



**BSI Standards Publication**

## **Eurocode 9 — Design of aluminium structures**

---

Part 1-1: General rules

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

## National foreword

This British Standard is the UK implementation of EN 1999-1-1:2023. It supersedes BS EN 1999-1-1:2007+A2:2013, which will be withdrawn on 30 March 2028.

The UK participation in its preparation was entrusted to Technical Committee B/525/9, Structural use of aluminium.

A list of organizations represented on this committee can be obtained on request to its committee manager.

National choice is allowed in this standard where explicitly stated within notes. The National Annex to this standard contains the national choices to be used for buildings and civil engineering works constructed in the UK.

The first generation of EN Eurocodes was published between 2002 and 2007, with conflicting British Standards withdrawn in 2010. This document forms part of the second generation of EN Eurocodes.

The second generation of EN Eurocodes is expected to be published between 2023 and 2026. These documents are being published as soon as they are available. This is being done to enable users to prepare for the transition from the first generation to second generation of EN Eurocodes.

UK adoptions of the first generation of EN Eurocodes will be withdrawn by BSI on 30 March 2028. Until that date, the first generation documents should be considered as the applicable standards for buildings and civil engineering works constructed in the UK unless otherwise specified by the relevant authority or in the specification for a particular project.

This standard is intended to be used with its National Annex and other referenced documents, including other second generation Eurocodes, as an interdependent suite of documents.

While the use of provisions in this standard in conjunction with first generation Eurocodes is not precluded, it should be undertaken with care and should only be done when users are satisfied that it will not result in a lower level of reliability than the minimum level set in the first generation Eurocodes and associated UK National Annexes.

### Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

© The British Standards Institution 2023  
Published by BSI Standards Limited 2023

ISBN 978 0 539 12371 5

ICS 77.150.10; 91.010.30; 91.080.10

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2023.

**Amendments/corrigenda issued since publication**

Date

Text affected

---

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

This is a preview of BS EN 1999-1-1:2023. Click here to purchase the full version from the ANSI store.

**EUROPÄISCHE NORM**

March 2023

ICS 91.010.30; 91.080.17

Supersedes EN 1999-1-1:2007

English Version

**Eurocode 9 - Design of aluminium structures - Part 1-1:  
General rules**Eurocode 9 - Calcul des structures en aluminium -  
Partie 1-1: Règles généralesEurocode 9 - Bemessung und Konstruktion von  
Aluminiumtragwerken - Teil 1-1: Allgemeine  
Bemessungsregeln

This European Standard was approved by CEN on 2 January 2023.

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.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

European foreword .....	8
0 Introduction.....	10
1 Scope.....	13
2 Normative references.....	14
3 Terms, definitions and symbols .....	15
3.1 Terms and definitions .....	15
3.2 Symbols .....	17
3.3 Conventions for member axes.....	32
4 Basis of design.....	34
4.1 General rules .....	34
4.1.1 Basic requirements .....	34
4.1.2 Structural reliability .....	34
4.1.3 Design service life, durability and robustness.....	34
4.2 Principles of limit state design.....	35
4.3 Basic variables .....	35
4.3.1 Actions and environmental influences .....	35
4.3.2 Material and product properties.....	35
4.4 Verification by the partial factor method .....	35
4.4.1 Design value of material properties .....	35
4.4.2 Design value of geometrical data .....	35
4.4.3 Design resistances .....	35
4.5 Design assisted by testing.....	36
4.6 Execution requirements.....	36
5 Materials .....	37
5.1 General.....	37
5.2 Structural aluminium.....	37
5.2.1 Range of materials.....	37
5.2.2 Material properties for wrought and casting alloys.....	39
5.2.3 Material properties for cast aluminium alloys .....	46
5.2.4 Dimensions, mass and tolerances.....	47
5.2.5 Design values of material constants .....	47
5.3 Connecting devices.....	48
5.3.1 General.....	48
5.3.2 Bolts, nuts, washers and self-tapping and self-drilling screws .....	48
5.3.3 Rivets.....	50
5.3.4 Welding consumables .....	50
5.3.5 Adhesives.....	51
6 Durability.....	51
7 Structural analysis.....	52
7.1 Structural modelling for analysis .....	52
7.1.1 Structural modelling and basic assumptions .....	52
7.1.2 Joint modelling.....	52
7.1.3 Ground-structure interaction.....	52
7.2 Global analysis .....	52
7.2.1 Effects of deformed geometry of the structure .....	52
7.2.2 Structural stability of frames.....	53
7.3 Imperfections .....	54
7.3.1 General.....	54

