BRITISH STANDARD

BS EN
14399-1:2005

High-strength structural bolting assemblies for preloading —

Part 1: General requirements

The European Standard EN 14399-1:2005 has the status of a British Standard

ICS 21.060.01

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 14399-1:2005.

EN 14339-1:2005 is a candidate "harmonized" European Standard and fully takes into account the requirements of the European Commission mandate M/120, *Structural metallic products and ancillaries*, given under the EU Construction Products Directive (89/106/EEC), and is intended to lead to CE marking. The date of applicability of EN 14399-1:2005 as a harmonized European Standard, i.e. the date after which this standard may be used for CE marking purposes, is subject to an announcement in the *Official Journal of the European Communities*.

The Commission in consultation with Member States has agreed a transition period for the co-existence of harmonized European Standards and their corresponding national standard(s). It is intended that this period will comprise a period, usually nine months, after the date of availability of the European Standard, during which any required changes to national regulations are to be made, followed by a further period, usually of 12 months, for the implementation of CE marking. In this instance an application has been made to CEN for a two-year extended co-existence period, from September 2005 to September 2007[1)]. At the end of the co-existence period, the national standard(s) will be declared obsolescent, and will be withdrawn on publication of Eurocode 3.

EN 14399-1:2005 is the subject of transitional arrangements agreed under the Commission mandate. In the UK, the corresponding national standards are:

— BS 4395-1:1969, *Specification for high strength friction grip bolts and associated nuts and washers for structural engineering — Part 1: General grade*;

— BS 4395-2:1969, *Specification for high strength friction grip bolts and associated nuts and washers for structural engineering — Part 2: Higher grade bolts and nuts and general trade washers*[2)];

and based on the applied-for transition period, it is planned that BS 4395-1:1969 and BS 4395-2:1969 will be declared obsolescent in September 2007[1)], and then, together with BS 449 and BS 5950, will be withdrawn upon publication of Eurocode 3.
BS 4395-1:1969 and BS 4395-2:1969 currently support BS 449 and BS 5950.

NOTE This date is approximate. Users of this standard should contact BSI Customer Services for confirmation of withdrawal.

1) CEN/TC 185/WG 6 has applied for a two-year extended co-existence period, to "September 2007", and for a corrigendum to amend the second "September 2005" date in the Foreword to EN 14399-1:2005 to "September 2007".

2) Together with BS EN 14399-2:2005, BS EN 14399-3:2005, BS EN 14399-4:2005, BS EN 14399-5:2005 and BS EN 14399-6:2005, BS EN 14399-1:2005 supersedes BS 4395-1:1969 and BS 4395-2:1969.

Summary of pages

This document comprises a front cover, page i, a blank page, an inside front cover, the EN title page, pages 2 to 22, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 7 October 2005

Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 46543 8

The UK participation in the preparation of EN 14399-1 was entrusted by Technical Committee FME/9, Nuts, bolts and accessories/Steering Committee, to its Subcommittee, FME/9/1, Materials, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Additional Information

This part of BS EN 14399 is one of several parts that comprise the BS EN 14399 series of standards. BS EN 14399-1 provides the general requirements to which the other parts, which provide specific requirements regarding manufacture, materials and testing, relate.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

blank

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14399-1

March 2005

ICS 21.060.01

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.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 14399-1:2005: E

Contents

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.

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 require-ments	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)

3.2
manufacturing lot
quantity of fasteners of a single designation including product grade, property class and size[1)], 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:

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.

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 ($F_{\text{bi max}}$[a], $\Delta\Theta_2$[b], k-class)	EN 14399-3 or EN 14399-4

[a] Maximum individual value of the bolt force during tightening test in accordance with EN 14399-2.

[b] Angle by which the nut (or bolt) has to be turned starting from a preload of $0{,}7 f_{\text{ub}} \times A_{\text{s}}$ until the individual value of the bolt force has dropped again to $0{,}7 f_{\text{ub}} \times A_{\text{s}}$.

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.

Table 7 — Bolts

Critical dimension[a]	Accuracy (mm)	Method
Width across flats (s) or head diameter (d_k)	≤ 0,05	Measurement
Width across corners (e)	≤ 0,05	Measurement
Head height (k)	≤ 0,05	Measurement
Shank diameter (d_s)	≤ 0,05	Measurement
Nominal length (l)	≤ 0,1	Measurement
Shank length (l_s)	≤ 0,1	Measurement
Grip length (l_g)	≤ 0,1	Measurement
Thread dimensions	—	Gauge
Underhead radius (r)	—	Gauge
Head angle (of countersunk bolts) (α)	≤ 0,5°	Measurement
[a] Symbols and descriptions of dimensions as defined in EN 20225.		

