April 2019

DIN EN 1992-4

ICS 91.010.30; 91.080.40

Supersedes: see below

Eurocode 2 – Design of concrete structures – Part 4: Design of fastenings for use in concrete; English version EN 1992-4:2018, English translation of DIN EN 1992-4:2019-04

Eurocode 2 –
Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken –
Teil 4: Bemessung der Verankerung von Befestigungen in Beton;
Englische Fassung EN 1992-4:2018,
Englische Übersetzung von DIN EN 1992-4:2019-04

Eurocode 2 –
Calcul des structures en béton –
Partie 4: Conception et calcul des éléments de fixation pour béton;
Version anglaise EN 1992-4:2018,
Traduction anglaise de DIN EN 1992-4:2019-04

Supersedes DIN CEN/TS 1992-4-1 (DIN SPEC 1021-4-1):2009-08, DIN CEN/TS 1992-4-2 (DIN SPEC 1021-4-2):2009-08, DIN CEN/TS 1992-4-3 (DIN SPEC 1021-4-3):2009-08, DIN CEN/TS 1992-4-4 (DIN SPEC 1021-4-4):2009-08 and DIN CEN/TS 1992-4-5 (DIN SPEC 1021-4-5):2009-08

Document comprises 133 pages

Translation by DIN-Sprachendienst.

In case of doubt, the German-language original shall be considered authoritative.

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A comma is used as the decimal marker.

National foreword

This document (EN 1992-4:2018) has been prepared by Technical Committee CEN/TC 250 "Structural Eurocodes" (Secretariat: BSI, United Kingdom).

The responsible German body involved in its preparation was *DIN-Normenausschuss Bauwesen* (DIN Standards Committee Building and Civil Engineering), Working Group NA 005-07-01-01 AK "Design of fastenings for use in concrete (national mirror committee for CEN/TC 250/SC 2/WG 2)".

This standard includes a National footnote to subclause 6.2.1(1).

Amendments

This standard differs from DIN CEN/TS 1992-4-1 (DIN SPEC 1021-4-1):2009-08, DIN CEN/TS 1992-4-2 (DIN SPEC 1021-4-2):2009-08, DIN CEN/TS 1992-4-3 (DIN SPEC 1021-4-3):2009-08, DIN CEN/TS 1992-4-4 (DIN SPEC 1021-4-4):2009-08 and DIN CEN/TS 1992-4-5 (DIN SPEC 1021-4-5):2009-08 as follows:

a) the content of the standards series CEN/TS 1992-4 has been shortened and completely revised in order to be able to publish a single standard covering the design of different types of inserts and post-installed fastening elements;

b) normative references have been updated; some standards referenced to in the standards series CEN/TS 1992-4 have been moved to the Bibliography (new);

c) 1.2 (5) and Figure 1.2: the configuration of fastenings with headed or post-installed fasteners covered by EN 1992-4 has been described in more detail;

d) 1.31.3 (1), 1.3 (2) and 7.3: requirements for fastening elements for fastening statically indeterminate non-structural systems have been included. Details of the design method are given in CEN/TR 17079, *Design of fasteners for use in concrete — Redundant non-structural systems*;

e) 4.4.2.2 and Table 4.1: partial material safety factors for accidental design situations which are about 15% smaller than those for permanent and transient design situations have been included;

f) 6.2.1 (2): more specific conditions have been included in order to ensure rigid fixtures and requirements have been added in cases where elastic but flexible fixtures are used;

g) Clauses 7 to 11: the verifications are based on the characteristic cylinder strength rather than on the cube strength; the factors k_i for the calculation of the basic characteristic resistances for the different failures modes have been adapted accordingly;

h) 7.2.1.4 (1), Formula (7.1) and 7.2.1.4 (7): the factor $\psi_{M,N}$ has been introduced to take into account the favorable effect of a compression force between fixture and concrete on the concrete cone resistance in case of bending moments with or without axial force;

i) 7.2.1.6 (2), Formula (7.14): the product dependent factor ψ_{sus} has been introduced to take into account the influence of sustained load on the bond strength of post-installed bonded fasteners for the verification of combined pull-out and concrete failure;

