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Lesene konstrukcije - Paličasta vezna sredstva - Zahteve

Timber structures - Dowel-type fasteners - Requirements

Holzbauwerke - Stiftförmige Verbindungsmittel - Anforderungen

Structures en bois - Éléments de fixation de type tige - Exigences

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European foreword

This document (EN 14592:2022) has been prepared by Technical Committee CEN/TC 124 “Timber structures”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by October 2022 and conflicting national standards shall be withdrawn at the latest by January 2024.

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

This document supersedes EN 14592:2008+A1:2012.

The main changes with respect to the previous edition are listed below:

— new concepts concerning dimensions and tolerances, e.g. target diameter;

— improved categories for corrosion protection;

— new specifications on wood density for testing of connections with dowel-type fasteners;

— low cycle ductility classes (seismic performance) and related test method;

— axial stiffness, static ductility and torsional ratio for screws.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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1 Scope

This document specifies the characteristics of the following types of dowel-type fasteners:

— nails;

— staples;

— screws;

— dowels;

— bolts with nuts.

This document covers dowel-type fasteners for structural use in load bearing timber structures only. This document covers also the following additional intended uses of the screws:

— to fix roof or cladding elements to the timber structure, with or without insulation layers; and

— as reinforcement inserted in timber or in a glue laminated timber element to improve its resistance to compression perpendicular to the grain.

This document covers types of dowel-type fasteners, which are manufactured of either carbon steel or stainless steel and which may be coated for the following purposes:

— corrosion protection (as Type 1 coating);

— lubrication, to facilitate insertion (as Type 2 coating);

— withdrawal enhancement and/or collation for nails and staples (adhesive and/or resin coatings) (as Type 3 coating).

This document covers types of dowel-type fasteners, which are manufactured from materials and within the specifications for their geometry related properties, only as they are specified for:

— nails (see G.1);

— staples (see G.2);

— screws (see G.3);

— dowels (see G.4); and

— bolts with nuts (see G.5).

This document specifies also the assessment and verification of constancy of performance (AVCP) procedures of these characteristics and includes provisions for marking of dowel-type fasteners.

This document does not cover dowel-type fasteners treated with fire retardants to improve their fire performance, nor does it cover glued-in rods.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 409:2009, *Timber structures - Test methods - Determination of the yield moment of dowel type fasteners*

EN 634-2:2007, *Cement-bonded particleboards - Specifications - Part 2: Requirements for OPC bonded particleboards for use in dry, humid and external conditions*

EN 636:2012+A1:2015, *Plywood - Specifications*

EN 1382:2016, *Timber Structures - Test methods - Withdrawal capacity of timber fasteners*

EN 1383:2016, *Timber structures - Test methods - Pull through resistance of timber fasteners*

EN 1990:2002, *Eurocode - Basis of structural design*

EN 1993-1-4:2006/A1:2015, *Eurocode 3 - Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels*

EN 1995-1-1:2004[1], *Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings*

EN 10025-2:2019, *Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10025-3:2019, *Hot rolled products of structural steels - Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels*

EN 10088-1:2014, *Stainless steels - Part 1: List of stainless steels*

EN 10088-2:2014, *Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

EN 10088-3:2014, *Stainless steels - Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes*

EN 10088-4:2009, *Stainless steels - Part 4: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes*

EN 10088-5:2009, *Stainless steels - Part 5: Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes*

EN 10149-1:2013, *Hot rolled flat products made of high yield strength steels for cold forming - Part 1: General technical delivery conditions*

EN 10204:2004, *Metallic products - Types of inspection documents*

[1] As impacted by EN 1995-1-1:2004/A1:2008 and EN 1995-1-1:2004/A2:2014.

EN 10218-1:2012, *Steel wire and wire products - General - Part 1: Test methods*

EN 10277:2018, *Bright steel products - Technical delivery conditions*

EN 13501-1:2018, *Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests*

EN 13986:2004+A1:2015, *Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking*

EN 14081-1:2016+A1:2019, *Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements*

EN 14358:2016, *Timber structures - Calculation and verification of characteristic values*

EN 15737:2009, *Timber Structures - Test methods - Torsional resistance of driving in screws*

EN ISO 898-1:2013[2], *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 898-1:2013)*

EN ISO 898-2:2012, *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 898-2:2012)*

EN ISO 1460:1994, *Metallic coatings - Hot dip galvanized coatings on ferrous materials - Gravimetric determination of the mass per unit area (ISO 1460:1992)*

EN ISO 1463:2004, *Metallic and oxide coatings - Measurement of coating thickness - Microscopical method (ISO 1463:2003)*