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

7.3.3	Imperfection for analysis of bracing systems .....	61
7.3.4	Member imperfections .....	63
7.4	Methods of analysis.....	63
7.4.1	General .....	63
7.4.2	Elastic global analysis .....	64
7.4.3	Plastic global analysis .....	64
8	Ultimate limit states for members.....	64
8.1	Basis.....	64
8.1.1	General .....	64
8.1.2	Characteristic value of strength .....	64
8.1.3	Partial factors.....	65
8.1.4	Classification of cross-sections.....	65
8.1.5	Local buckling resistance in class 4 members .....	73
8.1.6	HAZ softening adjacent to welds .....	74
8.2	Resistance of cross-sections .....	77
8.2.1	General .....	77
8.2.2	Section properties .....	78
8.2.3	Tension.....	79
8.2.4	Compression.....	80
8.2.5	Bending moment.....	81
8.2.6	Shear.....	84
8.2.7	Torsion .....	85
8.2.8	Bending and shear.....	86
8.2.9	Bending and axial force .....	87
8.2.10	Bending, shear and axial force.....	88
8.2.11	Web bearing.....	88
8.3	Buckling resistance of members .....	89
8.3.1	Members in compression.....	89
8.3.2	Members in bending.....	95
8.3.3	Members in bending and axial compression .....	98
8.4	Simplified analysis of resistance .....	103
8.5	Uniform built-up members .....	104
8.5.1	General .....	104
8.5.2	Laced compression members.....	106
8.5.3	Battened compression members .....	108
8.5.4	Closely spaced built-up members.....	109
8.6	Un-stiffened plates under in-plane loading .....	110
8.6.1	General .....	110
8.6.2	Resistance under uniform compression .....	111
8.6.3	Resistance under in-plane moment.....	112
8.6.4	Resistance under transverse or longitudinal stress gradient.....	113
8.6.5	Shear resistance.....	113
8.6.6	Resistance under out-of-plane loading.....	114
8.6.7	Resistance under combined action .....	115
8.7	Stiffened plates under in-plane loading .....	116
8.7.1	General .....	116
8.7.2	Stiffened plates under uniform compression.....	117
8.7.3	Stiffened plates under in-plane moment .....	119
8.7.4	Longitudinal stress gradient on multi-stiffened plates .....	120
8.7.5	Multi-stiffened plate in shear.....	120
8.7.6	Buckling load for orthotropic plates .....	121
8.7.7	Out-of-plane loading.....	124
8.7.8	Resistance under combined loading.....	126

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

8.8.1	General.....	128
8.8.2	Resistance of plate girders under in-plane bending.....	128
8.8.3	Plate girders with longitudinal web stiffeners .....	129
8.8.4	Shear resistance .....	131
8.8.5	Resistance to transverse forces.....	136
8.8.6	Interaction.....	140
8.8.7	Flange induced buckling .....	141
8.8.8	Web stiffeners .....	142
8.9	Members with corrugated webs.....	143
8.9.1	General.....	143
8.9.2	Bending moment resistance .....	143
8.9.3	Shear force resistance.....	144
9	Serviceability limit states .....	146
9.1	General.....	146
9.2	Deformations and dynamic effects for buildings .....	146
10	Design of joints .....	147
10.1	Basis of design.....	147
10.1.1	Introduction.....	147
10.1.2	Applied forces and moments.....	147
10.1.3	Resistance of joints.....	148
10.1.4	Design assumptions .....	148
10.1.5	Fabrication and execution.....	148
10.2	Intersections for bolted, riveted and welded joints.....	149
10.3	Joints loaded in shear subject to impact, vibration and/or load reversal .....	149
10.4	Classification of joints .....	149
10.5	Connections made with bolts, rivets and pins.....	149
10.5.1	Positioning of holes for bolts and rivets.....	149
10.5.2	Deductions for fastener holes .....	152
10.5.3	Categories of bolted connections .....	155
10.5.4	Design resistances of bolts .....	157
10.5.5	Design resistance of rivets.....	159
10.5.6	Countersunk bolts and rivets .....	160
10.5.7	Self-tapping and self-drilling screws and blind rivets.....	160
10.5.8	Bolts in slip-resistant connections .....	161
10.5.9	Long joints .....	163
10.5.10	Single lap joints of flats with only one row of fasteners .....	163
10.5.11	Fasteners through packings .....	164
10.5.12	Pin connections .....	164
10.5.13	Aluminium connecting devices .....	166
10.6	Welded connections.....	167
10.6.1	General.....	167
10.6.2	Design of welded connections.....	168
10.7	Design of friction stir welds .....	183
10.8	Hybrid connections.....	184
10.9	Special joints.....	184
10.9.1	General.....	184
10.9.2	Bolt-channel joints .....	185
10.9.3	Screw grooves and screw ports .....	188
10.10	Equivalent T-stub in tension.....	188
10.10.1	General.....	188
10.10.2	Prying Forces in typical T-Stub Stand-alone Connection .....	189
10.10.3	General rules for resistance evaluation .....	191
10.10.4	Geometrical limitations.....	199