j) 7.2.2.5 (13) and 7.4.2.5 (7): the factor $\psi_{re,V}$ to take into account the effect of edge reinforcement and closely spaced stirrups or wire mesh on the characteristic resistance for concrete edge failure has been limited to cracked concrete;

k) 7.4.1.3 (2) and 7.4.2.3 (2): for the verification of anchor channels for local flexure of channel lips under tension loads and shear loads without lever arm, the influence of closely spaced channel bolts has been considered;

l) 7.4.1.7, Formula (7.69): for the verification of the resistance of anchor channels to concrete blow-out failure, the factor $\psi_{g,Nb}$ has been deleted;

m) 7.4.2.3.1 and Table 7.5: for the verification of the resistance of anchor channels to shear forces without lever arm in case of steel failure, the failure modes “anchor” and “connection between anchor and channel” have been added;

n) 7.4.2.5 (2): Formula (7.78) has been modified. The influence of the edge distance on the basic characteristic resistance in case of concrete edge failure has been taken into account with $c_1^{4/3}$ instead of $c_1^{1,5}$;

o) 7.4.3 and Table 7.6: requirements for the different models of steel failure and for failure modes other than steel failure have been included in case of interaction of shear and tension loads acting on anchor channels;

p) Clause 8: the values for the characteristic fatigue resistance in case of concrete related failure modes for $2 \cdot 10^6$ load cycles have been reduced;

q) Clause 9 and Annex C: the verifications for seismic loading have been completely revised;

r) Clause 10: requirements for the verification of fire resistance have been added. The informative Annex D provides a design method for cast-in-place headed fasteners, anchor channels and post-installed fasteners exposed to fire;

s) normative Annex E: characteristics for the design of fastenings to be provided by European Technical Product Specifications have been added;

t) Annex F: product specific sections of the CEN/TS 1992-4 series on assumptions for design specifications on the execution of fastenings have been combined in this normative annex;

u) Annex G: the design specifications of the CEN/TS 1992-4 series for post-installed fasteners using simplified methods have been moved into this informative annex;

v) Annex B of CEN/TS 1992-4-1 “Plastic design approach” has been moved to CEN/TR 17081, *Design of fastenings for use in concrete — Plastic design of fastenings with headed and post-installed fasteners*.

Previous editions

DIN CEN/TS 1992-4-1 (DIN SPEC 1021-4-1): 2009-08
DIN CEN/TS 1992-4-2 (DIN SPEC 1021-4-2): 2009-08
DIN CEN/TS 1992-4-3 (DIN SPEC 1021-4-3): 2009-08
DIN CEN/TS 1992-4-4 (DIN SPEC 1021-4-4): 2009-08
DIN CEN/TS 1992-4-5 (DIN SPEC 1021-4-5): 2009-08

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1992-4

September 2018

ICS 91.010.30; 91.080.40

Supersedes CEN/TS 1992-4-1:2009, CEN/TS 1992-4-2:2009, CEN/TS 1992-4-3:2009, CEN/TS 1992-4-4:2009, CEN/TS 1992-4-5:2009

English Version

Eurocode 2 - Design of concrete structures - Part 4: Design of fastenings for use in concrete

Eurocode 2 - Calcul des structures en béton - Partie 4: Conception et calcul des éléments de fixation pour béton

Eurocode 2 - Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 4: Bemessung der Verankerung von Befestigungen in Beton

This European Standard was approved by CEN on 9 March 2018.

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

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 1992-4:2018) has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes”, 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 March 2019 and conflicting national standards shall be withdrawn at the latest by March 2019.

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 CEN/TS 1992-4-1:2009, CEN/TS 1992-4-2:2009, CEN/TS 1992-4-3:2009, CEN/TS 1992-4-4:2009 and CEN/TS 1992-4-5:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document differs from CEN/TS 1992-4-1:2009, CEN/TS 1992-4-2:2009, CEN/TS 1992-4-3:2009, CEN/TS 1992-4-4:2009 and CEN/TS 1992-4-5:2009 as follows:

— The content of the CEN/TS 1992-4 series is condensed and completely revised to be published as one single standard covering the design of the different types of cast-in situ and post-installed fastening systems.

— Normative references are updated. Some standards given in the CEN/TS 1992-4 series are moved to an added Bibliography.

