

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

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

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English Version

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

Boulonnerie de construction métallique à haute
résistance apte à la précontrainte - Partie 9 : Système
HR ou HV - Boulons avec rondelles indicatrices de
précontrainte

Hochfeste vorspannbare Garnituren für
Schraubverbindungen im Metallbau - Teil 9: System HR
oder HV - Direkte Kraftanzeiger für Garnituren aus
Schrauben und Muttern

This European Standard was approved by CEN on 22 October 2017.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 14399-9:2018) has been prepared by Technical Committee CEN/TC 185 "Fasteners", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by November 2018 and conflicting national standards shall be withdrawn at the latest by November 2018.

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 14399-9:2009.

In comparison with EN 14399-9:2009, the following modifications have been made:

- Table 1 containing the overview of the composition of bolting assemblies and component marking has been revised;
- the test method for measuring compression loads on direct tension indicators has been revised;
- the suitability test for bolting assemblies including direct tension indicators has been revised;
- Informative Annex A has been deleted;
- Informative Annex on the use of direct tension indicators has been added.

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 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, 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document is part of the EN 14399 series which specify high-strength structural bolting for preloading; this part belongs to both types, HR and HV. Direct tension indicators (known formerly as load indicating washers) used in conjunction with nut face washers (HN) and bolt face washers (HB) are load indicating devices which are placed under the bolt head or under the nut. The direct tension indicators have protrusions on one face which compress under load and thus may be used to indicate that at least the required preload has been achieved in the bolting assembly.

Direct tension indicators are only to be sold as components of structural bolting assemblies comprised of bolts, nuts and associated washers that otherwise complies with EN 14399-3, EN 14399-4, EN 14399-7 or EN 14399-8. The composition of bolt/nut/washer/direct tension indicator assemblies is shown in Table 1.

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

For the same reason it is important that the coating of the bolting assemblies is under the control of one manufacturer.

Beside the mechanical properties of the components, the functionality of the bolting assemblies requires that the specified preload can be achieved when the gap remaining after tightening (compressed protrusions) is less than the specified values in this standard, if the assembly is tightened with a suitable procedure. For this purpose the test method given in this standard was developed, which demonstrates whether the functionality of the bolting assemblies is fulfilled.

Table 1 — Composition of high-strength structural bolting assemblies and component marking

Type of bolting assembly	System HR				System HV		System HRC		
General requirements	EN 14399-1								
Suitability for preloading	EN 14399-2 and, if any, additional testing specified in the product standard								
Bolt and nut	EN 14399-3		EN 14399-7		EN 14399-4	EN 14399-8	EN 14399-10		
Marking	Bolt	HR8.8	HR10.9	HR8.8	HR10.9	HVP10.9	HRC10.9		
	Nut	HR8 or HR10	HR10	HR8 or HR10	HR10	HV10	HRD10		
Washer(s)	EN 14399-5 ^a or EN 14399-6			EN 14399-6		EN 14399-5 ^a or EN 14399-6			
Marking	H or HR ^b			H or HV ^b		H or HR ^b	H or HR ^b or HD ^c		
Direct tension indicator and nut face washer or bolt face washer, if any	EN 14399-9			Not applicable					
Marking	Direct tension indicator	H8	H10					H8	H10
	Nut face washer	HN						HN	
	bolt face washer	HB	Not applicable					HB	
^a EN 14399-5 can only be used under the nut. ^b At the choice of the manufacturer. ^c Mandatory mark for washers with enlarged outer diameter according to EN 14399-5 only.									

1 Scope

This document specifies, together with EN 14399-1 and EN 14399-2, the requirements for direct tension indicators, nut face washers (HN) and bolt face washers (HB) as part of high-strength structural bolting assemblies suitable for preloaded joints.

These direct tension indicators are specified as part of high-strength structural bolting assemblies of system HR or HV in accordance with EN 14399-3, EN 14399-4, EN 14399-7 or EN 14399-8, with nominal thread sizes M12 up to and including M36 and property classes 8.8/8 or 8.8/10 and 10.9/10.

It specifies two property designations H8 and H10 for direct tension indicators, together with general dimensions, tolerances, materials and functional property/ies.

Bolting assemblies in accordance with this document have been designed to allow preloading of at least $0,7 f_{ub} \times A_s^{1)}$ according to EN 1993-1-8 (*Eurocode 3*) and to obtain ductility predominantly by plastic elongation of the bolt for system HR in accordance with EN 14399-3 or EN 14399-7, or by plastic deformation of the engaged threads for system HV in accordance with EN 14399-4 or EN 14399-8.

Bolting assemblies conforming to this document may include washer(s) according to EN 14399-6 or to EN 14399-5 (under the nut only).

NOTE 1 Attention is drawn to the importance of ensuring that the bolting assemblies are correctly used if satisfactory results are to be obtained. For recommendations concerning proper application, reference to EN 1090-2 is made.

General requirements and requirements for suitability for preloading are specified in EN 14399-2 together with Clause 5 of this document.

NOTE 2 Direct tension indicators are also known as load indicating washers.

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 ISO 17668, *Zinc diffusion coatings on ferrous products — Sherardizing — Specification (ISO 17668)*

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

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

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

EN 14399-4, *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*

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

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

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

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

EN ISO 4759-3, *Tolerances for fasteners — Part 3: Washers for bolts, screws and nuts — Product grades A, C and F (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 (ISO 6508-1)*

EN ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system (ISO 7500-1)*

3 Direct tension indicators

3.1 General

The purpose of direct tension indicators is to show that a defined preload is achieved in the bolting assemblies. The direct tension indicator shall be used as specified in 5.1, with or without nut face washers (HN), and with or without bolt face washers (HB). The direct tension indicators shall be qualified as components of bolting assemblies, in accordance with EN 14399-1.

To comply with EN 14399-2 the bolting assemblies shall be supplied by one manufacturer, and shall include bolts, nuts, washers and direct tension indicators. Bolting assemblies may also include nut face washers (HN) and/or bolt face washers (HB), if required.

3.2 Dimensions

Before installation, the dimensions and tolerances of direct tension indicators shall be as specified in Table 2 and Figure 1. The size and number of protrusions on the direct tension indicator shall be sufficient to meet the requirements of 3.4 and their number shall be not less than four. The protrusions on the direct tension indicator shall be spaced at equal angular intervals. The shape of the protrusions is at the choice of the manufacturer.