Table 8 — Nuts

Critical dimension[a]	Accuracy (mm)	Method
Width across flats (s)	≤ 0,05	Measurement
Width across corners (e)	≤ 0,05	Measurement
Nut height (m)	≤ 0,05	Measurement
Thread dimensions	—	Gauge
[a] Symbols and descriptions of dimensions as defined in EN 20225.		

Table 9 — Washers

Critical dimension[a]	Accuracy (mm)	Method
Hole diameter (d_1)	≤ 0,1/–	Measurement/Gauge
Outer diameter (d_2)	≤ 0,1	Measurement
Thickness (h)	≤ 0,05	Measurement
[a] Symbols and descriptions of dimensions as defined in EN 14399-5 and EN 14399-6.		

5.3 Testing of mechanical characteristics of components

The mechanical characteristics of bolts, nuts and washers shall be tested in accordance with Tables 10 to 12.

Table 10 — Bolts

Mechanical characteristic	Test	Reference standard for the test procedure
Percent elongation after fracture	Tensile test	EN ISO 898-1
Minimum tensile strength	Tensile test	EN ISO 898-1
Stress at 0,2 % non-proportional elongation	Tensile test	EN ISO 898-1
Stress under proof load	Proof load test	EN ISO 898-1
Strength under wedge loading	Wedge loading test	EN ISO 898-1
Hardness	Hardness test	EN ISO 898-1
Impact strength	Impact test	EN 10045-1

Table 11 — Nuts

Mechanical characteristic	Test	Reference standard for the test procedure
Stress under proof load	Proof load test	EN 20898-2
Hardness	Hardness test	EN 20898-2

Table 12 — Washers

Mechanical characteristic	Test	Reference standard for the test procedure
Hardness	Hardness test	EN ISO 6507-1

5.4 Testing of functional characteristics of assembly

The test of functional characteristics shall be in accordance with Table 13.

Table 13 — Testing of assembly

Functional characteristic	Test	Standard
Suitability for preloading ($F_{bi\ max}$[a], $\Delta\Theta_2$[a], k-class)	Suitability test for preloading	EN 14399-2
[a] See Table 5		

5.5 Acceptance criteria

All fasteners tested for conformity evaluation shall pass the tests to be in conformance with this document.

6 Evaluation of conformity

6.1 General

The conformity of the components and assemblies to the requirements of this document and with the stated values shall be demonstrated by:

— initial type testing;

— factory production control by the manufacturer, including product assessment.

For the purposes of testing, the products may be grouped into families, where it is considered that the selected properties are common to all the products within that family.

6.2 Initial type testing

6.2.1 General

An initial type test is the complete set of tests or other procedures, determining the performance of samples of products representative of the product type.

Initial type testing shall be performed to show conformity with this document on first use of this document for products being put onto the market and:

— at the beginning of the production of a new or modified assembly design, raw material or source or supplier of the raw material or the components;

— at the beginning of a new or modified method of production.

In case of type testing on products for which initial type testing in accordance with this document was already performed, type testing may be reduced:

— if it has been established that the performance characteristics compared with the already tested products have not been affected, or

— in accordance with the rules for grouping and/or direct application or application by extrapolation of test results.

NOTE Assemblies CE marked in accordance with appropriate harmonised European specifications may be presumed to have the performance stated with the CE marking, although this does not replace the responsibility of the assembly manufacturer to ensure that the assembly is correctly designed and its components have the necessary performance values to meet the design.

6.2.2 Characteristics

All characteristics in 4.4 shall be subject to initial type testing, with the following exception:

— release of dangerous substances may be assessed indirectly by controlling the content of the substance concerned.

6.2.3 Use of historical data

Tests previously performed on the same products in accordance with the provisions of this document (same characteristic(s), test method, sampling procedure, system of attestation of conformity, etc.) may be taken into account.

6.2.4 Treatment of calculated values and design

In some cases, the manufacturer may produce products in accordance with a design and/or calculations provided by a third party. In this case, verification will not be of the design or calculations themselves, but only on the fact that the products conform to with the assumptions of the design and/or calculations.

6.2.5 Sampling, testing and conformity criteria

6.2.5.1 Sampling

Initial type testing shall be performed on samples of products representative for the manufactured product type.

6.2.5.2 Testing and conformity criteria

The number of bolts, nuts and washers and assemblies to be tested shall be in accordance with Table 14.

