SLOVENSKI STANDARD
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Visokotrdnostne strukturne vijačne zveze za prednapetje - 2. del: Primernost za prednapetje

High-strength structural bolting assemblies for preloading - Part 2: Suitability for preloading

Hochfeste vorspannbare Garnituren für Schraubverbindungen im Metallbau - Teil 2: Eignung zum Vorspannen

Boulonnerie de construction métallique à haute résistance apte à la précontrainte - Partie 2: Aptitude à l'emploi pour la mise en précontrainte

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English Version

High-strength structural bolting assemblies for preloading - Part 2: Suitability for preloading

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

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Foreword

This document (FprEN 14399-2:2014) has been prepared by Technical Committee CEN/TC 185 “Fasteners”, the secretariat of which is held by DIN.

This document is currently submitted to the Formal Vote.

This document will supersede EN 14399-2:2005.

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*.

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(s) assemblies. These solutions consist of two different systems (HR and HV) of bolt/nut/washer assemblies, see Table 1. Both systems are well proven and it is the responsibility of the experts using 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.

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.

For the same reason it is important that 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 if the bolting assemblies are tightened with a suitable procedure. For this purpose a test method for the suitability of the bolting assemblies for preloading was created, which will demonstrate whether the functionality of the bolting assemblies 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 eccentrically 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 was common practice in Europe.

1 Scope

This European Standard specifies the technical requirements for high strength structural bolting assemblies in order to ensure the suitability for preloading of bolted connections in metallic structures.

A suitability test is specified to check the behaviour of the structural bolting assemblies so as to ensure that the required preload can be reliably obtained by the tightening methods specified in EN 1090-2 with sufficient margins against overtightening and against failure.

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 1090-2, *Execution of steel structures and aluminium structures — Part 2: Technical requirements for steel structures*

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

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*

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 14399-9, *High-strength structural bolting assemblies for preloading — Part 9: System HR or HV — Direct tension indicators for bolt and nut assemblies*

EN 14399-10, *High-strength structural bolting assemblies for preloading — Part 10: System HRC — Bolt and nut assemblies with calibrated preload*

EN ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread (ISO 898-1)*

EN ISO 898-2, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes — Coarse thread and fine pitch thread (ISO 898-2)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14399-1 apply.

4 Symbols and units

A	elongation, (mm)
A_s	nominal stress area of the bolt, (mm^2) (see EN ISO 898-1)
d	nominal thread diameter, (mm)
F_b	bolt force during the test, (kN)
F_{bi}	individual value of the bolt force related to a given nut rotation, torque or bolt elongation, (kN)
F_{bm}	mean value of F_{bi} values, (kN)
$F_{bi,max}$	individual value of the maximum bolt force reached during the test, (kN)
$F_{p,C}$	required preload of 0,7 f_{ub} A_s, (kN)
f_{ub}	nominal tensile strength ($R_{m,nom}$), (MPa)
k	k-factor
k_i	individual value of the k-factor
k_m	mean value of the k-factor
$l_{b,eff}$	effective preloaded bolt length given as the clamp length (Σt) plus half the nominal nut height, (mm)
M	torque applied during the test, (Nm)
M_i	individual value of the torque applied during the test, (Nm)
M_{pi}	individual value of the torque at which the bolt force has first reached the value of $F_{p,C}$, (Nm)
M_{spec}	specified value of the torque to be applied to the bolting assemblies, (Nm)
n	number of test results
s_F	estimated standard deviation of the F_{bi} values for a tightening torque M_{spec}
s_k	estimated standard deviation of the k_i-values for the preload $F_{p,C}$
V_k	coefficient of variation of the k-factor for the preload $F_{p,C}$
θ	angle of rotation of the nut relative to the bolt, (°)
θ_{pi}	individual value of the angle θ at which the bolt force has first reached the value of $F_{p,C}$, (°)
θ_{1i}	individual value of the angle θ at which the bolt force has reached its maximum value $F_{bi,max}$, (°)
θ_{2i}	individual value of the angle θ, (°)
$\Delta\theta_{1i}$	individual angle difference ($\theta_{1i} - \theta_{pi}$), (°)
$\Delta\theta_{2i}$	individual angle difference ($\theta_{2i} - \theta_{pi}$), (°)
$\Delta\theta_{2min}$	minimum required value of the angle difference $\Delta\theta_{2i}$ as specified in the relevant product standard (°)
Σt	clamp length given as the total thickness of the clamped parts between the nut bearing face and the bolt head bearing face, (mm)