SLOVENSKI STANDARD
SIST EN 1515-4:2021

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Nadomešča:
SIST EN 1515-4:2010

Prirobnice in prirobnični spoji - Vijaki in matice - 4. del: Izbira vijakov in matic za opremo, ki je v skladu z Direktivo o tlačni opremi 2014/68/EU

Flanges and their joints - Bolting - Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 2014/68/EU

Flansche und ihre Verbindungen - Schrauben und Muttern - Teil 4: Auswahl von Schrauben und Muttern zur Anwendung im Gültigkeitsbereich der Druckgeräterichtlinie 2014/68/EU

Brides et leurs assemblages - Boulonnerie - Partie 4 : Sélection de la boulonnerie pour équipments relevant de la Directive Equipments sous pression 2014/68/EU

Ta slovenski standard je istoveten z: **EN 1515-4:2021**

ICS:

21.060.10	Sorniki, vijaki, stebelni vijaki	Bolts, screws, studs
21.060.20	Matice	Nuts
23.040.60	Prirobnice, oglavki in spojni elementi	Flanges, couplings and joints

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English Version

Flanges and their joints - Bolting - Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 2014/68/EU

Brides et leurs assemblages - Boulonnerie - Partie 4 : Sélection de la boulonnerie pour équipments relevant de la Directive Equipments sous pression 2014/68/EU

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This European Standard was approved by CEN on 1 February 2021.

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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.

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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 (EN 1515-4:2021) 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of an identical text or by endorsement, at the latest by September 2021, and conflicting national standards shall be withdrawn at the latest by September 2021.

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.

This document supersedes EN 1515-4:2009.

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 2014/68/EU*.

Main changes compared to edition EN 1515-4:2009:

— explanation of requirements for starting material in accordance to EN 10269:2013;

— some temperature ranges and assignment of material groups are amended in Table 3;

— option for traceability by means of lot identification marking instead of inspection documents;

— separate requirements have been given to bolting other than those in EN 10269:2013;

— requirements for prevention of brittle fracture have been updated.

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.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document is applicable to the selection of bolting for flanged joints on equipment subject to the Pressure Equipment Directive 2014/68/EU.

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

NOTE 1 Washers are not within the scope of this document.

The selection is based on commonly used bolting. It covers common temperature ranges of the general service of flanges.

When selecting bolting according to this document it is essential to take into account environmental conditions and other parameters including type of fluids, corrosion hazards, sour service, low temperature brittle failure and relaxation at elevated temperatures.

The purpose of this document is to provide a selection of most commonly used bolting types and bolting material combinations.

It is not the intention to specify all possible applications but to give guidance on the most common applications. For example, application limits for material in the creep range are not explicitly covered in this document. Where material standard provides mechanical properties for the creep 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 and Table 4 may be required.

NOTE 3 In Annex B there are bolting types and bolting material combinations according to commonly used national standards other than those listed in Table 2, Table 3 and Table 4.

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 764-5:2014, *Pressure equipment - Part 5: Inspection documentation of metallic materials and compliance with the material specification*

EN 1092-1:2018, *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 joint - 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 10269:2013, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

EN 13445-3:2014,[1] *Unfired pressure vessels - Part 3: Design*

[1] As impacted by EN 13445-3:2014/A1:2015, EN 13445-3:2014/A2:2016, EN 13445-3:2014/A3:2017, EN 13445-3:2014/A4:2018, EN 13445-3:2014/A5:2018, EN 13445-3:2014/A6:2019, EN 13445-3:2014/A7:2019 and EN 13445-3:2014/A8:2019.

