as required.

Certification to this European Standard provides an attestation of general competency in accordance with the stated syllabi and assessments.

Certification to this European Standard does not represent an authorisation to operate, since this remains the responsibility of the employer, and the certified person may require additional specialised knowledge of employer-specific procedures, processes and equipment.

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## 2 Normative references

Not applicable.

## 3 Terms and definitions

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

### 3.1

#### **manufacturer**

organisation that manufactures the device having the bolted connection

### 3.2

#### **operator**

organisation that is, or will be, responsible for the operation and maintenance of equipment

Note 1 to entry: This includes suppliers or contractors employed to disassemble, assemble and tighten bolted connections on pressurised equipment.

### 3.3

#### **constructor**

organisation that is or will be responsible for the construction and/or commissioning of a plant containing pipework and equipment

Note 1 to entry: This includes suppliers and contractors employed to disassemble, assemble and tighten bolted gasketed connections on pressurised equipment.

**EN 1591-4:2013 (E)****3.4****trainer/training provider**

organisation or individual with the competence and capability to deliver the required training

**3.5****assessor/assessment body**

qualified person or organisation appointed to validate that the bolting technician, responsible engineer or technical authority is competent

**3.6****bolting technician**

person whose role is to disassemble, assemble or tighten the bolted connections of systems that will be pressurised in service

**3.7****responsible engineer**

person whose role is to plan and supervise the activity of bolting technicians

**3.8****technical authority**

person who, on behalf of the manufacturer, operator or constructor, is responsible for the technical aspects of the project that has resulted in the need for assembly of bolted connections

**3.9****core topic**

topic that requires a theoretical and/or practical understanding and the ability to apply that understanding safely and effectively

**3.10****awareness topic**

topic that requires an individual to retain sufficient knowledge about a subject for him/her to be conscious of its existence and its broad content

**3.11****foundation level**

level of training required, subject to assessment that the content has been assimilated, to ensure competency in the assembly of bolted connections whose bolts are capable of being tightened with hand operate torque wrenches

Note 1 to entry: Once competency at the foundation level has been achieved, further training and assessment for larger bolts and in specialist areas is possible.

**3.12****critical service**

any pressurised system where failure of the connection would result in danger to personnel or the environment

**4 Qualification of trainer**

The trainer shall be able to demonstrate a thorough understanding of the technical and practical aspects of the syllabus. For many institutions providing training, such as vocational technical schools, this shall be mandated in the school's quality plan.



## 5 Qualification of assessor

The assessor chosen shall be qualified as competent to be an assessor in the field of pressurised bolted connection related manual skilled vocations.

## 6 Personnel with work-based learning

Bolting technicians and responsible engineers who have acquired skills previously during employment can have acquired those skills by one of two routes:

- a) practical and theoretical training as part of an apprenticeship or similar craft training based upon the syllabus of the following clauses below or an equivalent;
- b) on-site practical learning by working with skilled technicians with no formal theoretical training.

In the case of those bolting technicians and responsible engineers who acquired the necessary skills by practical and theoretical training as part of an apprenticeship or similar craft training, they shall move directly to competency assessment as indicated in Clause 10 without the need for the training outlined below. If they fail the competency assessment then they shall undergo training as outlined below by a training provider before a second competency assessment as indicated in Clause 10.

In the case of those bolting technicians and responsible engineers who acquired their skills only by on-site practical learning by working with skilled technicians with no formal theoretical instruction, they shall undergo training as outlined below by a training provider before competency assessment as indicated in Clause 10.

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## 7 Training location

Training shall either take place at a suitable training centre within the framework of professional training or a craft apprenticeship or at the facility where the bolting technician normally works.

The location shall include both a suitable classroom and a suitably equipped workshop so that the personnel being trained gain both a theoretical understanding and practical experience with bolted connections that are representative of the different types present at the bolting technician's normal place of work.

## 8 Training syllabi

### 8.1 Syllabi content

The relevant syllabi shall include as a minimum all pressurised bolted connections types that will be encountered by the bolting technicians when they return to their work site. For bolting technicians who are expected to work on a variety of sites, the content shall be sufficiently generic to cover all commonly encountered pressurised bolted connections. The manufacturer or operator requiring the training shall ensure the above requirement is met by the organisation selected to provide the training.

The syllabi shall include a number of key topics to ensure a comprehensive understanding and appreciation of the pressurised bolted connections. The topics shall be divided between those that require awareness and core topics requiring an in-depth understanding.

Awareness topics shall ensure bolting technicians appreciate the engineering principles that underpin the core topics requiring in-depth understanding. Core topics shall be understood thoroughly by bolting technicians. For example, bolting technicians shall be shown and understand how the relationship between torque and bolt load is impacted by the coefficient of friction, before being taught torque tightening of a bolted joint.

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The matrices in 8.2 and 8.3 provide the mandatory minimum syllabi for the various levels of training. By agreement between the manufacturer/operator/constructor and the training provider, additional topics of local importance shall be added to meet the requirements of the manufacturer/operator/constructor. At all times, bolting technicians shall be trained using procedures and work instructions deemed most suitable by the manufacturer/operator/constructor.

Any additional topics added to the mandatory minimum syllabi shall be listed on the syllabus information supporting any certificate awarded, see 10.3.

The training shall be formatted to include both classroom and practical sessions. The duration of the training shall be agreed between the training provider and the operator, constructor or manufacturer and shall take into account the previous experience of the personnel being trained.

**8.2 Qualification level****8.2.1 General**

Various levels of speciality above the foundation level exist within the population of bolting technicians and these are represented by the content of the tables given below.

Once training in the foundation level (see Table 1) has been undertaken and the subsequent assessment has demonstrated the achievement of competency, bolting technicians may elect to achieve competency in one or more of the higher levels. The training matrices for these higher levels are given in Tables 2, 3, 4, 5, 6, 7, 8, 9 and 10 below.

Competency at the foundation level shall be demonstrated before training and competency assessment at higher levels is undertaken.

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## 8.2.2 Foundation level

Table 1 — Foundation level training matrix

Topic	Core	Awareness
Types of bolted connections		X
Functionality of gaskets		X
Types of gaskets and their relative features		X
Relationship between bolt elongation (strain), bolt load and gasket stress		X
Common causes of the failure of gasketed bolted connections		X
Bolt load loss and implications		X
Applied and residual bolt loads		X
General health and safety precautions	X	
Safe joint disassembly	X	
Seal face preparation	X	
Identification of defects and faults	X	
Face alignment and gap uniformity	X	
Gasket storage, handling, preparation and placement	X	
Effect of thread friction on load when using torque tightening	X	
Importance of using the specified thread lubricant	X	
Bolt tightening methods and their relative accuracies		X
The need for bolt tightening patterns	X	
Bolt tightening patterns	X	
Tightness level		X
Requirement to meet a specific class of tightness	X	
Manual torque tightening	X	
Maintenance and calibration of manual torque wrenches	X	
Requirements for hydraulic torqueing and tensioning		X
Confirming that joint can return to service	X	
Recording of work carried out	X	
Reporting of variance or irregularity	X	
Emission monitoring and leakage management		X