



SLOVENSKI STANDARD

SIST EN 14399-1:2005

01-maj-2005

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

Hochfeste planmäßig vorspannbare Schraubenverbindungen für den Metallbau - Teil 1:
Allgemeine Anforderungen

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

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EUROPEAN STANDARD
NORME EUROPÉENNE
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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

Garnituren für hochfeste planmäßig vorspannbare
Schraubenverbindungen für den Metallbau - Teil 1:
Allgemeine Anforderungen

This European Standard was approved by CEN on 3 February 2005.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

This document (EN 14399-1:2005) has been prepared by Technical Committee CEN/TC 185, "Threaded and non-threaded mechanical fasteners and accessories", 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of an identical text or by endorsement, at the latest by September 2005, and conflicting national standards shall be withdrawn at the latest by September 2005.

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 EC Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This document includes a Bibliography

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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EN 14399-1:2005 (E)

Introduction

This document on structural bolting reflects the situation in Europe where two technical solutions exist to achieve the necessary ductility of bolt/nut/washer assemblies. These solutions utilize different systems (HR and HV) of bolt/nut/washer assemblies, see Table 1. Both systems are well proved and it is up to the experts responsible for structural bolting whether they use the one or the other system.

It is, however, important for the performance of the 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 uniform.

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		EN 14399-4
Marking	HR		HV
Property classes	8.8/8	10.9/10	10.9/10
Washer(s)	EN 14399-5 or EN 14399-6		EN 14399-5 or EN 14399-6
Marking	H		H
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 coating of the assembly is 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 if the assembly is tightened with a suitable 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.

For the time being, the product standards EN 14399-3 to EN 14399-6 are the only European Standards which have regard to the general requirements of EN 14399-1. However, further product standards on

- fit bolts,
- countersunk head bolts, and
- load indicating washers

for the use in high strength structural bolting for preloading are under preparation.

1 Scope

This document specifies the general requirements for the components of bolt/nut/washer(s) assemblies for high-strength structural bolting, which are suitable for preloading, and for the assemblies themselves.

Examples for components which fulfil the requirements of this document are specified in EN 14399-3, EN 14399-4, EN 14399-5 and EN 14399-6.

NOTE For clauses of this document addressing the provisions of the EU Construction Products Directive, see Annex ZA.

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.

ENV 1090-1:1996, *Execution of steel structures — Part 1: General rules and rules for buildings*.

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*.

EN 10204, *Metallic products — Types of inspection documents*.

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

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

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

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

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

EN 20225, *Fasteners — Bolts, screws, studs and nuts — Symbols and designation of dimensions (ISO 225:1983)*.

EN 20898-2, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread (ISO 898-2:1992)*.

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)*.

EN ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method (ISO 6507-1:1997)*.

EN ISO 9001, *Quality management systems — Requirements (ISO 9001:2000)*.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in *Guide to the Implementation of Directives Based on the New Approach and Global Approach* and ENV 1090-1:1996 and the following apply.

3.1

assembly

comprises matching bolt, nut and necessary washer(s)

EN 14399-1:2005 (E)**3.2
manufacturing lot**

quantity of fasteners of a single designation including product grade, property class and size¹⁾, 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 process, if any

NOTE 1 Same heat treatment or coating 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 The manufacturing lot may be split into a number of manufacturing batches for processing purposes and then reassembled into the same manufacturing lot.

NOTE 3 Adapted from ISO 15330.

**3.3
assembly lot**

assemblies supplied together as a set comprising:

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

**3.4
extended assembly lot**

manufacturing lot of that component that mainly influences the result of the suitability test combined with the other components from the same supplier chosen by a documented method

NOTE The component with the main influence is determined on the basis of test results.

4 Requirements**4.1 Ordering information**

At the time of order the manufacturer shall obtain the following information:

- a) the quantities to be delivered,
- b) the product designation,
- c) the *k*-class according to 4.4.4; if no *k*-class is specified, *k*-class K0 applies,
- d) Others requirements as agreed between the supplier and purchaser (for example: low temperature requirements), in so far they do not conflict with regulatory requirements.

4.2 Manufacturing process**4.2.1 Dangerous substances**

Materials used in products shall not release any dangerous substances in excess of the maximum permitted levels specified in a relevant European Standard for the material or permitted in the national regulations of the member state of destination.

1) Size of a bolt means thread diameter and length.

4.2.2 Nuts

Hot dip galvanized nuts shall be galvanized before they are threaded. Nuts shall not be re-threaded.

4.2.3 Bolts

The manufacturing process for bolts of property class 10.9 shall take due care of the risk of hydrogen embrittlement, especially during the coating process. Appropriate additional process should be considered when the risk of hydrogen embrittlement cannot be avoided.

Bolts of property class 10.9 shall have rolled threads.

4.2.4 Finish and coating

Finish and coating shall be as specified in the relevant part of this document.

Coatings of all components of an assembly shall be compatible and shall have similar corrosion resistance.

Hot dip galvanizing of each component shall be under the control of the manufacturer of the assemblies.

4.3 Delivery conditions

All fasteners shall be supplied to the purchaser either in the original unopened, single sealed container or alternatively in separate sealed containers of the manufacturer of the assemblies.