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

10.11.1	General .....	199
10.11.2	Column web in transverse tension .....	200
10.11.3	Column web in transverse compression.....	204
10.12	Adhesive bonded joints .....	206
10.13	Other joining methods .....	206
<b>Annex A (normative) Quality requirements for execution.....</b>		<b>207</b>
A.1	Use of this annex .....	207
A.2	Scope and field of application .....	207
A.3	General .....	207
A.4	Selection process for execution class .....	208
A.5	Evaluation of utilization grades .....	210
<b>Annex B (informative) Finite Element Methods of analysis (FEM).....</b>		<b>211</b>
B.1	Use of this Annex.....	211
B.2	Scope and field of application .....	211
B.3	Use of FEM for design .....	211
B.4	Modelling.....	212
B.5	Choice of software and documentation .....	212
B.6	Use of imperfections.....	212
B.7	Material properties.....	214
B.8	Loads .....	214
B.9	Limit state criteria.....	214
B.10	Partial factors.....	215
<b>Annex C (informative) Materials selection.....</b>		<b>218</b>
C.1	Use of this Annex.....	218
C.2	Scope and field of application .....	218
C.3	General .....	218
C.4	Wrought products .....	218
C.5	Cast products.....	222
<b>Annex D (informative) Corrosion and surface protection .....</b>		<b>224</b>
D.1	Use of this Annex.....	224
D.2	Scope and field of application .....	224
D.3	Corrosion of aluminium under various exposure conditions .....	224
D.4	Durability ratings of aluminium alloys.....	226
D.5	Corrosion protection .....	227
<b>Annex E (normative) Castings .....</b>		<b>233</b>
E.1	Use of this Annex.....	233
E.2	Scope and field of application .....	233
E.3	General design provisions for castings.....	233
<b>Annex F (informative) Analytical models for stress-strain relationship .....</b>		<b>236</b>
F.1	Use of this Annex.....	236
F.2	Scope and field of application .....	236
F.3	Analytical models .....	236
F.4	Approximate evaluation of $\epsilon_{uni,max}$ .....	244
<b>Annex G (informative) Geometrical properties of cross-sections.....</b>		<b>245</b>
G.1	Use of this Annex.....	245
G.2	Scope and field of application .....	245
G.3	Torsion constant $I_t$ .....	245
G.4	Torsion modulus $W_t$ .....	246
G.5	Position of shear centre S .....	246
G.6	Warping constant $I_w$ .....	246