EN ISO 2081:2018, *Metallic and other inorganic coatings - Electroplated coatings of zinc with supplementary treatments on iron or steel (ISO 2081:2018)*

EN ISO 2178:2016, *Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method (ISO 2178:2016)*

EN ISO 3497:2000, *Metallic coatings - Measurement of coating thickness - X-ray spectrometric methods (ISO 3497:2000)*

EN ISO 3506-1:2009, *Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs (ISO 3506-1:2009)*

EN ISO 4042:2018, *Fasteners - Electroplated coating systems (ISO 4042:2018)*

EN ISO 6270-1:2018, *Paints and varnishes - Determination of resistance to humidity - Part 1: Condensation (single-sided exposure) (ISO 6270-1:2017)*

EN ISO 6892-1:2019, *Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1:2019)*

[2] As impacted by EN ISO 898-1:2013/AC:2013.

EN ISO 8407:2014, *Corrosion of metals and alloys - Removal of corrosion products from corrosion test specimens (ISO 8407:2009)*

EN ISO 8565:2011, *Metals and alloys - Atmospheric corrosion testing - General requirements (ISO 8565:2011)*

EN ISO 9226:2012, *Corrosion of metals and alloys - Corrosivity of atmospheres - Determination of corrosion rate of standard specimens for the evaluation of corrosivity (ISO 9226:2012)*

EN ISO 9227:2017, *Corrosion tests in artificial atmospheres - Salt spray tests (ISO 9227:2017)*

EN ISO 10289:2001, *Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates - Rating of test specimens and manufactured articles subjected to corrosion tests (ISO 10289:1999)*

EN ISO 10666:1999, *Drilling screws with tapping screw thread - Mechanical and functional properties (ISO 10666:1999)*

EN ISO 10684:2004,[3] *Fasteners - Hot dip galvanized coatings (ISO 10684:2004)*

EN ISO 11997-1:2017, *Paints and varnishes - Determination of resistance to cyclic corrosion conditions - Part 1: Wet (salt fog)/dry/humid (ISO 11997-1:2017)*

EN ISO 16120-1:2017, *Non-alloy steel wire rod for conversion to wire - Part 1: General requirements (ISO 16120-1:2017)*

EN ISO 16120-2:2017, *Non-alloy steel wire rod for conversion to wire - Part 2: Specific requirements for general purpose wire rod (ISO 16120-2:2017)*

EN ISO 16120-3:2011, *Non-alloy steel wire rod for conversion to wire - Part 3: Specific requirements for rimmed and rimmed substitute, low-carbon steel wire rod (ISO 16120-3:2011)*

EN ISO 16120-4:2017, *Non-alloy steel wire rod for conversion to wire - Part 4: Specific requirements for wire rod for special applications (ISO 16120-4:2017)*

EN ISO 21968:2019, *Non-magnetic metallic coatings on metallic and non-metallic basis materials - Measurement of coating thickness - Phase-sensitive eddy-current method (ISO 21968:2019)*

ISO 965-1:2013, *ISO general purpose metric screw threads - Tolerances - Part 1: Principles and basic data*

ISO 965-2:1998, *ISO general purpose metric screw threads - Tolerances - Part 2: Limits of sizes for general purpose external and internal screw threads - Medium quality*

ISO 965-3:1998, *ISO general purpose metric screw threads - Tolerances - Part 3: Deviations for constructional screw threads*

ISO 965-4:1998, *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*

[3] As impacted by EN ISO 10684:2004/AC:2009.

ISO 965-5:1998, *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, definitions, symbols, units and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1995-1-1:2004 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
smooth shank nail
nail that has a constant cross-section along its entire length

EXAMPLE Round, square or grooved.

3.1.2
ring shank nail
nail that has a profiled shank along a part of its length

EXAMPLE Ringed or twisted.

Note 1 to entry: The profiled length l_g is defined in Figure G.1 b).

3.1.3
staple crown width
distance between the outer edges of the staple legs

3.1.4
dowel
cylindrical metal fastener that does not contain an integral head

3.1.5
bolt
cylindrical metal fastener consisting of a screw part and a nut part

3.1.6
nominal diameter
cross-sectional dimension of a dowel-type fastener for the determination of a load bearing capacity

Note 1 to entry: Nails: for smooth shank nails, spiral rolled nails or annular ring shank nails, d is the outer cross-sectional diameter of the round nail wire, or the side length dimension of the cross-section for a square nail, for all other profiled nails, *d* is the cross-sectional diameter of the original wire rod, from which the profiled nail has been produced.