Table 14 — Number of samples to be tested and conformity criteria for initial type and further testing

Characteristics	Requirement clause	Test method	Number of tests		Conformity criteria
			Initial type testing	Periodical audit	
Bolts					
Dimensions and tolerances	4.4.2	according to 5.2	a	b	c
Percent elongation after fracture	4.4.3	Tensile test	a	b	c
Minimum tensile strength	4.4.3	Tensile test	a	b	c
Stress at 0,2 % non-proportional elongation	4.4.3	Tensile test	a	b	c
Stress under proof loading	4.4.3	Proof load test	a	b	c
Strength under wedge loading	4.4.3	Wedge loading test	a	b	c
Hardness	4.4.3	Hardness test	a	b	c
Impact strength	4.4.3	Impact test	a	b	c
Nuts					
Dimensions and tolerances	4.4.2	according to 5.2	a	b	c
Stress under proof loading	4.4.3	Proof load test	a	b	c
Hardness	4.4.3	Hardness test	a	b	c
Washers					
Dimensions and tolerances	4.4.2	according to 5.2	a	b	c
Hardness	4.4.3	Hardness test	a	b	c
Assemblies					
Suitability for preloading	4.4.4	Suitability test for preloading	a	b	c

[a] 5 tests for
- 4 different nominal diameters which should reflect the different manufacturing methods;
- each property class;
- each type of coating and
- each type and source of material.

[b] 5 tests for one assembly lot.

[c] All samples tested shall pass the test.

The results of all type tests shall be recorded and held by the manufacturer for at least 10 years.

6.3 Factory production control (FPC)

6.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market conform to the declared performance characteristics. The FPC system shall consist of written procedures (works' manual), regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

An FPC system conforming with the requirements of EN ISO 9001, and made product specific to the requirements of this document, is considered to satisfy the above requirements.

The results of inspections, tests or assessments requiring action shall be recorded, as shall any action taken. The action to be taken when control values or criteria are not met shall be recorded and retained for the period specified in the manufacturer's FPC procedures.

6.3.2 Personnel

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product conformity, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-conformities from occurring, actions in case of non-conformities and to identify and register product conformity problems.

6.3.3 Equipment

All measuring and testing equipment shall be calibrated or verified and regularly inspected according to documented procedures, frequencies and criteria.

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process.

Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer's written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

6.3.4 Design process

The factory production control system shall document the various stages in the design of the products, identify the checking procedure and those individuals responsible for all stages of design.

During the design process itself, a record shall be kept of all checks, their results, and any corrective actions taken. This record shall be sufficiently detailed and accurate to demonstrate that all stages of the design phase, and all checks, have been carried out satisfactorily.

6.3.5 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their conformity.

In case supplied assembly components are used, the attestation of conformity level should at least coincide with that of the assembly. If this is not the case, the inspection scheme should be raised to obtain that level.

6.3.6 In-process control

Characteristics, which cannot be controlled on the finished product, shall be controlled by in-process control.

6.3.7 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the production tolerances allow for the product performances to be in conformity with the declared values, derived from initial type testing.

The characteristics and the means of verification are given in Table 15.

Table 15 — Frequency of testing for product testing and evaluation as part of FPC

Characteristic	Clause for relevant test	Minimum number of samples and minimum test frequency	
		Delivery condition according to 4.3 a)	Delivery condition according to 4.3 b)
Bolts Strength under wedge loading	5.3	1 piece per hour for continuous heat treatment or 1 piece per batch	1 piece per hour for continuous heat treatment or 1 piece per batch
or hardness	5.3		
Nuts Hardness	5.3		
Washers Hardness	5.3		
Assembly Suitability for preloading	5.4	5 assemblies per assembly lot	1 assembly per bolt manufacturing lot but at least 5 assemblies per extended assembly lot independent of bolt length (i.e. the extended assembly lot may include different bolt lengths)

The manufacturer shall record the results of the tests specified in Table 15. These records shall at least include the following information:

— identification of the product and assembly tested;

— the date of sampling and testing;

— the test methods performed;

— the test results.

6.3.8 Traceability and marking

Individual components and assemblies shall be identifiable and traceable with regard to their production origin. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings (see 4.4.5) are inspected regularly.

6.3.9 Non-conforming products

The manufacturer shall have written procedures, which specify how non-conforming products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures.

6.3.10 Handling, storage, packaging

The manufacturer shall have written procedures providing methods of product handling and shall provide suitable storage areas preventing damages or deterioration.