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

<b>G.8</b>	<b>Torsion constant of cross-section with closed part.....</b>	<b>252</b>
<b>G.9</b>	<b>Shear area.....</b>	<b>253</b>
<b>G.10</b>	<b>Plastic section modulus and interaction formula.....</b>	<b>254</b>
<b>Annex H (informative) Behaviour of cross-sections beyond elastic limit.....</b>		<b>256</b>
<b>H.1</b>	<b>Use of this Annex.....</b>	<b>256</b>
<b>H.2</b>	<b>Scope and field of application .....</b>	<b>256</b>
<b>H.3</b>	<b>Definition of cross-section limit states .....</b>	<b>256</b>
<b>H.4</b>	<b>Classification of cross-sections to limit states.....</b>	<b>257</b>
<b>H.5</b>	<b>Boundary values of ultimate axial load .....</b>	<b>258</b>
<b>H.6</b>	<b>Boundary values of ultimate moment.....</b>	<b>259</b>
<b>H.7</b>	<b>Ultimate resistance .....</b>	<b>260</b>
<b>Annex I (informative) Lateral-torsional buckling of beams and torsional or torsional-flexural buckling of compressed members .....</b>		<b>261</b>
<b>I.1</b>	<b>Use of this Annex.....</b>	<b>261</b>
<b>I.2</b>	<b>Scope and field of application .....</b>	<b>261</b>
<b>I.3</b>	<b>Elastic critical moment and slenderness.....</b>	<b>261</b>
<b>I.4</b>	<b>Slenderness for lateral-torsional buckling.....</b>	<b>271</b>
<b>I.5</b>	<b>Elastic critical axial force for torsional and torsional-flexural buckling.....</b>	<b>272</b>
<b>I.6</b>	<b>Slenderness for torsional and torsional-flexural buckling .....</b>	<b>275</b>
<b>Annex J (informative) Shear lag effects in member design.....</b>		<b>279</b>
<b>J.1</b>	<b>Use of this Annex.....</b>	<b>279</b>
<b>J.2</b>	<b>Scope and field of application .....</b>	<b>279</b>
<b>J.3</b>	<b>Effective width for elastic shear lag .....</b>	<b>279</b>
<b>J.4</b>	<b>Shear lag at ultimate limit states.....</b>	<b>283</b>
<b>Annex K (informative) Plastic hinge method for continuous beams .....</b>		<b>284</b>
<b>K.1</b>	<b>Use of this Annex.....</b>	<b>284</b>
<b>K.2</b>	<b>Scope and field of application .....</b>	<b>284</b>
<b>K.3</b>	<b>Determination of ultimate bending moment <math>M_u</math>.....</b>	<b>285</b>
<b>Annex L (informative) Cross-sectional ductility and rotation capacity .....</b>		<b>287</b>
<b>L.1</b>	<b>Use of this Annex.....</b>	<b>287</b>
<b>L.2</b>	<b>Scope and field of application .....</b>	<b>287</b>
<b>L.3</b>	<b>Moment-curvature analysis of cross-section.....</b>	<b>288</b>
<b>L.4</b>	<b>Evaluation of rotation capacity.....</b>	<b>293</b>
<b>L.5</b>	<b>Empirical relations for ultimate resistance .....</b>	<b>294</b>
<b>L.6</b>	<b>Empirical relations for rotation capacity .....</b>	<b>295</b>
<b>Annex M (informative) Classification of joints.....</b>		<b>297</b>
<b>M.1</b>	<b>Use of this Annex.....</b>	<b>297</b>
<b>M.2</b>	<b>Scope and field of application .....</b>	<b>297</b>
<b>M.3</b>	<b>General.....</b>	<b>297</b>
<b>M.4</b>	<b>Fully restoring joints .....</b>	<b>298</b>
<b>M.5</b>	<b>Partially restoring joints.....</b>	<b>298</b>
<b>M.6</b>	<b>Classification according to rigidity.....</b>	<b>298</b>
<b>M.7</b>	<b>Classification according to strength.....</b>	<b>298</b>
<b>M.8</b>	<b>Classification according to ductility.....</b>	<b>299</b>
<b>M.9</b>	<b>General design requirements for joints .....</b>	<b>301</b>
<b>M.10</b>	<b>Requirements for framing joints.....</b>	<b>301</b>
<b>Annex N (informative) The use of the component method for joints .....</b>		<b>305</b>
<b>N.1</b>	<b>Use of this Annex.....</b>	<b>305</b>
<b>N.2</b>	<b>Scope and field of application .....</b>	<b>305</b>
<b>Annex O (informative) Screw grooves and screw ports.....</b>		<b>306</b>