EN 13480-3:2017,[2] *Metallic industrial piping - Part 3: Design and calculation*

EN ISO 898-1:2013, *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 898-1:2013)*

EN ISO 898-2:2012, *Mechanical properties of fasteners made of carbon steel and alloy steel - Part 2: Nuts with specified property classes - Coarse thread and fine pitch thread (ISO 898-2:2012)*

EN ISO 3269:2019, *Fasteners - Acceptance inspection (ISO 3269:2019)*

EN ISO 3506-1:2020, *Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs with specified grades and property classes (ISO 3506-1:2020)*

EN ISO 3506-2:2020, *Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 2: Nuts with specified grades and property classes (ISO 3506-2:2020)*

EN ISO 4014:2011, *Hexagon head bolts - Product grades A and B (ISO 4014:2011)*

EN ISO 4017:2014, *Fasteners - Hexagon head screws - Product grades A and B (ISO 4017:2014)*

EN ISO 4032:2012, *Hexagon regular nuts (style 1) - Product grades A and B (ISO 4032:2012)*

EN ISO 4033:2012, *Hexagon high nuts (style 2) - Product grades A and B (ISO 4033:2012)*

EN ISO 4042:2018, *Fasteners - Electroplated coating systems (ISO 4042:2018)*

EN ISO 6892-2:2018, *Metallic materials - Tensile testing - Part 2: Method of test at elevated temperature (ISO 6892-2:2018)*

EN ISO 16228:2018, *Fasteners - Types of inspection documents (ISO 16228:2017)*

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

ISO 261:1998, *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

3.1 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 https://www.iso.org/obp

3.1.1
bolting
type of fastener such as a bolt, screw or stud with normal, reduced or waisted shank or nut

[2] As impacted by EN 13480-3/A1:2021, EN 13480-3/A2:2020 and EN 13480-3/A3:2020.

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

Note 1 to entry: Where a purchaser has responsibilities under the requirements of EU Directive listed in Annex ZA, the use of this European Standard, if its reference is published in the OJEU (Official Journal of European Union), will provide the presumption of conformity with the essential requirements of the Directive as 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 starting 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 to entry: 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 to entry: 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

3.1.6
starting material
material from which the bolt or nut is manufactured

3.1.7
creep range
the temperature range at which a material has time dependent mechanical properties

3.2 Symbols and units

The symbols and respective units used in this document 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 of the bolting	°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 consider in addition to the requirements covered by this document, the range of application of the equipment for which the bolting is intended to be used. The selection shall consider all service conditions including maximum/minimum allowable temperature, required bolt load, tightening method and resultant 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.

The minimum yield strength, tensile strength, and creep of the bolting shall be suitable for the required bolt load determined for the application and tightening method. Where there is a requirement concerning the strength category for bolting given in EN 1092-1:2018, Annex E, EN 1759-1:2004, Annex B, EN 13480-3:2017, Annex D[2], or EN 13445-3:2014, Clause 11[1], then this shall be observed by the user of this document.

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 4014:2011	EN ISO 4032:2012 EN ISO 4033:2012[a]	Hexagon head bolt
EN ISO 4017:2014	EN ISO 4032:2012 EN ISO 4033:2012[a]	Hexagon head bolt, threaded full length
Annex A	EN ISO 4032:2012 EN ISO 4033:2012[a]	Stud bolt, threaded full length

[a] The user shall determine whether EN ISO 4033:2012 Nuts are required for the application. 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 application ranges is shown in Table 3 and Table 4. Combination of bolting materials other than the combinations shown may reduce the given temperature limits.

All bolting materials shall conform to the requirements of the standard that specifies it and starting material shall fulfil all the requirements of EN 10269:2013. The heat treatment may be performed on the starting material or on the finished bolting.

Guidance on conditions to determine the permissible minimum temperature is defined in 6.2.

Table 3 — Selection of bolting materials combinations acc. to EN 10269:2013 with suitable application ranges