6.4 Testing of samples taken at the factory by the manufacturer

As a periodic audit, the testing of samples taken at the factory by the manufacturer in accordance with a prescribed plan as specified in Clause 5 and in 6.2 shall be the means of evaluation of conformity of the product delivered in accordance with the relevant part of EN 14399.

The following minimum test frequencies apply:

First year of implementation of this standard: Twice

Following years: Once a year in the absence of any major non-conformances

If a failure occurs repeat testing at a frequency which will avoid defective products being placed on the market and subsequently: Twice a year until a complete year has been achieved without major non-conformances

If required, the report of such testing as carried out by the manufacturer shall be an inspection document 3.1.B in accordance with EN 10204.

7 Documentation of test results

The test results shall be documented for each assembly lot or extended assembly lot. The documentation shall include all the results of all tests mentioned in 6.3 and shall be retained for a minimum of 10 years after the tests were carried out.

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of EU Construction Products Directive (89/106/EEC)

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under a mandate M/120 "Structural metallic products and ancillaries" given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in Annex ZA meet requirements of the mandate M/120 given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the construction products covered by this Part of EN 14399 for their intended use.

In this European standard "Structural connectors" are referred to as bolts, nuts and washers intended for use in preloaded assemblies for high-strength structural bolting (systems HR and HV).

WARNING: Other requirements and other EU Directives, not affecting the fitness for intended uses, can be applicable to the components for high strength structural bolting falling within the scope of this European Standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this Standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm).

This Annex has the same scope as clause 1 of this standard with regard to the products covered. It establishes the conditions for CE marking of components of bolt/nut/washer assemblies and of the assemblies themselves intended for the intended use and shows the relevant clauses applicable, see Table ZA.1.

Table ZA.1 — Components and assemblies for high-strength structural bolting for preloading for general building and civil engineering for use in accordance with the k-classes defined

Essential performance characteristic for the mandate	Requirement clause	Classes	NOTES
Bolts			
Tolerances on dimensions, form and position	4.4.2	—	—
Percent elongation after fracture	4.4.3	—	see Table 2
Minimum tensile strength	4.4.3	—	see Table 2
Stress at 0,2 % non-proportional elongation	4.4.3	—	see Table 2
Stress under proof load	4.4.3	—	see Table 2
Strength under wedge loading	4.4.3	—	see Table 2
Hardness	4.4.3	—	see Table 2
Impact strength	4.4.3	—	see Table 2
Friction coefficient (k-class)	4.4.4	—	see Table 6
Release of dangerous substances	4.2.1	—	—
Durability	4.5	—	—
Nuts			
Tolerances on dimensions, form and position	4.4.2	—	—
Stress under proof load	4.4.3	—	see Table 3
Hardness	4.4.3	—	see Table 3
Release of dangerous substances	4.2.1	—	—
Durability	4.5	—	—
Washers			
Tolerances on dimensions, form and position	4.4.2	—	—
Hardness	4.4.3	—	see Table 4
Release of dangerous substances	4.2.1	—	—
Durability	4.5	—	—
Assemblies			
Suitability of assembly for preloading ($F_{\text{bi max}}$, $\Delta\Theta_2$, k-class)	4.4.4	—	k-classes K0, K1, K2
Durability	4.5	—	—

The requirement on a certain characteristic is not applicable in those Member States where there are no regulatory requirements on that characteristic for the intended end use of the product. In this case, manufacturers placing their products on the market of these Member States are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option "No performance determined" (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZA.2 Procedures for the attestation for conformity of products

ZA.2.1 System of attestation of conformity

The system of attestation of conformity of the components of bolt/nut/washer assemblies and of the assemblies themselves, indicated in Table ZA.1 in accordance with the Decision of the Commission 98/214/EC of March 1998 as given in Annex III of the Mandate M/120 "STRUCTURAL METALLIC PRODUCTS and ancillaries", is shown in Table ZA.2 for the intended uses.

Table ZA.2 — Attestation of conformity system

Products	Intended uses	Level or class	Attestation of conformity system
STRUCTURAL CONNECTORS	Structural metallic works	—	2+[a]

[a] System 2+: See Directive 89/106/EEC (CPD) Annex III.2.(ii), First possibility, including certification of the factory production control by an approved body on the basis of its initial inspection of factory and of factory production control as well as of continuous surveillance, assessment and approval of factory production control.