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

<b>O.2</b>	<b>Scope and field of application</b> .....	<b>306</b>
<b>O.3</b>	<b>Tensile resistance</b> .....	<b>307</b>
<b>O.4</b>	<b>Shear resistance</b> .....	<b>309</b>
<b>Annex P (informative) Adhesive bonded joints</b> .....		<b>312</b>
<b>P.1</b>	<b>Use of this Annex</b> .....	<b>312</b>
<b>P.2</b>	<b>Scope and field of application</b> .....	<b>312</b>
<b>P.3</b>	<b>General</b> .....	<b>312</b>
<b>P.4</b>	<b>Adhesives</b> .....	<b>312</b>
<b>P.5</b>	<b>Design of adhesive bonded joints</b> .....	<b>313</b>
<b>P.6</b>	<b>Tests</b> .....	<b>315</b>
<b>Annex Q (informative) Determining the extent of HAZ from hardness tests</b> .....		<b>316</b>
<b>Q.1</b>	<b>Use of this Annex</b> .....	<b>316</b>
<b>Q.2</b>	<b>Scope and field of application</b> .....	<b>316</b>
<b>Q.3</b>	<b>Determining the extent of HAZ from hardness tests</b> .....	<b>316</b>
<b>Annex R (informative) Weld studs connected by arc stud welding with tip ignition</b> .....		<b>318</b>
<b>R.1</b>	<b>Use of this Annex</b> .....	<b>318</b>
<b>R.2</b>	<b>Scope and field of application</b> .....	<b>318</b>
<b>R.3</b>	<b>Construction</b> .....	<b>318</b>
<b>R.4</b>	<b>Design</b> .....	<b>319</b>
<b>Annex S (normative) Aluminium bridges</b> .....		<b>321</b>
<b>S.1</b>	<b>Use of this Annex</b> .....	<b>321</b>
<b>S.2</b>	<b>Scope and field of application</b> .....	<b>321</b>
<b>S.3</b>	<b>Terms, definitions and symbols</b> .....	<b>321</b>
<b>S.4</b>	<b>Basis of design</b> .....	<b>321</b>
<b>S.5</b>	<b>Materials</b> .....	<b>322</b>
<b>S.6</b>	<b>Durability</b> .....	<b>322</b>
<b>S.7</b>	<b>Structural Analysis</b> .....	<b>323</b>
<b>S.8</b>	<b>Ultimate limit states</b> .....	<b>324</b>
<b>S.9</b>	<b>Serviceability limit states</b> .....	<b>325</b>
<b>S.10</b>	<b>Fatigue</b> .....	<b>326</b>
<b>S.11</b>	<b>Detailing</b> .....	<b>327</b>
<b>Annex T (informative) Lattice spatial roof structures</b> .....		<b>340</b>
<b>T.1</b>	<b>Use of this Annex</b> .....	<b>340</b>
<b>T.2</b>	<b>Scope and field of application</b> .....	<b>340</b>
<b>T.3</b>	<b>General requirements</b> .....	<b>340</b>
<b>T.4</b>	<b>Double layer reticulated structures</b> .....	<b>340</b>
<b>T.5</b>	<b>Single-layer reticulated structures</b> .....	<b>348</b>
<b>Annex U (informative) Composite Aluminium Concrete Beams</b> .....		<b>356</b>
<b>U.1</b>	<b>Use of this Annex</b> .....	<b>356</b>
<b>U.2</b>	<b>Scope and field of application</b> .....	<b>356</b>
<b>U.3</b>	<b>General and main problems</b> .....	<b>356</b>
<b>U.4</b>	<b>Calculation of Internal Forces</b> .....	<b>357</b>
<b>U.5</b>	<b>Ultimate limit states</b> .....	<b>358</b>
<b>U.6</b>	<b>Shear Connectors</b> .....	<b>364</b>
<b>Annex V (normative) Modified Buckling Conditions</b> .....		<b>367</b>
<b>V.1</b>	<b>Use of this Annex</b> .....	<b>367</b>
<b>V.2</b>	<b>Scope and field of application</b> .....	<b>367</b>
<b>V.3</b>	<b>Design of flexural buckling for bow imperfections <math>L/500</math></b> .....	<b>367</b>
<b>Bibliography</b> .....		<b>369</b>

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

This document (EN 1999-1-1:2023) has been prepared by Technical Committee CEN/TC250 "Structural Eurocodes", the secretariat of which is held by BSI. CEN/TC 250 is responsible for all Structural Eurocodes and has been assigned responsibility for structural and geotechnical design matters by CEN.

