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Non-preloaded structural bolting assemblies - Part 1: General requirements

Garnituren für nicht vorgespannte Schraubverbindungen im Metallbau - Teil 1: Allgemeine Anforderungen

Boulonnerie de construction métallique non précontrainte - Partie 1: Exigences générales

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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-CENELEC Management Centre has the same status as the official versions.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN 15048-1:2016) has been prepared by Technical Committee CEN/TC 185 "Fasteners", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by April 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15048-1:2007.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports basic work requirements of Regulation (EU) No 305/2011.

For relationship with Regulation (EU) No 305/2011 see informative Annex ZA, which is an integral part of this document.

EN 15048 consists of the following parts, under the general title *Non-preloaded structural bolting assemblies:*

— *Part 1: General requirements*;

— *Part 2: Fitness for purpose*.

Compared to the previous version, the modifications are the following:

— the standard was revised to meet the new format for harmonized standards and in relation to the Regulation (EU) No. 305/2011 (CPR);

— the requirements of this standard only relate to the product characteristics of bolting assemblies which are necessary for CE marking;

— all clauses dealing with further technical or other requirements have been transferred to EN 15048-2;

— washers are not considered as part of the non-preloaded bolting assemblies, however they can be used as relevant;

— addition of bolting assemblies made in aluminum and aluminum alloys;

— addition of nominal diameters M5 to M10;

— Railway rail fasteners have been excluded.

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Rules for design and execution of bolted connections with non-preloaded structural bolts are defined for instance in EN 1993-1-8 and EN 1090-2 for steel structures or EN 1999-1-1 and EN 1090-3 for aluminium or aluminium alloy structures.

The parts of this European Standard on structural bolting assemblies specify the general requirements which ensure that bolting assemblies comprising bolts and nuts are suitable for use as non-preloaded structural bolting in structural metallic works. They can be used in shear connections and/or in tension connections if no preload is required.

Structural bolting assemblies which meet the requirements of this part of this European Standard have been designed to allow tensile resistance of at least $f_{ub} \times A_s$. For this purpose the tensile test of bolting assemblies specified in EN 15048-2 is a mean to check whether the function of the assembly is fulfilled.

Washers or other elements can be used additionally if necessary.

1 Scope

This part of this European Standard specifies the general requirements for bolting assemblies for non-preloaded structural bolting. Bolting assemblies in accordance with this European Standard are designed to be used in structural bolting connections for shear and/or tensile loading.

The intended use of bolting assemblies in accordance with this European standard is structural metallic works.

It applies to bolts (the term used when bolts partially threaded, screws, studs and stud-bolts are considered all together) and nuts made of carbon steel, alloy steel, stainless steel or aluminium or aluminium alloy with the following property classes:

— bolts made of carbon steel or alloy steel: 4.6, 4.8, 5.6, 5.8, 6.8, 8.8, 10.9 (in accordance with EN ISO 898-1);

— nuts made of carbon steel or alloy steel: 5, 6, 8, 10, 12 (in accordance with EN ISO 898-2);

— bolts made of austenitic stainless steel: 50, 70, 80 (in accordance with EN ISO 3506-1);

— nuts made of austenitic stainless steel: 50, 70, 80 (in accordance with EN ISO 3506-2);

— bolts made of aluminium or aluminium alloy: AL1 to AL6 (in accordance with EN 28839);

— nuts made of aluminium or aluminium alloy: AL1 to AL6 (in accordance with EN 28839).

This European Standard applies to bolting assemblies with ISO metric coarse pitch thread from sizes M12 to M39 for use in steel structures according to EN 1090-2, and from M5 to M39 for use in aluminium or aluminium alloy structures according to EN 1090-3. The use of thread sizes larger than M39 is not precluded provided all applicable requirements of this standard are met.

WARNING — Only bolting assemblies are covered by this harmonized standard: separate bolts or nuts, not tested as part of an assembly lot of bolting assemblies in accordance with EN 15048-2, are not covered by this harmonized standard and cannot be CE marked.

NOTE 1 The property classes 4.8, 5.8 and 6.8 may be subjected to limitations of use.

NOTE 2 High-strength structural bolting assemblies for preloading which meet the requirements of EN 14399–1 are not within the scope of this European Standard but they are also suitable for use in non-preloaded structural bolting.

NOTE 3 Bolts and nuts made of aluminium or aluminium alloys are not designed to be used in steel structures, see EN 1090–2.

Bolting assemblies in accordance with this European Standard are not designed to be welded.

Railway rail fasteners are not covered by this European Standard.

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 15048-2, *Non-preloaded structural bolting assemblies — Part 2: Suitability test*

EN 28839, *Mechanical properties of fasteners — Bolts, screws, studs and nuts made of non-ferrous metals (ISO 8839)*

EN ISO 225, *Fasteners — Bolts, screws, studs and nuts — Symbols and descriptions of dimensions (ISO 225)*

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)*

EN ISO 3506-1, *Mechanical properties of corrosion-resistant stainless steel fasteners — Part 1: Bolts, screws and studs (ISO 3506-1)*

EN ISO 3506-2, *Mechanical properties of corrosion-resistant stainless steel fasteners — Part 2: Nuts (ISO 3506-2)*

EN ISO 4759-1, *Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts — Product grades A, B and C (ISO 4759-1)*

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

ISO 965-1, *ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data*

ISO 965-2, *ISO general purpose metric screw threads — Tolerances — Part 2: Limits of sizes for general purpose external and internal screw threads — Medium quality*

ISO 965-3, *ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads*

ISO 965-4, *ISO general purpose metric screw threads — Tolerances — Part 4: Limits of sizes for hot-dip galvanized external screw threads to mate with internal screw threads tapped with tolerance position H or G after galvanizing*

ISO 965-5, *ISO general purpose metric screw threads — Tolerances — Part 5: Limits of sizes for internal screw threads to mate with hot-dip galvanized external screw threads with maximum size of tolerance position h before galvanizing*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1090-2 and the following apply.

