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Flanges and their joints - Design rules for gasketed circular flange connections - Part 4:  
Qualification of personnel competency in the assembly of bolted joints fitted to equipment  
subject to the Pressure Equipment Directive

Flansche und ihre Verbindungen - Regeln für die Auslegung von Flanschverbindungen  
mit runden Flanschen und Dichtung - Teil 4: Qualifizierung der Kompetenz von Personal  
zur Montage von Schraubverbindungen im Geltungsbereich der Druckgeräterichtlinie

[SIST-TS CEN/TS 1591-4:2007](#)

Brides et leurs assemblages - Regles de calcul des assemblages a brides circulaires  
avec joint - Partie 4 : Qualification des compétences du personnel en charge du montage  
des assemblages boulonnés sur des équipements relevant de la Directive Équipements  
sous pression

**Ta slovenski standard je istoveten z: CEN/TS 1591-4:2007**

**ICS:**

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

**SIST-TS CEN/TS 1591-4:2007** en,fr,de

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English Version

**Flanges and their joints - Design rules for gasketed circular  
flange connections - Part 4: Qualification of personnel  
competency in the assembly of bolted joints fitted to equipment  
subject to the Pressure Equipment Directive**

Brides et leurs assemblages - Règles de calcul des  
assemblages à brides circulaires avec joint - Partie 4 :  
Qualification des compétences du personnel en charge du  
montage des assemblages boulonnés sur des équipements  
relevant de la Directive Équipements sous pression

Flansche und ihre Verbindungen - Regeln für die  
Auslegung von Flanschverbindungen mit runden Flanschen  
und Dichtung - Teil 4: Qualifizierung der Kompetenz von  
Personal zur Montage von Schraubverbindungen im  
Geltungsbereich der Druckgeräte-Richtlinie

This Technical Specification (CEN/TS) was approved by CEN on 26 May 2007 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

CEN members are the national standards bodies of 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 United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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## Foreword

This document (CEN/TS 1591-4:2007) has been prepared by Technical Committee CEN/TC 74 "Flanges and their joints", the secretariat of which is held by DIN.

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.

The integrity of a bolted joint is key in any pressure containment system and should be subjected to personnel competence. The aim of this document is to offer a procedure for training and competency assessment of personnel who disassemble, assemble and tighten bolted joints under the Pressure Equipment Directive 97/23/EC.

EN / ENV / CEN/TS 1591 *Flanges and their joints — Design rules for gasketed circular flange connections* consists of the following parts:

*Part 1: Calculation method (EN)*

*Part 2: Gasket parameters (ENV)*

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

*Part 4: Qualification of personnel competency in the assembly of bolted joints fitted to equipment subject to the Pressure Equipment Directive (CEN/TS)*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this CEN Technical Specification: 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 United Kingdom.

## 1 Scope

### 1.1 General

This European Technical Specification establishes a process for training and competency assessment of personnel who disassemble, assemble and tighten bolted joints such as fitted to equipment subject to the Pressure Equipment Directive 97/23/EC (PED), in the content of this Technical Specification named "PED".

### 1.2 Requirement for competency

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 knowledge are all required to achieve competence.

Design codes for mechanical joints (see for example EN 1591-1 or CEN/TS 1591-3) increasingly require controlled bolt tightening in order to meet the specified bolt load tolerances.

The intent of this Technical Specification is to ensure personnel are competent to assemble and tighten bolted joints using the design bolt load and documented work instructions, thereby establishing a joint capable of maintaining a leak-free status throughout its' service life.

Competency in the analysis of joint failure is not required beyond use of knowledge gained during training. A correctly assembled and tightened joint that fails in service requires specialist knowledge and is out with the scope of this Technical Specification.

### 1.3 Validity

This Technical Specification is applicable for bolted joints included on mechanical equipment subject to the PED, or any joint where failure would endanger personnel, plant or the environment. Such joints may or may not be fitted with a gasket.

The validity includes all bolting arrangements, both circular and non-circular, and fluids (gas or liquid) with the exception of:

- joints having less than 4 bolts, or bolt diameters less than M16;
- potable or fire water, sewage systems.

This Specification excludes:

- craft personnel who are trained, examined and verified as competent in their craft training or normal course of work to assemble bolted joints, such as in the manufacture of equipment;
- professional persons, who by their professional training and experience and contemporary practices are regularly concerned with bolted joints and their assembly.