— 1.2 (5) and Fig.1.2: The configurations of fastenings with headed or post-installed fasteners covered by EN 1992-4 are described in more detail.

— 1.3 (1), 1.3(2) and 7.3: Provisions on fasteners for fastening statically indeterminate non-structural systems are added. Details of the design method are given in CEN/TR 17079, *Design of fasteners for use in concrete - Redundant non-structural systems.*

— 4.4.2.2 and Table 4.1: Partial material safety factors for accidental design situations are introduced which are about 15% smaller than for permanent and transient design situations.

— 6.2.1 (2): More specific conditions to ensure a rigid fixture are given and provisions in case of an elastic, but flexible fixture are added.

— 7 to 11: The verifications are based on the characteristic concrete cylinder strength and not cube strength and the factors k_i for calculating the basic characteristic resistances for the different failure modes are adjusted accordingly.

— 7.2.1.4 (1), Formula (7.1) and 7.2.1.4 (7): The factor $\psi_{M,N}$ is introduced to take into account the favorable effect of a compression force between fixture and concrete in case of bending moments with or without axial force on the concrete cone resistance.

— 7.2.1.6 (2), Formula (7.14): The product dependent factor ψ_{sus} is introduced to take account of the influence of sustained load on the bond strength of post-installed bonded fasteners for the verification of combined pull-out and concrete failure

— 7.2.2.5 (13) and Clause 7.4.2.5 (7): The factor $\psi_{re,V}$ to take into account the effect of edge reinforcement and closely spaced stirrups or wire mesh on the characteristic resistance for concrete edge failure is limited to cracked concrete.

— 7.4.1.3 (2) and 7.4.2.3 (2): For the verification of anchor channels for local flexure of channel lips under tension loads and shear loads without lever arm the influence of closely spaced channel bolts is considered.

— 7.4.1.7, Formula (7.69): For the verification of anchor channels for concrete blow-out failure the factor $\psi_{g,Nb}$ is deleted.

— 7.4.2.3.1 and Table 7.5: For the verification of anchor channels subjected to shear forces without lever arm in case of steel failure the failure modes 'anchor' and 'connection between anchor and channel' are added.

— 7.4.2.5 (2): Formula (7.78) is modified. The influence of edge distance on the basic characteristic resistance in case of concrete edge failure is taken into account with $c_1^{4/3}$ instead with $c_1^{1,5}$.

— 7.4.3 and Table 7.6: In case of interaction of shear and tension loads acting on anchor channels provisions are given for the different modes of steel failure and for failure modes other than steel failure.

— Clause 8: The values for the characteristic fatigue resistance in case of concrete related failure modes for $2 \cdot 10^6$ load cycles are reduced.

— Clause 9 and Annex C: The verifications for seismic loading are completely revised.

— Clause 10: Provisions for the verification for fire resistance are added. Informative Annex D provides a design method for cast-in-place headed fasteners, anchor channels and post-installed fasteners exposed to fire.

— Normative Annex E: Characteristics for the design of fastenings to be provided by European Technical Product Specifications are added.

— Annex F: Product specific Sections of the CEN/TS 1992-4 series on assumptions for design provisions regarding execution of fastenings are condensed in this normative Annex.

— Annex G: The design provisions of the CEN/TS 1992-4 series for post-installed fasteners using simplified methods are moved to this informative Annex.

— Annex B of CEN/TS 1992-4:1"Plastic design approach" is moved to CEN/TR 17081, *Design of fastenings for use in concrete – Plastic design of fastenings with headed and post-installed fasteners.*

EN 1992 is composed of the following parts:

— EN 1992-1-1, *Eurocode 2: Design of concrete structures — Part 1-1: General rules and rules for buildings*;

— EN 1992-1-2, *Eurocode 2: Design of concrete structures — Part 1-2: General rules — Structural fire design*;

— EN 1992-2, *Eurocode 2 — Design of concrete structures — Concrete bridges — Design and detailing rules*;

— EN 1992-3, *Eurocode 2 — Design of concrete structures — Part 3: Liquid retaining and containment structures*;

— EN 1992-4, *Eurocode 2 — Design of concrete structures — Part 4: Design of fastenings for use in concrete*.