Note 2 to entry: Staples: *d* is the diameter of a round rod with the same area as that of the cross-sectional area of one leg of the staple. See G.2 for exceptions.

Note 3 to entry: Screws: *d* is the outer thread diameter.

Note 4 to entry: Dowels: *d* is the diameter.

Note 5 to entry: Bolts: *d* is the nominal diameter of the threaded part of the screw.

3.1.7
target diameter
diameter used to declare the nominal diameter of screws intended for use in load bearing timber structures as specified in G.3

Note 1 to entry: For the purpose of both production specifications and applicability, screws may only be produced allowing some tolerances. Thus for production purposes these tolerances are measured on the target diameter, d_t.

3.1.8
inner thread diameter
inner diameter of the thread of a screw

Note 1 to entry: The inner diameter is used in EN 1995-1-1:2004 to determine the effective diameter for laterally loaded screws.

3.1.9
stiffness
force for a unit deformation

3.1.10
coating type
the purpose of a coating is defined as follows:

— Type 1 coating: corrosion protection, with either pure zinc coating or hot-dipped galvanized coating or alternative coatings;

— Type 2 coating: lubrication, to facilitate insertion;

— Type 3 coating: withdrawal enhancement and/or collation for nails and staples (adhesive and/or resin coatings)

Note 1 to entry: A coating can serve more than one purpose, i.e. for staples the coating is both adhesive and serves collation purposes.

3.2 Symbols, units and abbreviated terms

For the purposes of this document, the symbols and abbreviations given in EN 1995-1-1:2004[4] and the following apply:

A_{80}	percentage elongation (%)
A_h	nail head area (mm²)
A_s	staple leg cross-sectional area (mm²)
b_R	staple crown width (mm)
d	nominal diameter (mm)
d_h	head diameter (mm)
d_s	diameter of the smooth shank of a screw (mm)
d^t	target diameter (mm)
d_i	inner thread diameter; inner diameter of fluting (mm)
d_1	secondary thread diameter (mm)
$f_{ax,k}$	characteristic withdrawal parameter (N/mm²)
$f_{head,k}$	characteristic head pull-through parameter (N/mm²)
$F_{tens,k}$	characteristic tensile capacity (N)
$f_{y,tens,k}$	characteristic tensile yield stress (N/mm²)
f_u	tensile strength of the wire (N/mm²)
h_t	nail head thickness (mm)
L	nominal dowel-type fastener length (mm)
l_g	length of profiling/threading (mm)
$l_{g,1}$	length of the secondary profiling/threading (mm)
l_p	length of the nail point (mm)
$M_{y,Rk}$	characteristic yield moment (N.mm)
$M_{tor,Rk}$	characteristic torsional moment capacity (N.mm)
α	bend angle (°)
α_c	bend angle under cyclic loading (°)
ρ_k	characteristic timber density when conditioned to constant mass at 20 °C and 65 % relative humidity (kg/m³)
ω	moisture content

[4] As impacted by EN 1995-1-1:2004/A1:2008 and EN 1995-1-1:2004/A2:2014.

4 General product characteristics – Testing, assessment and sampling method

4.1 Corrosion resistance

4.1.1 General

Dowel-type fasteners shall withstand corrosion exposure of both the timber and the atmosphere for the design service life. Pure zinc coated and hot-dipped galvanized coated dowel-type fasteners shall be assigned to a T-category and C-category in accordance with Table 1 and Table 2. Stainless steel dowel-type fasteners shall be assigned to a category for corrosion resistance in atmosphere expressed by a Corrosion Resistance Class (CRC) and a T-category in accordance with Table 3 and Table 4. Alternative coated dowel-type fasteners shall be assigned to a T-category and C-category in accordance with Table 5 and Table 6.

The T-category refers to the fastener resistance with respect corrosion caused by the timber. The C-category and CRC refers to the fastener resistance with respect corrosion caused by the atmosphere.

The design service life is generally assumed to be 50 years for T-categories, C-categories and CRC. In addition, for alternative coated dowel-type fasteners to be used in structures with shorter service life or in replaceable structural parts, additional T-categories and C-categories with a design service life of 15 years are provided in Clause 4.1.4.

NOTE Advices on appropriate categories specification are given in Annex B.

4.1.2 Pure zinc coating and hot-dipped galvanized coating

4.1.2.1 Determination

The specifications to achieve a category of corrosion resistance with respect to timber and atmospheres shall be determined in accordance with Table 1 and Table 2, respectively. The corrosion protection stated in these tables is assumed to secure a design service life of 50 years.