ZA.2.2 Assignment of evaluation of conformity task for products under system 2+

See Table ZA.3

Table ZA.3 — Assignment of evaluation of conformity tasks for products under system 2+

Tasks			Content of the task	Evaluation of conformity clause to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)		Parameters related to all relevant performance characteristics of Table ZA.1	6.3
	Initial type testing		All relevant performance characteristics of Table ZA.1	6.2
	Testing of samples taken at the factory		All relevant performance characteristics of Table ZA.1	6.4
Tasks under the responsibility of the FPC certification body	Certification of FPC on the basis of	Initial inspection of factory and of FPC	Parameters related to all relevant performance characteristics of Table ZA.1	6.3
		Continuous surveillance, assessment and approval of FPC	Parameters related to all relevant performance characteristics of Table ZA.1	6.3

ZA.2.3 EC Certificate and declaration of conformity

When compliance with the conditions of this Annex is achieved, the manufacturer or his agent established in the European Economic Area (EEA) shall prepare and retain a declaration of conformity, which entitles the manufacturer to affix the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and the place of production;

— description of the product (type, identification, use …), and a copy of the information accompanying the CE marking, see ZA.3;

— provisions to which the product conforms (e.g. this Annex ZA of this document);

— particular conditions applicable to the use of the product [if necessary];

— the number of the accompanying factory production control certificate;

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or supplier or his authorized representative.

The declaration shall be accompanied by a factory production certificate, drawn up by the notified body, which shall contain, in addition to the information above, the following:

— Name and address of the notified body;

— The number of the factory production control certificate;

— Conditions and period of validity of the certificate, where applicable;

— Name of, and position held by, the person empowered to sign the certificate.

This declaration and certificate shall be made available upon request and presented in the official language(s) acceptable to the member state of intended use of the product.

ZA.3 CE marking and labelling

The manufacturer of the assemblies or his authorized representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol shall be in accordance with Directive 93/68/EEC[2)] and shall be shown on the packaging or on the accompanying commercial documents (inspection documents).

The CE marking consists of the letters "CE" in the specified form and shall be accompanied by the following information:

— identification number of the notified body;

— name or identifying mark of the manufacturer of the assemblies;

— the last two digits of the year of CE marking;

— the number of the certificate of conformity with regard to the factory production control system;

— the reference to this document (EN 14399-1);

— the product designation by reference to the relevant parts of this document;

— the k-class with the following information, as relevant:

- K0: NPD (No performance determined)
- K1: range of individual test values k_i
- K2: Mean value of the k-factor (k_m) , coefficient of variation of the k-factor (V_k) .

NOTE 1 The product designation includes the property classes of bolts and nuts, which specify the mechanical and physical properties of these products and are defined in EN ISO 898-1 and in EN 20898-2 respectively.

The “No performance determined” (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is no subject to regulatory requirements in the Member state of destination.

2) Council Directive 93/68/EEC of 22 July 1993 amending 12 Directives, including Directive 89/106/EEC harmonizing the provisions for CE marking.

Examples for CE marking:

CE 1234
Any Co Ltd., PO Box 23, B-1070 02 Number xxx/2002 of the EC certificate
EN 14399-1 Bolt assembly for preloading for use in accordance with a defined k-class Bolt EN 14399-3 — M16 × 80 — 8.8 — HR Nut EN 14399-3 — M16 — 8 — HR Washer EN 14399-5 — 16 k-class: K0: NPD

CE 1234
Any Co Ltd., PO Box 23, B-1070 02 Number xxx/2002 of the EC certificate
EN 14399-1 Bolt assembly for preloading for use in accordance with a defined k-class Bolt EN 14399-3 — M16 × 80 — 10.9 — HR Nut EN 14399-3 — M16 — 10 — HR Washer EN 14399-6 — 16 k-class: K2: k_m = 0,13, V_k = 0,06

CE 1234
Any Co Ltd., PO Box 23, B-1070 02 Number xxx/2002 of the EC certificate
EN 14399-1 Bolt assembly for preloading for use in accordance with a defined k-class Bolt EN 14399-4 — M16 × 80 — 10.9 — HV — tZn Nut EN 14399-4 — M16 — 10 — HV — tZn Washer EN 14399-6 — 16 — tZn k-class: K1: 0,10 ≤ k ≤ 0,16

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE 2 European legislation without national derogations need not be mentioned.

Bibliography

[1] EN ISO 12944 *(all parts)*, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems*

[2] EN ISO 15330:1999, *Fasteners — Preloading test for the detection of hydrogen embrittlement — Parallel bearing surface method (ISO 15330:1999)*

[3] *Guide to the Implementation of Directives Based on the New Approach and Global Approach,* Luxembourg: Office for Official Publications of the European Communities, 2000

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL