

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

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 14399-10:2009 sisaldab Euroopa standardi EN 14399-10:2009 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 30.04.2009 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 18.03.2009.

Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-EN 14399-10:2009 consists of the English text of the European standard EN 14399-10:2009.

This standard is ratified with the order of Estonian Centre for Standardisation dated 30.04.2009 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

Date of Availability of the European standard text 18.03.2009.

The standard is available from Estonian standardisation organisation.

ICS 21.060.01

**Võtmesõnad:**

### Standardite reprodutseerimis- ja levitamisoigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonilisse süsteemi või edastamine ükskõik millises vormis või millisel teel on keelatud ilma Eesti Standardikeskuse poolt antud kirjaliku loata.

Kui Teil on küsimusi standardite autorikaitse kohta, palun võtke ühendust Eesti Standardikeskusega:  
Aru 10 Tallinn 10317 Eesti; [www.evs.ee](http://www.evs.ee); Telefon: 605 5050; E-post: [info@evs.ee](mailto:info@evs.ee)

ICS 21.060.01

English Version

High-strength structural bolting assemblies for preloading - Part  
10: System HRC - Bolt and nut assemblies with calibrated  
preload

Boulonnerie de construction métallique à haute résistance  
apte à la précontrainte - Partie 10: Système HRC - Boulons  
(vis + écrou + rondelle) à précontrainte calibrée

Hochfeste planmäßig vorspannbare  
Schraubenverbindungen für den Metallbau - Teil 10:  
System HRC - Garnituren aus Schrauben und Muttern mit  
kalibrierter Vorspannung

This European Standard was approved by CEN on 24 January 2009.

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 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 Management Centre has the same status as the official versions.

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  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

## Contents

Page

Foreword.....	4
Introduction .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms and definitions .....	7
4 Bolts .....	7
4.1 Dimensions of bolts .....	7
4.2 Specification for bolts and reference standards .....	12
4.3 Marking of bolts .....	12
5 Nuts .....	13
5.1 Dimensions of nuts.....	13
5.2 Specification for nuts and reference standards .....	15
5.3 Proof load values of nuts .....	15
5.4 Decarburization of the nut thread .....	16
5.5 Marking of nuts .....	16
6 Designation of the bolt/nut assembly.....	17
7 Associated washers .....	17
8 Functional characteristics of the bolt/nut/washer assembly .....	18
8.1 General.....	18
8.2 Suitability test for preloading .....	18
8.3 Suitability test for calibrated preload .....	18
8.4 Requirements .....	19
Bibliography .....	21

## Figures

Figure 1 — Bolt HRC with hexagon head .....	8
Figure 2 — Bolt HRC with cup head .....	9
Figure 3 — Examples for bolt marking .....	13
Figure 4 — Dimension of the nut .....	14
Figure 5 — Examples for nut marking .....	17

## Tables

Table 1 — Dimensions of hexagon bolts <sup>a</sup> .....	9
Table 2 — Dimensions of cup head bolts <sup>a b</sup> .....	11
Table 3 — Dimensions of spline-end <sup>a</sup> .....	11
Table 4 — Specifications for bolts and reference standards.....	12
Table 5 — Dimensions of nuts according to EN 14399-3:2005 (HR) <sup>a</sup> .....	14
Table 6 — Dimensions of nuts with height $m = 1 d$ (HRD) <sup>a</sup> .....	15
Table 7 — Specifications for nuts and reference standards.....	15
Table 8 — Proof load values of nuts .....	16
Table 9 — Limiting values of bolt force at the fracture of the spline-end .....	20

## Foreword

This document (EN 14399-10:2009) 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 September 2009, and conflicting national standards shall be withdrawn at the latest by September 2011.

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.

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

- *Part 1: General requirements*
- *Part 2: Suitability test 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*

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.