Line No	PN Class up to	Suitable temperature range °C	Type of bolting and description of material groups		Steel designation name Steel designation number Material standard	
			Bolts, screws, studs	Nuts	Bolts, screws, studs	Nuts
1	All	−10 to 400	0,25C-1Cr-Mo	Unalloyed steel elev. temp.	25CrMo4 1.7218 EN 10269:2013	C35E 1.1181 EN 10269:2013
2	All	−10 to 350	0,42C-1Cr-Mo	Unalloyed steel elev. temp.	42CrMo4 1.7225 EN 10269:2013	C45E 1.1191 EN 10269:2013
3	All	−60 to 500	0,25C-1Cr-Mo	0,25C-1Cr-Mo	25CrMo4[e] 1.7218 EN 10269:2013	25CrMo4 1.7218 EN 10269:2013
4	All	−40 to 500	0,25C-1Cr-Mo	0,42C-1Cr-Mo	25CrMo4[e] 1.7218 EN 10269:2013	42CrMo4 1.7225 EN 10269:2013
5	All	−40 to 500	0,42C-1Cr-Mo	0,42C-1Cr-Mo	42CrMo4 1.7225 EN 10269:2013	42CrMo4 1.7225 EN 10269:2013
6	All	−10 to 500	0,42C-1,3Cr-0,6Mo	0,42C-1Cr-Mo	42CrMo5−6[e] 1.7233 EN 10269:2013	42CrMo4 1.7225 EN 10269:2013
7	All	−10 to 500	0,40C-1Cr-0,6Mo-V	0,42C-1Cr-Mo	40CrMoV4−6[e] 1.7711 EN 10269:2013	42CrMo4 1.7225 EN 10269:2013
8	All[c]	−10 to 500	0,21C-1,3Cr-0,7Mo-V	0,21C-1,3Cr-0,7Mo-V	21CrMoV5−7[e] 1.7709 EN 10269:2013	21CrMoV5−7 1.7709 EN 10269:2013
9	All	−10 to 500	0,2C-1Cr-1Mo-V-Ti-B	0,2C-1Cr-1Mo-V-Ti-B	20CrMoVTiB4−10[e] 1.7729 EN 10269:2013	20CrMoVTiB4−10 1.7729 EN 10269:2013

Line No	PN Class up to	Suitable temperature range °C	Type of bolting and description of material groups		Steel designation name Steel designation number Material standard	
			Bolts, screws, studs	Nuts	Bolts, screws, studs	Nuts
10	All[b]	−60[f] to 650	25Ni-15Cr-0,2Ti-Mo-V-B	25Ni-15Cr-0,2Ti-Mo-V-B	X6NiCrTiMoVB[e] 25–15–2 1.4980 EN 10269:2013	X6NiCrTiMoVB 25–15–2 1.4980 EN 10269:2013
11	All[b]	−10 to 500	12Cr-1Mo-V	12Cr-1Mo-V	X22CrMoV12–1 QT2[e] 1.4923 EN 10269:2013	X22CrMoV12–1 QT2 1.4923 EN 10269:2013
12	All	−10 to 650	16Cr-16Ni-Mo-B-Nb	16Cr-16Ni-Mo-B-Nb	X7CrNiMoBNb16–16[e] 1.4986 EN 10269:2013	X7CrNiMoBNb16–16 1.4986 EN 10269:2013
13	PN 40[c] Cl. 300	−196 to 550	17Cr-12Ni-2Mo	17Cr-12Ni-2Mo	X5CrNiMo17–12–2 +AT 1.4401 EN 10269:2013	X5CrNiMo17–12–2 1.4401 EN 10269:2013
14	PN 100 Cl. 600	−196 to 200[a]	17Cr-12Ni-2Mo +AT+C	17Cr-12Ni-2Mo	X5CrNiMo17–12–2 +AT+C700 1.4401 EN 10269:2013	X5CrNiMo17–12–2 1.4401 EN 10269:2013
15	PN 40[c] Cl. 300	−196 to 550	18Cr-10Ni	18Cr-10Ni	X5CrNi18–10 +AT 1.4301 EN 10269:2013	X5CrNi18–10 1.4301 EN 10269:2013
16	PN 100 Cl. 600	−60[d] to 200[a]	18Cr-10Ni AT+C	18Cr-10Ni	X5CrNi18–10 +AT+C700 1.4301 EN 10269:2013	X5CrNi18–10 1.4301 EN 10269:2013

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

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

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

[d] −200 °C for studs or for bolts manufactured by machining from annealed rods or bars (AT) without work hardening except thread forming, if any.

[e] May be used in the creep range. For maximum suitable temperature see EN 10269:2013.

[f] When intended to be used down to −273 °C, for additional requirements see Table 7.