



# SLOVENSKI STANDARD

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Nadomešča:

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### Visokotrnostne strukturne vijačne zveze za prednapetje - 1. del: Splošne zahteve

High strength structural bolting assemblies for preloading - Part 1: General requirements

Hochfeste vorspannbare Garnituren für Schraubverbindungen im Metallbau - Teil 1:  
Allgemeine Anforderungen

Boulonnerie de construction métallique à haute résistance apte à la précontrainte - Partie  
1: Exigences générales

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English Version

**High-strength structural bolting assemblies for preloading - Part  
1: General requirements**

Boulonnerie de construction métallique à haute résistance  
apte à la précontrainte - Partie 1: Exigences générales

Hochfeste vorspannbare Garnituren für  
Schraubverbindungen im Metallbau - Teil 1: Allgemeine  
Anforderungen

This European Standard was approved by CEN on 22 August 2014.

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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

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# Contents

Page

Foreword.....	3
Introduction .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms and definitions .....	7
4 Product characteristics .....	8
4.1 General.....	8
4.2 Type (bolting assemblies).....	8
4.3 Property class (bolting assemblies) .....	9
4.4 Product grade (bolts, nuts, washers and, if provided, direct tension indicators) .....	10
4.5 <i>k</i> -class and <i>k</i> -factor (bolting assemblies).....	11
5 Testing and assessment methods .....	11
5.1 General.....	11
5.2 Type (bolting assemblies).....	12
5.3 Property class (bolting assemblies) .....	12
5.4 Product grade (bolts, nuts, washers and, if provided, direct tension indicators) .....	13
5.5 <i>k</i> -class and <i>k</i> -factor (bolting assemblies) .....	15
6 Assessment and Verification of Constancy of Performance (AVCP).....	15
6.1 General.....	15
6.2 Type testing.....	16
6.3 Factory production control (FPC).....	17
Annex ZA (informative) Clauses of this European Standard addressing the provisions of the EU Construction Products Regulation .....	23
ZA.1 Scope and relevant characteristics .....	23
ZA.2 Procedure for Assessment and Verification of Constancy of Performance (AVCP) of high- strength structural bolting assemblies for preloading.....	24
ZA.3 CE marking and labelling .....	28
Bibliography .....	30

## Foreword

This document (EN 14399-1:2015) has been prepared by Technical Committee CEN/TC 185 "Fasteners", 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 August 2015 and conflicting national standards shall be withdrawn at the latest by November 2016.

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 14399-1:2005.

In comparison with EN 14399-1:2005, the following modifications have been made:

- the standard was revised to meet the new format for harmonized standards and in relation to the Regulation (EU) No. 305/2011 (CPR);
- the requirements of this standard only relate to the product characteristics of bolting assemblies which are necessary for CE marking;
- all clauses dealing with further technical or other requirements have been transferred to EN 14399-2;
- the table containing the overview of the composition of bolting assemblies and component marking has been transferred to EN 14399-2.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports basic work requirements of Regulation (EU) No. 305/2011.

For relationship with Regulation (EU) No. 305/2011, see informative Annex ZA, which is an integral part of this document.

EN 14399 consists of the following parts, under the general title *High-strength structural bolting assemblies for preloading*:

- *Part 1: General requirements* (the present document);
- *Part 2: Suitability for preloading*;
- *Part 3: System HR — Hexagon bolt and nut assemblies*;
- *Part 4: System HV — Hexagon bolt and nut assemblies*;
- *Part 5: Plain washers*;
- *Part 6: Plain chamfered washers*;
- *Part 7: System HR — Countersunk head bolt and nut assemblies*;
- *Part 8: System HV — Hexagon fit bolt and nut assemblies*;
- *Part 9: System HR or HV — Direct tension indicators for bolt and nut assemblies*;
- *Part 10: System HRC — Bolt and nut assemblies with calibrated preload*.

**EN 14399-1:2015 (E)**

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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## Introduction

This document on structural bolting assemblies reflects the situation in Europe where two technical solutions exist to achieve the necessary ductility of bolting assemblies. These solutions utilize different bolting assemblies (system HR, HV and HRC). Both systems are well proven and it is the responsibility of the experts for structural connections whether they use the one or the other system.

It is however important for the performance of the bolting assembly to avoid mixing up the components of both systems. Therefore, the bolts and nuts for both systems are standardized in one single part of this European Standard each and the marking of the components of the same system is consistent.

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**EN 14399-1:2015 (E)****1 Scope**

This European Standard specifies the general requirements for bolt/nut/washer(s) assemblies for high-strength structural bolting, which are suitable for preloading.

The intended use of bolting assemblies in accordance with this European Standard is structural metallic works.

NOTE 1 High-strength structural bolting assemblies in accordance with EN 14399-2 to EN 14399-10 are designed to fulfil the requirements of this European Standard.