## Introduction

This part of this European Standard completes the series of European standards EN 14399 parts 1 to 10 which specify high-strength structural bolting for preloading; it belongs to the system HR. The specificity of bolt and nut assemblies with a calibrated preload, compared with the system HR as defined in EN 14399-3, is the preload in the bolt which is controlled during tightening by the fracture of the spline-end of the bolt under torsional stress, this fracture occurring for a precise predetermined stress.

Preloaded bolted assemblies are very sensitive to differences in manufacture and lubrication. Therefore it is important that the assembly is supplied by one manufacturer who is always responsible for the function of the assembly.

For the same reason it is important that the coating of the assembly is under the control of the manufacturer.

Besides the mechanical properties of the components, the functionality of the assembly requires that the specified preload can be achieved when the fracture of the break neck at the spline-end of the bolt occurs under the predetermined torsional stress when the assembly is tightened with the appropriate procedure. For this purpose a test method for the suitability of the components for preloading was created which will demonstrate whether the function of the assembly is fulfilled.

It should be pointed out that, compared to ISO 272, the widths across flats (large series) for M12 and M20 have been changed to 22 mm and 32 mm respectively. These changes are justified by the following reasons:

- under the specific conditions of structural bolting the compressive stresses under the bolt head or nut for the sizes M12 may become too large with the width across flats of 21 mm, especially if the washer is fitted eccentrically to the bolt axis;
- for the size M20 the width across flats of 34 mm is very difficult to be produced; the change to 32 mm is primarily motivated by economics but it should also be pointed out that the width across flats of 32 mm is already common practice in Europe.

## 1 Scope

This part of this European Standard specifies, together with EN 14399-1, the requirements for assemblies of high-strength structural bolts and nuts of system HRC suitable for preloaded joints, with hexagon head (large widths across flats) or cup head, thread sizes M12 to M30 and property class 10.9/10.

Bolt and nut assemblies conforming to this part of this European Standard have been designed to allow preloading of at least  $0,7 f_{ub} \times A_s$ <sup>1)</sup> according to EN 1993-1-8:2005 (*Eurocode 3*) and to obtain ductility predominantly by plastic elongation of the bolt. For this purpose the components have the following characteristics:

- nut according to EN 14399-3, or
- nut with height  $m = 1 d$ ,
- thread length of the bolt according to ISO 888.

Bolt and nut assemblies conforming to this part of this European Standard include washer(s) according to EN 14399-6 or to EN 14399-5 (under the nut only).

NOTE Attention is drawn to the importance of ensuring that the bolts are correctly used if a satisfactory result is to be obtained.

The test method for suitability for preloading is specified in EN 14399-2 and in Clause 8.

## 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 10045-1, *Metallic materials – Charpy impact test – Part 1: Test method*

EN 14399-1, *High-strength structural bolting assemblies for preloading – Part 1: General requirements*

EN 14399-2:2005, *High-strength structural bolting assemblies for preloading – Part 2: Suitability test for preloading*

EN 14399-3:2005, *High-strength structural bolting assemblies for preloading – Part 3: System HR – 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 20898-2, *Mechanical properties of fasteners – Part 2: Nuts with specified proof load values – Coarse thread (ISO 898-2:1992)*

EN 26157-1, *Fasteners – Surface discontinuities – Part 1: Bolts, screws and studs for general requirements (ISO 6157-1:1988)*

EN ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs (ISO 898-1:1999)*

---

1)  $f_{ub}$  is the nominal tensile strength ( $R_m$ ) and  $A_s$  the stress area of the bolt.

EN ISO 3269, *Fasteners – Acceptance inspection (ISO 3269:2000)*

EN ISO 4759-1, *Tolerances for fasteners – Part 1: Bolts, screws, studs and nuts – Product grades A, B and C (ISO 4759-1:2000)*

EN ISO 6157-2, *Fasteners – Surface discontinuities – Part 2: Nuts (ISO 6157-2:1995)*

EN ISO 10684, *Fasteners – Hot dip galvanized coatings (ISO 10684:2004)*

ISO 148-1, *Metallic materials – Charpy pendulum impact test – Part 1: Test method*

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

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*