3.1
bolting assembly
matching bolts (including screws, studs and stud bolts) and nuts

3.2
manufacturing lot
quantity of components of a single designation including product grade, property class, type, and size, 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, coating and/or lubrication process, if any

Note 1 to entry: Same 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 to entry: The manufacturing lot may be split into a number of manufacturing batches for processing purposes and then re-assembled into the same manufacturing lot.

3.3
single bolting assembly lot
bolting assembly lot containing:

— bolts from a single manufacturing lot,

— nuts from a single manufacturing lot.

3.4
extended bolting assembly lot
bolting assembly lot containing:

— nuts from a single manufacturing lot,

— bolts from several manufacturing lots.

4 Product characteristics

4.1 General

The performance of the structural bolting assemblies depends on properties of their matched components. Therefore, the requirements specified in 4.2, 4.3 and 4.4 are assessed through the verification of the properties of the involved components and/or bolting assemblies, as applicable.

4.2 Type (bolting assemblies)

4.2.1 General

Type "SB" linked with the property class of the bolt covers the axial load of the structural bolting assembly assumed in design.

The geometry of the head is relevant for the ability of the bolting assembly to be loaded by tension.

The cross section of the shank is relevant for the ability of the bolting assembly to be loaded by shear.

Any suitable head shape and shank dimensions may be used provided that the requirements for tensile resistance are met.

4.2.2 Axial load (bolting assemblies)

Bolting assemblies shall be assessed in accordance with 5.2. The minimum tensile resistance of the bolting assembly shall comply with the values specified in Table 1, Table 2 and Table 3. The values correspond to the minimum tensile strength $R_{m,min}$ for the relevant property class of the structural bolting assembly, as specified in EN ISO 898-1, EN ISO 3506-1 or EN 28839 as appropriate.

Table 1 — Tensile resistance of bolt/nut assemblies made of carbon steel or alloy steel

Structure	Thread	Nominal stress area $A_{s,nom}$ mm²	Property class of the bolt						
			4.6	4.8	5.6	5.8	6.8	8.8	10.9
			Minimum tensile resistance $F_{ub,min}$, N ($A_{s,nom} \times R_{m,min}$)						
For aluminium structures	M5[a]	14,2	5 680	5 960	7 100	7 380	8 520	11 350	14 800
	M6[a]	20,1	8 040	8 440	10 000	10 400	12 100	16 100	20 900
	M7[a]	28,9	11 600	12 100	14 400	15 000	17 300	23 100	30 100
	M8[a]	36,6	14 600	15 400	18 300	19 000	22 000	29 200	38 100
	M10[a]	58,0	23 200	24 400	29 000	30 200	34 800	46 400	60 300
For steel and aluminium structures	M12[b]	84,3	33 700	35 400	42 200	43 800	50 600	70 000	87 700
	M14[b]	115	46 000	48 300	57 500	59 800	69 000	95 500	120 000
	M16[b]	157	62 800	65 900	78 500	81 600	94 000	130 000	163 000
	M18[b]	192	76 800	80 600	96 000	99 800	115 000	159 000	200 000
	M20[b]	245	98 000	103 000	122 000	127 000	147 000	203 000	255 000
	M22[b]	303	121 000	127 000	152 000	158 000	182 000	252 000	315 000
	M24[b]	353	141 000	148 000	176 000	184 000	212 000	293 000	367 000
	M27[b]	459	184 000	193 000	230 000	239 000	275 000	381 000	477 000
	M30[b]	561	224 000	236 000	280 000	292 000	337 000	466 000	583 000
	M33[b]	694	278 000	292 000	347 000	361 000	416 000	576 000	722 000
	M36[b]	817	327 000	343 000	408 000	425 000	490 000	678 000	850 000
	M39[b]	976	390 000	410 000	488 000	508 000	586 000	810 000	1 020 000

[a] When tested in accordance with EN 15048-2, hot dip galvanized structural bolting assemblies below M12 cannot meet the requirements for tensile resistance.

[b] To achieve full tensile resistance, hot dip galvanized bolting assemblies can require special measures, see EN ISO 10684:2004, Annex F.

Table 2 — Tensile resistance of bolt/nut assemblies made of stainless steel

Thread	Nominal stress area $A_{s,nom}$ mm²	Property class of the bolt		
		50	70	80
		Minimum tensile resistance $F_{ub,min}$, N ($A_{s,nom} \times R_{m,min}$)		
M5	14,2	7 100	9 900	11 400
M6	20,1	10 000	14 100	16 100
M7	28,9	14 400	20 200	23 100
M8	36,6	18 300	25 600	29 300
M10	58,0	29 000	40 600	46 400
M12	84,3	42 200	59 000	67 400
M14	115	57 500	80 500	92 000
M16	157	78 500	110 000	126 000
M18	192	96 000	134 000	154 000
M20	245	122 000	172 000	196 000
M22	303	152 000	212 000	242 000
M24	353	176 000	247 000	282 000
M27	459	230 000	321 000[a]	367 000[a]
M30	561	280 000	393 000[a]	449 000[a]
M33	694	347 000	486 000[a]	555 000[a]
M36	817	408 000	572 000[a]	654 000[a]
M39	976	488 000	683 000[a]	781 000[a]

[a] These sizes might not be available as bolt and nut assemblies, so studs or stud bolts with nuts may be used.