### 1.4 Quality management system

Manufacturers or operators need to develop and include a procedural framework within their quality management system to meet the requirements of this specification. Such a framework needs to address:

- identification of personnel requiring training;
- identification of a competent trainer or training provider, e.g. "Qualified Person for Pressure";

— evaluation of the effectiveness of the training.

For examples, refer to EN ISO 9001:2000, 6.2.2.

## 2 Normative references

Not applicable.

## 3 Terms and definitions

### 3.1

#### **manufacturer**

organisation that manufactures equipment subject to the PED directive

### 3.2

#### **operator**

organisation that is responsible for the operation and maintenance of equipment subject to the PED directive. This includes suppliers or contractors employed to assemble the operator's equipment joints

### 3.3

#### **training provider**

organisation with the capability to deliver the required training

### 3.4

#### **trainer**

individual assigned by the training provider to deliver the training

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## 4 Objective

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The objective of this Technical Specification is to set down a route for achieving competency in the skills required to safely and successfully disassemble, assemble and tighten bolted joints.

The essential elements to achieve competency are:

- classroom training followed by monitored workshop practice;
- written test to verify candidate has understood the classroom training;
- period of monitored work site experience under the supervision of a competent person;
- assessment by a qualified assessor to verify the training has been understood and applied.

These elements may be combined through perennial training including technical schooling, on-plant training, and final examination.

## 5 Training location

Training may either take place at a suitable training centre or at the facility where the candidates normally work.

The location should include a suitable classroom and practical workshop where the possibility exists to train with bolted joints that are representative of the candidate's normal place of work.

## 6 Training curriculum

### 6.1 General

The curriculum should include all joint types that will be encountered by the candidates when they return to their work site. For candidates who are expected to work on a variety of sites the content should be sufficiently generic to cover all commonly encountered joints. As a minimum, this will at least include bolted joints that are representative of the candidate's normal place of work.

The manufacturer or operator requiring the training should ensure the above requirement is met by the organisation selected to provide the training.

The curriculum will include a number of key topics to ensure a comprehensive understanding and appreciation of the bolted joint. The topics can be divided between topics that require awareness and those requiring an in-depth understanding.

Awareness topics are required to ensure candidates appreciate the engineering principles that underpin the topics requiring in-depth understanding. For example, candidates should be shown and understand how the relationship between torque and bolt load is impacted by the coefficient of friction, before being taught torque tightening a bolted joint.

The training provider is responsible for setting the content of each module and will confirm the content is appropriate and detailed enough to meet the manufacturer or operator's needs.

### 6.2 General knowledge **iTeh STANDARD PREVIEW**

The curriculum will ensure candidates are aware of the following and their importance when working with bolted joints. The list is exemplary; the exact content of the training depends on the quality management system, pipeline specifications, and operational requirements:

- the principles of bolt elongation (strain), bolt load and stress;
- importance of applied and residual bolt loads;
- bolt load loss and the implications;
- effect of coefficient of friction on bolt load when using torque;
- bolt tightening methods and their relative accuracies;
- joint assembly methods and tightening procedures;
- the requirements to meet a specific class of tightness;
- flange, bolt and gasket types and their limitations;
- functionality of gasket and seal;
- factors affecting the degradation of bolted assemblies, e.g. corrosion;
- common causes of joint failure and leakage;
- specific health or safety requirements associated with joint components;
- maintenance requirements of bolt tightening systems;
- importance of certification and records.



### 6.3 Specific knowledge

The curriculum will ensure candidates have a thorough understanding of the following aspects of joint disassembly, assembly and tightening. Training will take place using the appropriate tools, components, and bolted joints. The list is exemplary; the exact content of the training depends on the quality management system, pipeline specifications, and operational requirements:

- general health and safety precautions;
- procedure for preparing a joint for closure;
- identification of correct joint components;
- seal face preparation;
- gasket handling, preparation and installation;
- functionality of clamp or engineered joints;
- importance of alignment and gap uniformity;
- importance of using the specified lubricant;
- manual torque joint tightening;
- hydraulic torque joint tightening;
- joint tightening using hydraulic bolt tensioners;
- techniques for measuring bolt strain;
- confirming joint can return to service;
- identifying defects or faults;
- variance or irregularity reporting;
- safe joint disassembly;
- safety requirements when selecting and operating bolt tightening tooling;
- calibration of bolt tightening tooling;
- recording bolted joint activity and maintenance of records.

### 7 Format of training

The training will be formatted to include both classroom and practical sessions. The duration of the course will be at the discretion of the training provider.