SLOVENSKI STANDARD
SIST EN 1515-4:2010

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Prirobnice in prirobnični spoji - Vijaki in matice - 4. del: Izbira vijakov in matic za opremo, ki je v skladu z Direktivo o tlačni opremi

Flanges and their joints - Bolting - Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 97/23/EC

Flansche und ihre Verbindungen - Schrauben und Muttern - Teil 4: Auswahl von Schrauben und Muttern zur Anwendung im Gültigkeitsbereich der Druckgeräterichtlinie 97/23/EG

Brides et leurs assemblages - Boulonnerie - Partie 4: Sélection de la boulonnerie pour équipements relevant de la Directive Equipements sous pression 97/23/CE

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

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Flanges and their joints - Bolting - Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 97/23/EC

Brides et leurs assemblages - Boulonnerie - Partie 4: Sélection de la boulonnerie pour équipements relevant de la Directive Equipements sous pression 97/23/CE

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 1515-4:2009) 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of an identical text or by endorsement, at the latest by June 2010, and conflicting national standards shall be withdrawn at the latest by June 2010.

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 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 1515, *Flanges and their joints — Bolting*, consists of the following parts:

— *Part 1: Selection of bolting*

— *Part 2: Classification of bolt materials for steel flanges, PN designated*

— *Part 3: Classification of bolt materials for steel flanges, class designated*

— *Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 97/23/EC*

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 Scope

This European Standard is applicable to the selection of bolting for equipment subject to the Pressure Equipment Directive 97/23/EC.

It specifies standards and additional requirements for dimensions, materials and technical conditions of delivery for bolting.

The bolting selection covered by this European Standard is regarded to be used for combination with flanges according to the series EN 1092 (PN designated flanges) and the series EN 1759 (Class designated flanges).

The selection is based on commonly used materials, bolts and nuts. It covers temperature ranges of the general service of standard flanges (based on PN or Class).

NOTE 1 The bolting selection given may be used in combination with non-standard flanges too provided that the range of application of the equipment for which the bolting is intended to be used is covered. It is the purchaser's option to decide on this.

When selecting bolting according to this European Standard it is essential to take into account other parameters such as type of fluids, corrosion hazards and relaxation at elevated temperatures.

The purpose of this European Standard is to provide a selection of most commonly used bolting types and bolting material combinations as well a tool for easy selection of suitable bolting for equipment.

It is not the intention to specify all possible applications but to give guidance on the most commonly applications. According to this, e.g. application limits for material in the creep range are not explicitly covered in this European Standard but some bolting materials listed (see Table 3, footnote h) are suitable to be used in this temperature range. Wherever the starting material standard provides mechanical properties for this temperature range respective reference is made in Table 3.

NOTE 2 Special services and ambient conditions may require the application of coatings. It is the purchaser's option to decide on this. Depending on the coating used, a verification of the temperature ranges given in Table 3 may be required.

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 764-5:2002, *Pressure Equipment — Part 5: Compliance and Inspection Documentation of Materials*

EN 1092-1:2007, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1759-1:2004, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 1: Steel flanges, NPS 1/2 to 24*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN 10269:1999, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

EN 13445-3:2009, *Unfired pressure vessels — Part 3: Design*

EN 13480-3:2002, *Metallic industrial piping — Part 3: Design and calculation*

EN 20898-2,:1993 *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread (ISO 898-2:1992)*

EN ISO 898-1:2009, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread (ISO 898-1:2009)*

EN ISO 3506-1:1997, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 1: Bolts, screws and studs (ISO 3506-1:1997)*

EN ISO 3506-2:1997, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 2: Nuts (ISO 3506-2:1997)*

EN ISO 4014:2000, *Hexagon head bolts — Product grades A and B (ISO 4014:1999)*

EN ISO 4017:2000, *Hexagon head screws — Product grades A and B (ISO 4017:1999)*

EN ISO 4032:2000, *Hexagon nuts, style 1 — Product grades A and B (ISO 4032:1999)*

EN ISO 4033:2000, *Hexagon nuts, style 2 — Product grades A and B (ISO 4033:1999)*

EN ISO 16426:2002, *Fasteners — Quality assurance system (ISO 16426:2002)*

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 965-2:1998, *ISO general purpose metric screw threads — Tolerances — Part 2: Limits of sizes for general purpose external and internal screw threads — Medium quality*

3 Terms and definitions, symbols and units

3.1 Terms and definitions

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

3.1.1
bolting
type of fastener such as a bolt, screw, stud, tie-rod, reduced shank bolt (also named as necked-down bolt) and nut

NOTE Also defined as fasteners (see EN ISO 16426).

3.1.2
purchaser
person or organization that orders products in accordance with this European Standard

NOTE The purchaser is not necessarily, but may be, a manufacturer of equipment in accordance with the EU Directive listed in Annex ZA. Where a purchaser has responsibilities under this EU Directive, this European Standard will provide a presumption of conformity with the essential requirements of the Directive so identified in Annex ZA.

