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

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NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 14399-9:2009 sisaldab Euroopa standardi EN 14399-9:2009 ingliskeelset teksti.	This Estonian standard EVS-EN 14399-9:2009 consists of the English text of the European standard EN 14399-9:2009.
Standard on kinnitatud Eesti Standardikeskuse 30.04.2009 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.	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.
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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 - Rondelles indicatrices de précontrainte pour les boulons

Hochfeste planmäßig vorspannbare Schraubenverbindungen für den Metallbau - Teil 9: System HR oder HV - Direkte Kraftanzeiger für Garnituren aus Schrauben und Muttern

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.

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Foreword

This document (EN 14399-9:2009) 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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2011.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 document is part of EN 14399 parts 1 to 10 which specify high-strength structural bolting for preloading; this part belongs to both systems, HR and HV. Direct tension indicators (known formerly as load indicating washers) used in conjunction with bolt and nut face washers are a load indicating device 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 the magnitude of the preload in the assembly.

Direct tension indicators are only to be sold as part of a complete assembly that comprises bolts and nuts and that otherwise complies with EN 14399-3, -4, -7 or -8. The systems of bolt/nut/washer assemblies are described in Table 1.

Table 1 — Systems of bolt/nut/washer assemblies

	Bolt/nut/washer assembly System HR		**Bolt/nut/washer assembly System HV**
General requirements	EN 14399-1		
Bolt/nut assembly	EN 14399-3 or EN 14399-7		EN 14399-4 or EN 14399-8
Marking	HR		HV
Property classes	8.8/8 or 8.8/10	10.9/10	10.9/10
Washers	EN 14399-5 or EN 14399-6		EN 14399-5 or EN 14399-6
Marking	H		H
Direct tension indicator	EN 14399-9		
Marking	H8	H10	H10
Bolt/nut face washer	EN 14399-9		
Marking	HB/HN		HB/HN
Suitability test for preloading	EN 14399-2		EN 14399-2

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 hot dip galvanizing or other surface coatings of the assembly are under the control of one manufacturer.

Beside the mechanical properties of the components, the functionality of the assembly requires that the specified preload can be achieved when the average gap remaining after tightening (compressed protrusions) is less than the specified values in this standard, if the assembly is tightened with a suitable procedure. The test method given in this standard has been developed to demonstrate the suitability of the components for preloading.

1 Scope

This document specifies, together with EN 14399-1, the requirements for assemblies of high-strength structural bolts and nuts, with large width across flats, of system HR or HV, including the requirements for the general dimensions, tolerances, materials and performance for two grades, H8 and H10, of compressible washer-type direct tension indicators, nut face washers and bolt face washers suitable for preloaded joints. The assemblies include the nominal thread sizes M12 up to and including M36 and property classes 8.8/8, 8.8/10 and 10.9/10.

Bolt and nut assemblies to this document have been designed to allow preloading of at least 0,7 f_{ub} × A_s [1)] according to EN 1993-1-8:2005 (*Eurocode 3*) and to obtain ductility predominantly by plastic elongation of the bolt for system HR according to EN 14399-3 or by plastic deformation of the engaged threads for system HV according to EN 14399-4; also countersunk and fit bolts according to EN 14399-7 and -8 respectively.

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

The purpose of the direct tension indicators is to show that a defined preload is achieved in the bolt. The direct tension indicator can be used alone or with bolt face washers or nut face washers conforming to this standard. In either case it is essential that the direct tension indicators are used as part of an assembly in accordance with EN 14399-1.

To comply with EN 14399-1, it is essential that the assemblies are supplied by one manufacturer and include bolts, nuts, washers and direct tension indicators.

NOTE 1 Attention is drawn to the importance of ensuring that the assemblies are correctly used if satisfactory results are to be obtained.

The test method for suitability for preloading is specified in EN 14399-2 and supplemented by Clause 5.

Guidance on the use of compressible washer-type direct tension indicators is given in EN 1090-2.

NOTE 2 Compressible washer-type direct tension indicators are also known as load indicating washers.

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 13811, *Sherardizing – Zinc diffusion coatings on ferrous products – Specification*

EN 14399-1:2005, *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, *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*

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

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, *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: Plain washers for bolts, screws and nuts – Product grades A and C (ISO 4759-3:2000)*

EN ISO 6507-1, *Metallic materials – Vickers hardness test – Part 1: Test method (ISO 6507-1:2005)*

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 6508-1:2005)*

EN ISO 7500-1, *Metallic materials – Verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

3 Direct tension indicators

3.1 Dimensions

Before installation, the dimensions and tolerances of compressible washer-type direct tension indicators shall be as given in Table 2 and Figure 1. The size and number of protrusions on the direct tension indicator shall be sufficient to meet the performance requirements of 3.3 and their number shall be not less than four. The protrusions on a direct tension indicator shall be spaced at equal angular intervals. The shape of the protrusions is at the discretion of the manufacturer.