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 2027 and conflicting national standards shall be withdrawn at the latest by March 2028.

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 1999-1-1:2007.

The main changes compared to the previous edition are listed below:

- Reduction in the number of invitations for Nationally Determined Parameters;
- Introduction of a new material, alloy EN-AW 5383;
- Revision and improvement of the buckling curves;
- Addition of the case of out-of-plane loading on stiffened plating;
- New connection types: Friction Stir Welding, Bolt-Channels and Screw Grooves;
- Improvement and additional provisions for T-stub connection model in tension;
- Clarification of the distinction between buckling members with longitudinal welds and members with transverse welds;
- New provisions covering when the initial bow imperfection  $L/1000$  for members is not fulfilled (Annex V);
- New Annex to determine the extent of HAZ from hardness tests (Annex Q);
- New Annex on weld studs connected by arc stud welding with tip ignition (Annex R);
- New Annex on bridges (Annex S);
- New Annex on lattice space roof structures (Annex T);
- New Annex on composite aluminium-concrete beams (Annex U).

The first generation of EN Eurocodes was published between 2002 and 2007. This document forms part of the second generation of the Eurocodes, which have been prepared under Mandate M/515 issued to CEN by the European Commission and the European Free Trade Association.

The Eurocodes have been drafted to be used in conjunction with relevant execution, material, product and test standards, and to identify requirements for execution, materials, products and testing that are relied upon by the Eurocodes.

This is a preview of BS EN 1999-1-1:2023. [Click here to purchase the full version from the ANSI store.](#)

determine values related to regulatory safety matters at national level through the use of National Annexes.

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.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

## 0.1 Introduction to the Eurocodes

The Structural Eurocodes comprise the following standards generally consisting of a number of Parts:

- EN 1990 Eurocode: Basis of structural and geotechnical design
- EN 1991 Eurocode 1: Actions on structures
- EN 1992 Eurocode 2: Design of concrete structures
- EN 1993 Eurocode 3: Design of steel structures
- EN 1994 Eurocode 4: Design of composite steel and concrete structures
- EN 1995 Eurocode 5: Design of timber structures
- EN 1996 Eurocode 6: Design of masonry structures
- EN 1997 Eurocode 7: Geotechnical design
- EN 1998 Eurocode 8: Design of structures for earthquake resistance
- EN 1999 Eurocode 9: Design of aluminium structures
- New parts are under development, e.g. Eurocode for design of structural glass

The Eurocodes are intended for use by designers, clients, manufacturers, constructors, relevant authorities (in exercising their duties in accordance with national or international regulations), educators, software developers, and committees drafting standards for related product, testing and execution standards.

**NOTE** Some aspects of design are most appropriately specified by relevant authorities or, where not specified, can be agreed on a project-specific basis between relevant parties such as designers and clients. The Eurocodes identify such aspects making explicit reference to relevant authorities and relevant parties.

## 0.2 Introduction to EN 1999 (all parts)

EN 1999 (all parts) applies to the design of buildings and civil engineering and structural works made of aluminium. It complies with the principles and requirements for the safety and serviceability of structures, the basis of their design and verification that are given in EN 1990.

EN 1999 (all parts) is only concerned with requirements for resistance, serviceability, durability and fire resistance of aluminium structures. Other requirements, e.g. concerning thermal or sound insulation, are not considered.

EN 1999 (all parts) does not cover the special requirements of seismic design. Provisions related to such requirements are given in EN 1998, which complements, and is consistent with EN 1999.

For the design of new structures, EN 1999 is intended to be used, for direct application, together with EN 1990, EN 1991, EN 1992, EN 1993, EN 1994, EN 1995, EN 1997, EN 1998 and EN 1999.

Eurocode 9 is subdivided in various parts:

- EN 1999-1-1 Design of Aluminium Structures — Part 1-1: General rules;
- EN 1999-1-2 Design of Aluminium Structures — Part 1-2: Structural fire design;