

# High-strength structural bolting assemblies for preloading —

## Part 6: Plain chamfered washers

The European Standard EN 14399-6:2005 has the status of a  
British Standard

ICS 21.060.30

# National foreword

This British Standard is the official English language version of EN 14399-6:2005, including Corrigendum January 2006. Together with BS EN 14399-1:2005, BS EN 14399-2:2005, BS EN 14399-3:2005, BS EN 14399-4:2005 and BS EN 14399-5:2005, it supersedes BS 4395-1:1969 and BS 4395-2:1969, which are planned to be declared obsolescent in September 2007<sup>1)</sup>, and then, together with BS 449 and BS 5950, will be withdrawn upon publication of Eurocode 3.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.)

The UK participation in the preparation of EN 14399-6 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 the 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.**

<sup>1)</sup> 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 14399-6:2005 to “September 2007”.

## Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 8, an inside back cover and a back cover.

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

## Amendments issued since publication

Amd. No.	Date	Comments
16229 Corrigendum No. 1	August 2006	Changes applied to Clause 6

English version

## High-strength structural bolting assemblies for preloading - Part 6: Plain chamfered washers

Boulonnerie de construction métallique à haute résistance  
apte à la précontrainte - Partie 6 : Rondelles plates  
chanfreinées

Hochfeste planmäßig vorspannbare  
Schraubenverbindungen für den Metallbau - Teil 6: Flache  
Scheiben mit Fase

This European Standard was approved by CEN on 30 April 2004.

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

Contents		page
Foreword.....		3
Introduction .....		4
1	Scope .....	5
2	Normative references .....	5
3	Dimensions.....	6
4	Specification and reference standards .....	7
5	Designation .....	7
6	Marking .....	7
Bibliography .....		8

## Foreword

This document (EN 14399-6:2005) 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 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, 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**

	<b>Bolt/nut/washer assembly System HR</b>		<b>Bolt/nut/washer assembly System HV</b>
<b>General requirements</b>	EN 14399-1		
<b>Bolt/nut assembly</b>	EN 14399-3		EN 14399-4
Marking	HR		HV
Property classes	8.8/8	10.9/10	10.9/10
<b>Washer(s)</b>	EN 14399-5 or EN 14399-6		EN 14399-5 or EN 14399-6
Marking	H		H
<b>Suitability test for preloading</b>	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.

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 excentrically 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.

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, together with EN 14399-1, hardened and tempered plain washers with chamfer intended for assembly with large series hexagon high-strength structural bolts and nuts with thread sizes from M12 to M36 inclusive.

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

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

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

EN ISO 4759-3, *Tolerances for fasteners — Part 3: Plain washers for bolts, screws and nuts — Products grades A and C (ISO 4759-3:2000)*.

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

### 3 Dimensions

See Figure 1 and Table 2.

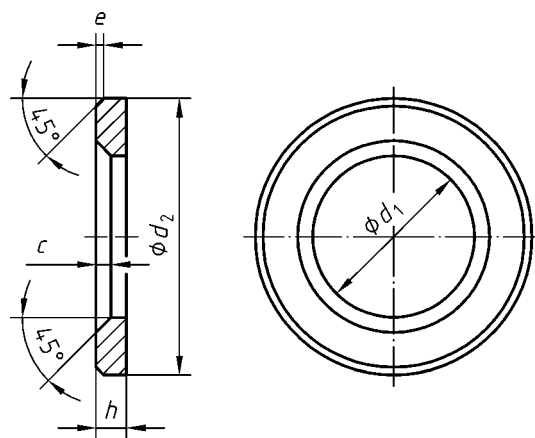


Figure 1 — Dimensions

Table 2 — Dimensions

Dimensions in millimetres

Nominal size $d$ (nominal thread diameter of associated bolts)		12	(14) <sup>a</sup>	16	(18) <sup>a</sup>	20	22	24	27	30	36
$d_1$	min.	13	15	17	19	21	23	25	28	31	37
	max.	13,27	15,27	17,27	19,33	21,33	23,33	25,33	28,52	31,62	37,62
$d_2$	min.	23,48	27,48	29,48	33,38	36,38	38,38	43,38	49	54,80	64,80
	max.	24	28	30	34	37	39	44	50	56	66
$h$	nom.	3	3	4	4	4	4	4	5	5	6
	min.	2,7	2,7	3,7	3,7	3,7	3,7	3,7	4,4	4,4	5,4
	max.	3,3	3,3	4,3	4,3	4,3	4,3	4,3	5,6	5,6	6,6
$e$	nom. = min.	0,5	0,5	0,75	0,75	0,75	0,75	0,75	1	1	1,25
	max.	1,0	1,0	1,50	1,50	1,50	1,50	1,50	2	2	2,50
$c$	min.	1,6	1,6	1,6	2	2,0	2,0	2,0	2,5	2,5	2,5
	max.	1,9	1,9	1,9	2,5	2,5	2,5	2,5	3,0	3,0	3,0

NOTE For hot dip galvanized washers the above dimensions apply prior to galvanizing.

<sup>a</sup> Sizes in brackets are non-preferred sizes.



## 4 Specification and reference standards

Table 3 — Specifications and reference standards

<b>Material</b>		Steel
<b>General requirements</b>		EN 14399-1
<b>Mechanical properties</b>	Hardness range	300 HV to 370 HV
	Product grade	A
<b>Tolerances</b>	International Standard	EN ISO 4759-3
	normal	as processed <sup>b</sup>
<b>Surface finish<sup>a</sup></b>	hot dip galvanized	EN ISO 10684
	others	to be agreed <sup>c</sup>
<b>Workmanship</b>		Parts shall be uniform and free of irregularities or detrimental defects. No protruding burrs shall appear on the washer.
<b>Acceptability</b>		For acceptance procedure, see EN ISO 3269.
<sup>a</sup> Attention is drawn to the need to consider the risk of hydrogen embrittlement when selecting an appropriate surface treatment process (e.g. cleaning and coating), see the relevant coating standards. <sup>b</sup> "As processed" means the normal finish resulting from heat treatment with a light coating of oil. <sup>c</sup> Other coatings may be negotiated between the purchaser and the manufacturer provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.		

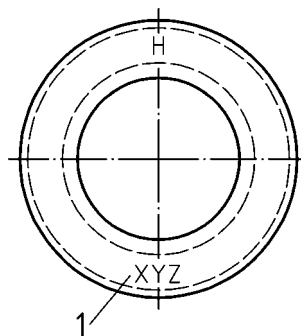
## 5 Designation

EXAMPLE A hardened and tempered chamfered plain washer, nominal size  $d = 16$  mm, for high-strength structural bolting for preloading is designated as follows:

Washer EN 14399-6 — 16

## 6 Marking

Hardened and tempered chamfered washers shall be marked with the identification mark of the manufacturer of the assembly and the letter H. The marking shall be indented on the non-chamfered side.



### Key

1 Identification mark of the manufacturer of the assembly

Figure 2 — Marking

## Bibliography

- [1] ENV 1090-1, *Execution of steel structures — Part 1: General rules and rules for buildings*.
- [2] ISO 272, *Fasteners — Hexagon products - Widths across flats*.



---

## **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](mailto: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](mailto: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](mailto: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**

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright & Licensing Manager.  
Tel: +44 (0)20 8996 7070. Fax: +44 (0)20 8996 7553.  
Email: [copyright@bsi-global.com](mailto:copyright@bsi-global.com).