3.1.3
bolting manufacturer
person or organization that is responsible for the compliance of the bolting with the requirements of this European Standard and the referenced standards given for bolting and materials agreed with the purchaser

3.1.4
manufacturing lot
quantity of fasteners of a single designation including product grade, property class and sizes, manufactured from bar, wire, rod or flat product from a single cast, processed through the same or similar steps at the same time or over a continuous time period through the same heat treatment and/or coating, if any

NOTE 1 Same heat treatment or coating means:

— for a continuous process, the same treatment cycle without any setting modification;

— for a discontinuous process, the same treatment cycle for identical consecutive loads (batches).

NOTE 2 The manufacturing lot may be split into several manufacturing batches for processing purposes and then reassembled into the same manufacturing lot.

3.1.5
manufacturing lot number
unique number assigned by the bolting manufacturer and which allows full traceability from the finished product back through all previous steps of the manufacturing operations to a given cast number of the starting material of manufacture

3.2 Symbols and units

The symbols and respective units used in this European Standard are defined in Table 1.

Table 1 — Symbols and units

Symbol	Designation	Unit
KV	Impact rupture energy	J
t_{KV}	Material impact test temperature	°C
t_M	Minimum metal temperature	°C

4 Selection of bolting types and materials

4.1 General

The selection of bolting types and bolting material combinations for a certain application shall comprise beside the requirements covered by this European Standard, the range of application of the equipment for which the bolting is intended to be used. That is all service conditions such as maximum/minimum allowable temperature, stresses, type of fluids, corrosion hazards and if applicable type and material of gasket.

Furthermore it shall be regarded that flanged joints shall remain tight under the expected operating conditions. Other properties like residual magnetism and relaxation properties shall be evaluated by the purchaser.

For selection of bolting types and bolting material combinations other than those listed in Table 2 and Table 3 according to commonly used national standards, see Annex B.

Requirements for combination of bolting and flange materials as given in some European Standards such as EN 13480-3 or EN 13445-3 shall be observed by the user of this standard.

Requirements concerning the strength category for bolting as given in EN 1092-1:2007, Annex E, EN 1759-1:2004, Annex B and EN 13480-3:2002, Annex D shall be observed by the user of this European Standard.

4.2 Selection of bolting types

Selection of bolting types according to Table 2.

Table 2 — Types of bolting

Dimensional standard		Remarks
Bolts/Studs	Nuts	
EN ISO 4014	EN ISO 4032 EN ISO 4033[a]	Hexagon head bolt
EN ISO 4017	EN ISO 4032 EN ISO 4033[a]	Hexagon head bolt, threaded full length
Annex A	EN ISO 4032 EN ISO 4033[a]	Stud bolt, threaded full length

[a] Nuts in accordance with EN ISO 4033 are normally used for industrial plants. For sizes ≥ M39 nuts with $m = d$ are recommended.

4.3 Selection of bolting material combinations

A selection of commonly used bolting material combinations and their suitable temperature ranges, based on PN or Class, is shown in Table 3. Combination of bolting materials other than the combinations shown may reduce the given temperature limits. Conditions to determine the permissible minimum temperature: see 6.2.

Starting material for bolting according to EN 20898-2, EN ISO 898-1, EN ISO 3506-1 and EN ISO 3506-2 shall comply with EN 10269.

NOTE 1 Requirement for starting material has been derived from EN 13445-2.

NOTE 2 Upper suitable temperatures listed in Table 3 correspond with the highest temperature for which minimum 0,2 % proof strength values are given in EN 10269 and the limits given in EN ISO 898-1, EN ISO 3506-1 and EN ISO 3506-2. Wherever material combinations are listed upper suitable temperature is chosen to comply with the lowest permissible of one of them. For some materials mechanical properties at higher temperature exist, e.g. creep values to be taken into consideration as appropriate.

NOTE 3 For determination of strength category of bolting, see EN 1515-2.

Table 3 — Selection of bolting material combinations with suitable temperatures ranges

Line No	PN Class up to	Suitable temperature range °C	Type of bolting and description of material groups		Steel designation name or property class Steel designation number Material standard	
			Bolts, screws, studs	Nuts	Bolts, screws, studs	Nuts
1	PN 40[a] Cl. 300	- 10 to 300	C-St	C-St	5.6[g] — EN ISO 898-1	5[e] — EN 20898-2
2	PN 40[a] Cl. 300	- 10 to 300	C-St	C-St	8.8[g] — EN ISO 898-1	8 — EN 20898-2
3	all	- 10 to 400	0,25C-1Cr-Mo	C-St elev. temp.	25CrMo4 1.7218 EN 10269	C35E 1.1181 EN 10269
4	all	- 10 to 350	0,42C-1Cr-Mo	C-St elev. temp.	42CrMo4 1.7225 EN 10269	C45E 1.1191 EN 10269
5	all	- 60 to 400	0,25C-1Cr-Mo	18Cr-9Ni	25CrMo4 1.7218 EN 10269	A2-50, A2-70 [g] — EN ISO 3506-2
6	all	- 60 to 500	0,25C-1Cr-Mo	0,25C-1Cr-Mo	25CrMo4[h] 1.7218 EN 10269	25CrMo4 1.7218 EN 10269
7	all	- 100 to 500	0,42C-1Cr-Mo	0,42C-1Cr-Mo	42CrMo4[h] 1.7225 EN 10269	42CrMo4 1.7225 EN 10269
8	all	- 10 to 500	0,42C-1,3Cr-0,6Mo	0,42C-1Cr-Mo	42CrMo5-6[h] 1.7233 EN 10269	42CrMo4 1.7225 EN 10269
9	all	- 10 to 500	0,40C-1Cr-0,6Mo-V	0,42C-1Cr-Mo	40CrMoV4-6[h] 1.7711 EN 10269	42CrMo4 1.7225 EN 10269
10	all[c]	- 10 to 500	0,21C-1,3Cr-0,7Mo-V	0,21C-1,3Cr-0,7Mo-V	21CrMoV5-7[h] 1.7709 EN 10269	21CrMoV5-7 1.7709 EN 10269
11	all	- 10 to 500	0,2C-1Cr-1Mo-V-Ti-B	0,2C-1Cr-1Mo-V-Ti-B	20CrMoVTiB4-10[h] 1.7729 EN 10269	20CrMoVTiB4-10 1.7729 EN 10269
12	all[c]	- 196[j] to 650	25Ni-15Cr-0,2Ti-Mo-V-B	25Ni-15Cr-0,2Ti-Mo-V-B	X6NiCrTiMoVB[h] 25-15-2 1.4980 EN 10269	X6NiCrTiMoVB 25-15-2 1.4980 EN 10269

Table 3 (*continued*)

Line No	PN Class up to	Suitable temperature range °C	Type of bolting and description of material groups		Steel designation name or property class Steel designation number Material standard	
			Bolts, screws, studs	Nuts	Bolts, screws, studs	Nuts
13	all[c]	- 10 to 500	12Cr-1Mo-V	12Cr-1Mo-V	X22CrMoV12-1[h] 1.4923 EN 10269	X22CrMoV12-1 1.4923 EN 10269
14	all	- 10 to 650	16Cr-16Ni-Mo-B-Nb	16Cr-16Ni-Mo-B-Nb	X7CrNiMoBNb16-16[h] 1.4986 EN 10269	X7CrNiMoBNb16-16 1.4986 EN 10269
15	PN 40[d] Cl. 300	- 196 to 400	18Cr-9Ni	18Cr-9Ni	A2-50[g] — EN ISO 3506-1	A2-50[g] — EN ISO 3506-2
16	PN 100 Cl. 600	- 196 to 400	18Cr-9Ni	18Cr-9Ni	A2-70[g] — EN ISO 3506-1	A2-70[g] — EN ISO 3506-2
17	PN 40[d] Cl. 300	- 60[f] to 400	18Cr-9Ni-Mo	18Cr-9Ni-Mo	A4-50[g] — EN ISO 3506-1	A4-50[g] — EN ISO 3506-2
18	PN 100 Cl. 600	- 60[f] to 400	18Cr-9Ni-Mo	18Cr-9Ni-Mo	A4-70[g] — EN ISO 3506-1	A4-70[g] — EN ISO 3506-2
19	PN 40[d] Cl. 300	- 196 to 550	17Cr-12Ni-2Mo	17Cr-12Ni-2Mo	X5CrNiMo17-12-2 AT 1.4401 EN 10269	X5CrNiMo17-12-2 1.4401 EN 10269
20	PN 100 Cl. 600	- 196 to 200[b]	17Cr-12Ni-2Mo AT+C	17Cr-12Ni-2Mo	X5CrNiMo17-12-2 AT+C 1.4401 EN 10269	X5CrNiMo17-12-2 1.4401 EN 10269
21	PN 40[d] Cl. 300	- 196 to 550	18Cr-10Ni	18Cr-10Ni	X5CrNi18-10 1.4301 EN 10269	X5CrNi18-10 1.4301 EN 10269
22	PN 100 Cl. 600	- 196 to 200[b]	18Cr-10Ni AT+C	18Cr-10Ni	X5CrNi18-10 AT+C 1.4301 EN 10269	X5CrNi18-10 1.4301 EN 10269

[a] Up to PN 63 for temperature up to 120 °C.

[b] Allowable stresses for elevated temperatures may be taken from the material in AT condition, as no stresses exist for the cold worked condition.

[c] Commonly used for PN 160 up to PN 400.

[d] Is limited to be used for max. PN 40/Cl. 300 (low strength bolting).

[e] The use of free-cutting steel is not permitted.

[f] – 196 °C for studs.

[g] Starting material shall comply with EN 10269 (see 6.1).

[h] May be used in the creep range. For maximum suitable temperature see EN 10269.

[i] When intended to be used down to – 273 °C, for additional requirements see Table 5, footnote a.