The suitability for preloading of the elements in an assembly supplied to the purchaser shall be assured by the suitability test in accordance with EN 14399-2. The manufacturer of the assembly shall specify the suitable methods for tightening in accordance with ENV 1090-1.

Assemblies shall be supplied in one of the following alternatives:

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- a) Bolts, nuts and washers supplied by one manufacturer. The elements of an assembly are packed together in one package that is labelled with an assembly lot number and the manufacturer's identification. The suitability test is to be performed on each assembly lot by use of representative sample testing as specified in Table 15.
- b) Bolts, nuts and washers supplied by one manufacturer. Each element is packed in separate packages that are labelled with the manufacturing lot number of the components and the manufacturer's identification. The elements in an assembly are freely interchangeable within the deliveries of one nominal thread diameter. The suitability test is to be performed on each extended assembly lot by use of representative sample testing as specified in Table 15.

4.4 Product requirements

4.4.1 General

The following requirements apply for evaluation of conformity as specified in Clause 6.

4.4.2 Dimensions and tolerances on dimensions, form and position

The under head radius of bolts as specified in EN 14399-3 and in EN 14399-4 shall be used for any bolts of property class 10.9 in order to reduce the risk of hydrogen embrittlement.

Tolerances on dimensions, form and position shall be in accordance with the requirements given in the order by reference to the relevant parts of this European Standard. They apply to the components before coating.

The thread tolerances shall be

- 6g for bolts;
- 6H for nuts without coating;
- 6AZ for nuts with hot dip galvanized coating.

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4.4.3 Mechanical properties of the components of assembly

The mechanical properties of the components of the assembly shall comply with the standards shown in Tables 2 to 4.

The property class of bolts shall be 8.8 or 10.9 in accordance with EN ISO 898-1.

The property class of nuts shall be 8 or 10 in accordance with EN 20898-2.

Table 2 — Bolts

Mechanical characteristic	Standard
Percent elongation after fracture	EN ISO 898-1
Minimum tensile strength	EN ISO 898-1
Stress at 0,2 % non-proportional elongation	EN ISO 898-1
Stress under proof load	EN ISO 898-1
Strength under wedge loading	EN ISO 898-1
Hardness	EN ISO 898-1
Impact strength	EN 14399-3 and EN 14399-4

Table 3 — Nuts

Mechanical characteristic	Standard
Stress under proof load	EN 14399-3 for system HR and EN 20898-2 for system HV
Hardness	EN 14399-3 for system HR and EN 20898-2 for system HV

Table 4 — Washers

Mechanical characteristic	Standard
Hardness	EN 14399-5 and EN 14399-6

4.4.4 Functional characteristics of the assembly

The functional characteristics of the assemblies shall comply with the relevant requirements in accordance with EN 14399-3 (system HR) and EN 14399-4 (system HV), see Table 5.

Table 5 — Assemblies

Functional characteristics	Standard
Suitability for preloading ($F_{bi \max}^a$, $\Delta\theta_2^b$, k -class)	EN 14399-3 or EN 14399-4
<p>^a Maximum individual value of the bolt force during tightening test in accordance with EN 14399-2.</p> <p>^b Angle by which the nut (or bolt) has to be turned starting from a preload of $0,7 f_{ub} \times A_s$ until the individual value of the bolt force has dropped again to $0,7 f_{ub} \times A_s$.</p>	

Concerning the k -factor, assemblies can be delivered according to one of the k -classes as specified in Table 6. The values of the characteristics k_i , k_m and V_k shall be as specified in the relevant product standards or as agreed. Assemblies according to k -class K2 shall be supplied only according alternative a) of 4.3.

Table 6 — k -classes

k -class	Information to be supplied
K0	No requirements for k -factor
K1	Range of individual test value k_i
K2	Mean test value k_m Coefficient of variation of k -factor V_k

4.4.5 Marking

All components used in assemblies for high strength structural bolting, which are suitable for preloading, shall be marked with the identification mark of the manufacturer of the assemblies and with the letter H.

Additional letters defining the system (e.g. R for HR or V for HV) shall be added to H for bolts and nuts.

All components of an assembly shall be marked with the same identification mark.

4.5 Durability

Finish and coating of assemblies shall be in accordance with 4.2.4.

A surface coating shall be used to enhance the inherent durability of assemblies against corrosion, if required. This durability shall be achieved either by applying a specified coating, or as part of the durability of the structure in which the assemblies are used.

NOTE 1 For durability of structures against corrosion, protective coatings and method application, ENV 1090-1:1996, Clause 10, refers to the relevant part of EN ISO 12944.

The mechanical durability of assemblies is assured for a reasonable economic working life if the assembly complies with the requirements of this document and is used in accordance with the manufacturer's specification for tightening.

NOTE 2 Tightening methods are given in ENV 1090-1.

5 Testing for conformity evaluation

5.1 Testing for dangerous substances

Release of dangerous substances may be assessed indirectly by controlling the content of the substances in the materials used.

5.2 Testing of dimensional requirements of the components

The tolerances of critical dimensions of the components shall be checked by standard gauges or measuring equipment of the required accuracy as given in the Tables 7 to 9.