NOTE 2 High-strength structural bolting assemblies are suitable for preloading in accordance with EN 1090-2 in steel structures.

High-strength structural bolting assemblies smaller than M12 are not designed to be preloaded.

High-strength structural bolting assemblies are not designed to be welded.

Railway rail fasteners are not covered by this standard.

**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 1090-2:2008+A1:2011, *Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures*

EN 14399-2:2015, *High-strength structural bolting assemblies for preloading - Part 2: Suitability for preloading*

EN 14399-3:2015, *High-strength structural bolting assemblies for preloading - Part 3: System HR - Hexagon bolt and nut assemblies*

EN 14399-4:2015, *High-strength structural bolting assemblies for preloading - Part 4: System HV - Hexagon bolt and nut assemblies*

EN 14399-5, *High-strength structural bolting assemblies for preloading - Part 5: Plain washers*

EN 14399-6, *High-strength structural bolting assemblies for preloading - Part 6: Plain chamfered washers*

EN 14399-7:2007, *High-strength structural bolting assemblies for preloading - Part 7: System HR - Countersunk head bolt and nut assemblies*

EN 14399-8:2007, *High-strength structural bolting assemblies for preloading - Part 8: System HV - Hexagon fit bolt and nut assemblies*

EN 14399-9:2009, *High-strength structural bolting assemblies for preloading - Part 9: System HR or HV - Direct tension indicators for bolt and nut assemblies*

EN 14399-10:2009, *High-strength structural bolting assemblies for preloading - Part 10: System HRC - Bolt and nut assemblies with calibrated preload*

EN ISO 225, *Fasteners - Bolts, screws, studs and nuts - Symbols and descriptions of dimensions (ISO 225)*



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 4759-1, *Tolerances for fasteners - Part 1: Bolts, screws, studs and nuts - Product grades A, B and C (ISO 4759-1)*

EN ISO 4759-3, *Tolerances for fasteners - Part 3: Plain washers for bolts, screws and nuts - Products grades A and C (ISO 4759-3)*

EN ISO 6507-1, *Metallic materials - Vickers hardness test - Part 1: Test method (ISO 6507-1)*

EN ISO 6508-1, *Metallic materials - Rockwell hardness test - Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T) (ISO 6508-1)*

EN ISO 10684, *Fasteners - Hot dip galvanized coatings (ISO 10684)*

ISO 888, *Fasteners - Bolts, screws and studs - Nominal lengths and thread lengths*

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

ISO 965-5, *ISO general purpose metric screw threads - Tolerances - Part 5: Limits of sizes for internal screw threads to mate with hot-dip galvanized external screw threads with maximum size of tolerance position h before galvanizing*

### 3 Terms and definitions

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For the purposes of this document, the terms and definitions given in EN 1090-2:2008+A1:2011 and the following apply.

#### 3.1

##### **bolting assembly**

matching bolt, nut, washer(s) and if relevant, direct tension indicator and nut face washer or bolt face washer

#### 3.2

##### **single bolting assembly lot**

bolting assembly lot containing:

- bolts from a single manufacturing lot;
- nuts from a single manufacturing lot;
- washers from a single manufacturing lot;

and, if relevant:

- direct tension indicators from a single manufacturing lot;
- nut face washers from a single manufacturing lot;
- bolt face washers from a single manufacturing lot

## EN 14399-1:2015 (E)

## 3.3

**extended bolting assembly lot**

bolting assembly lot containing:

- the component with the main influence on the result of the suitability test from a single manufacturing lot;
- the complementary components from several manufacturing lots

Note 1 to entry: The component having the main influence (either nut or direct tension indicator) is determined on the basis of test results.

Note 2 to entry: An extended bolting assembly lot contains bolts, nuts and washers and, if relevant, direct tension indicators and nut face washers or bolt face washers.

## 3.4

**manufacturing lot (for bolting assemblies components)**

quantity of components of a single designation including product grade, property class, type, and size, 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, coating and/or lubrication process, if any

Note 1 to entry: Same process 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 a number of manufacturing batches for processing purposes and then re-assembled into the same manufacturing lot.

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4 **Product characteristics**

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4.1 **General**

The performance of the high-strength structural bolting assemblies depends on the type of the bolting assemblies and on properties of their specific components (bolts, nuts, washers, and direct tension indicators if provided). Therefore, the requirements specified in 4.2 to 4.5 are assessed through the verification of the properties of the involved components and/or bolting assemblies, as applicable.

4.2 **Type (bolting assemblies)**4.2.1 **General**

**Type** covers the axial load expected from design and margin against overtightening. The Type is relevant for the ability of the bolting assembly to be tightened by different tightening methods given in EN 1090-2 in order to provide the declared performances of the bolting assemblies.