4.1.2.2 Evaluation

The zinc thicknesses shall be measured in accordance with Annex C. The mean value of the coating thickness, measured in accordance with Annex C, shall be greater than or equal to the thickness specified by the manufacturer.

The zinc layer thickness of Table 1 and Table 2 may be reduced when a protective layer is applied. For applications in C2 atmospheres, CrIII passivation may reduce the required coating thickness by 25 %, and with CrVI passivation the required coating thickness may be reduced by 50 %.

4.1.2.3 Expression

The corrosion resistance of dowel-type fasteners made of pure zinc coated carbon steel or hot-dipped galvanized coated carbon steel shall be expressed according to Table 1 and Table 2, giving the dowel-type fastener a corrosion resistance category for both timber and atmosphere. The indication of the categories implies fulfilment with the provisions for corrosion resistance.

EXAMPLE 1 T3/C3.

Table 1 — Categories for corrosion resistance of dowel-type fasteners in timber — Minimum thicknesses for pure zinc coating and hot-dipped galvanized coating

Timber category	T1	T2	T3	T4	T5
Zinc thickness on carbon steel	–	10 µm	20 µm	55 µm	n.a.

Table 2 — Categories for corrosion resistance of dowel-type fasteners in atmospheres — Minimum thicknesses for pure zinc coating and hot-dipped galvanized coating

Atmosphere category	C1	C2nw	C2w	C3	C4	C5
Zinc thickness on carbon steel	–	10 µm	20 µm	55 µm	110 µm	n.a.

NOTE The minimum zinc thicknesses are based on the upper limit of the average steady corrosion rate for zinc in the first 20 years of EN ISO 9224:2012 and linearly extended to 50 years.

4.1.3 Stainless steel

4.1.3.1 Determination

The specifications to achieve a category of corrosion resistance with respect to atmospheres shall be determined in accordance with Table 3. The specifications to achieve a category of corrosion resistance with respect to timber shall be determined in accordance with Table 4. The corrosion protection stated in these tables is assumed to secure a design service life of 50 years.

4.1.3.2 Evaluation

The assignment of stainless steel grades to CRC is given in Table 3.

4.1.3.3 Expression

The corrosion resistance of dowel-type fasteners made of stainless steel shall be expressed giving the dowel-type fastener a corrosion resistance category for timber according to Table 4 and a CRC for atmospheric corrosivity according to Table 3.

In addition, either the steel number according to EN 10088-1:2014 or steel grade according to EN ISO 3506-1:2009, Table 1 may be added. The indication of the T-category and the CRC class implies fulfilment with the provisions for corrosion resistance.

EXAMPLE 1 T3/CRC II.

EXAMPLE 2 T3/C3 (1.4567); T3/CII (A2).

Table 3 — Stainless steel grades assigned to Corrosion Resistance Classes

Corrosion Resistance Class (CRC)	Steel number according to EN 10088-1:2014	EN ISO 3506-1:2009, Table 1
CRC II	1.4301	A2
	1.4307	A2
	1.4567	A2
	1.4541	A3
	1.4318	-
	1.4306	-
	1.4311	-
	1.4482	-

Corrosion Resistance Class (CRC)	Steel number according to EN 10088-1:2014	EN ISO 3506-1:2009, Table 1
CRC III	1.4401	A4
	1.4404	A4
	1.4578	A4
	1.4571	A5
	1.4362	–
	1.4062	–
	1.4162	–
	1.4662	–
	1.4429	-
	1.4432	-
	1.4435	-
CRC IV	1.4439	–
	1.4462	–
	1.4539	–
CRC V	1.4565	–
	1.4529	–
	1.4547	–
	1.4410	-
	1.4501	-
	1.4507	-

NOTE Classes are in accordance with EN 1993-1-4:2006/A1:2015, Annex A.

Table 4 — Categories for corrosion resistance of dowel-type fasteners in timber — Minimum specifications for stainless steel

Timber category	T1	T2	T3	T4	T5
Corrosion Resistance Class for stainless steel	–	–	CRC II	CRC III	CRC III

4.1.4 Alternative coatings

4.1.4.1 Determination

The specifications to achieve a category of corrosion resistance with respect to timber and atmospheres shall be determined in accordance with Table 5 and Table 6, respectively. The corrosion protection stated in these tables is assumed to secure a design service life of 50 years unless otherwise specified.

Alternative coated dowel-type fasteners satisfying test procedure according to A.2.1 shall be assigned to classes T3 and C2w.