There are two types of bolting assemblies:

- Type HR (systems HR with or without direct tension indicators, if provided, and HRC) designed to obtain ductility predominantly by plastic elongation of the bolt (minimum nut height  $\geq 0,9 D$  and thread length of the bolt according to ISO 888);
- Type HV (system HV with or without direct tension indicators, if provided) designed to obtain ductility predominantly by plastic deformation of the engaged threads (nut height at approximately  $0,8 D$  and bolt with short thread length).

#### 4.2.2 Angle to failure during tightening (bolting assemblies)

Bolting assemblies shall be assessed in accordance with 5.2.1. The results shall meet the requirements specified in EN 14399-3, EN 14399-4, EN 14399-7, EN 14399-8, EN 14399-9 or EN 14399-10 for the relevant type.

#### 4.2.3 Axial load (bolting assemblies)

Bolting assemblies shall be assessed in accordance with 5.2.2. The results for the axial load during tightening ( $F_{bi \max}$ ) shall meet the requirements specified in EN 14399-3, EN 14399-4, EN 14399-7, EN 14399-8 or EN 14399-10 for the relevant Type.

#### 4.2.4 Compression load (bolting assemblies with direct tension indicators)

Bolting assemblies shall be assessed in accordance with 5.2.3. The results for compression load of bolting assemblies with direct tension indicators shall meet the requirements specified in EN 14399-9.

#### 4.2.5 Calibrated preload (bolting assemblies with calibrated preload)

Bolting assemblies shall be assessed in accordance with 5.2.4. The results for calibrated preload ( $F_n$ ) shall meet the requirements specified in EN 14399-10.

### 4.3 Property class (bolting assemblies)

#### 4.3.1 General

Property class expresses in a concise way a set of mechanical characteristics of the components. It is relevant for the ability of components to be matched together in order to obtain the declared performances of the bolting assemblies.

#### 4.3.2 Elongation (bolts)

Bolts shall be assessed in accordance with 5.3.2. The results for elongation shall meet the requirements specified in EN 14399-3, EN 14399-4, EN 14399-7, EN 14399-8 or EN 14399-10 for the relevant property class.

#### 4.3.3 Tensile strength (bolts)

Bolts shall be assessed in accordance with 5.3.3. The results for tensile strength shall meet the requirements specified in EN 14399-3, EN 14399-4, EN 14399-7, EN 14399-8 or EN 14399-10 for the relevant property class.

#### 4.3.4 Strength under wedge loading (bolts)

Bolts shall be assessed in accordance with 5.3.4. The results for strength under wedge loading shall meet the requirements specified in EN 14399-3, EN 14399-4, EN 14399-7, EN 14399-8 or EN 14399-10 for the relevant property class.

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**EN 14399-1:2015 (E)****4.3.5 Tensile yield strength (bolts)**

Bolts shall be assessed in accordance with 5.3.5. The results for the tensile yield strength shall meet the requirements specified in EN 14399-3, EN 14399-4, EN 14399-7, EN 14399-8 or EN 14399-10 for the relevant property class.

**4.3.6 Proof load (nuts and bolts)**

Bolts and nuts shall be assessed in accordance with 5.3.6. The results for proof load shall meet the requirements specified in EN 14399-3, EN 14399-4, EN 14399-7, EN 14399-8 or EN 14399-10 for the relevant property class.

**4.3.7 Impact strength (bolts)**

Bolts shall be assessed in accordance with 5.3.7. The results for impact strength shall meet the requirements specified in EN 14399-3, EN 14399-4, EN 14399-7, EN 14399-8 or EN 14399-10 for the relevant property class.

**4.3.8 Hardness (bolts, nuts, washers and, if provided, direct tension indicators)**

Bolts, nuts, washers and direct tension indicators if provided, shall be assessed in accordance with 5.3.8.

For bolts and nuts, the results shall meet the requirements specified in EN 14399-3, EN 14399-4, EN 14399-7, EN 14399-8 or EN 14399-10 for the relevant property class.

For plain washers and plain chamfered washers, the results shall meet the requirements specified in EN 14399-5 or EN 14399-6.

For nut face washers, bolt face washers and direct tension indicators the results shall meet the requirements specified in EN 14399-9.

**4.3.9 Compression load (direct tension indicators)**

Direct tension indicators shall be assessed in accordance with 5.3.9. The results for the compression load of direct tension indicators shall meet the requirements specified in EN 14399-9 for the relevant property designation.

**4.4 Product grade (bolts, nuts, washers and, if provided, direct tension indicators)****4.4.1 General**

Product grade covers tolerances on dimensions and shape for bolts, nuts and washers. Product grade covers three critical features for direct tension indicators. It is relevant for the ability of components to be matched together in order to provide the declared performances of the bolting assemblies.

**4.4.2 Bolts and nuts**

Bolts and nuts shall be assessed in accordance with 5.4.2.

The thread tolerance classes shall be:

- 6g in accordance with ISO 965-2 for bolts without coating;
- 6g in accordance with ISO 965-2 for bolts before coating;