danish housing and planning authority

DS/EN 1999-1-1 DK NA:2019

National Annex to

Eurocode 9: Design of aluminium structures – Part 1-1: General rules and rules for buildings

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Foreword

This National Annex (NA) is a revision of DS/EN 1999-1-1 DK NA:2013 and replaces the latter as from 2019-09-09. For a transition period until 2019-12-31, this National Annex as well as the previous National Annex will be applicable.

Text has been added under Clause 6.1.3(1) Ultimate limit states – General in relation to level of checking.

Previous, valid versions of the NAs as well as addenda to these can be found at www.eurocodes.dk.

This NA lays down the conditions for the implementation in Denmark of EN 1999-1-1 for construction works in conformity with the Danish Building Regulations.

This NA applies to construction works covered by section 16(1) of the Danish Building Regulations as well as to construction works covered by sections 24 to 27 of the Danish Building Regulations.

A National Annex contains national provisions, viz. nationally applicable values or selected methods. The Annex may furthermore provide non-contradictory, complementary information.

This NA includes:

- an overview of possible national choices and clauses containing complementary information;
- national choices;
- (non-contradictory) complementary information which may assist the user of the Eurocode.

For structures covered by sections 24 to 27 of the Danish Building Regulations BR18, or not covered by the Danish Building Regulations, levels of checking may still be used for the calculation of structures in ultimate limit states. For structures covered by section 16(1) of the Danish Building Regulations BR18, levels of checking cannot be applied.

Overview of possible national choices and clauses containing complementary information

The list below identifies the clauses where national choices are possible and the applicable/not applicable informative annexes. Furthermore, clauses giving complementary information are identified. Complementary information is given at the end of this document.

Clause	Subject	National choice [1)]	Complementary information[2)]
1.1.2(1)	Scope of EN 1999-1-1	Unchanged	
2.1.2(3)	Reliability management	No choice made	
2.3.1(1)	Actions and environmental influences	Unchanged	
3.2.1(1)	Range of materials	No choice made	
3.2.2(1)	Material properties for wrought aluminium alloys	Unchanged	
3.2.2(2)	Material properties for wrought aluminium alloys	Unchanged	
3.2.3.1(1)	Material properties for cast aluminium alloys	No choice made	
3.3.2.1(3)	Bolts, nuts and washers	Unchanged	
3.3.2.2(1)	Bolts, nuts and washers	No choice made	
5.2.1(3)	Effects of deformed geometry of the structure	Unchanged	
5.3.2(3)	Imperfections for global analysis of frames	Unchanged	
5.3.4(3)	Member imperfections	Unchanged	
6.1.3(1)	Partial safety factors	National choice	
6.2.1(5)	Resistance of cross-sections - General	Unchanged	
7.1(4)	Serviceability limit states - General	No choice made	
7.2.1(1)	Serviceability limit states for buildings - Vertical deflections		Complementary information
7.2.2(1)	Serviceability limit states for buildings - Horizontal deflections		Complementary information
7.2.3(1)	Serviceability limit states for buildings – Dynamic effects	Unchanged	
8.1.1(2)	Design of joints – Introduction	National choice	

Clause	Subject	National choice [1)]	Complementary information[2)]
8.9(3)	Other joining methods	Unchanged	
A(6) (Table A.1)	Execution classes	Unchanged	
C.3.4.1(2)	Special design rules for castings	National choice	
C.3.4.1(3)	Special design rules for castings	National choice	
C.3.4.1(4)	Special design rules for castings	Unchanged	
K.1(1)	Shear lag effects in member design - General	Unchanged	
K.3(1)	Shear lag effects in member design - Shear lag at ultimate limit states	National choice	

1)
Unchanged: Recommendations in the Eurocode to be followed.
No choice made: The Eurocode does not recommend values or methods, but allows the option of determining national values or methods.
National choice: A national choice has been made.
No further information: The Eurocode allows for further information – no additional information is given.

2)
Complementary information: Additional guidance on how to use the Eurocode.

National choices

6.1.3(1) Partial safety factors

The below expressions for γ_{Mi} are used, including the factor (γ_0) for the partial factors for strength parameters and resistances, cf. National Annex to EN 1990, Table A1.2(B+C):

$$\gamma_{M1} = 1{,}2 \cdot \gamma_0 \cdot \gamma_3$$
$$\gamma_{M2} = 1{,}35 \cdot \gamma_0 \cdot \gamma_3$$

The factor γ_0 takes into account the combination of actions, cf. National Annex to EN 1990, Table A1.2(B+C).

Limit state	**STR/GEO**				**STR**
Combination of actions	1	2	3	4	5
γ_0	1,0	1,0	K_{FI}	K_{FI}	$1{,}2 \cdot K_{FI}$

The factor γ_3 takes account of the level of checking of the product. The reduced level of checking is not used.
Extended level of checking: $\gamma_3 = 0{,}95$
Normal level of checking: $\gamma_3 = 1{,}00$

For structures covered by section 16(1) of the Danish Building Regulations BR18, the extended level of checking cannot be applied, and γ_3 is taken as 1,00.

The partial factors are determined in accordance with the National Annex to EN 1990, Annex F, where $\gamma_M = \gamma_1 \gamma_2 \gamma_3 \gamma_4$.

γ_1 takes into account the type of failure;
γ_2 takes into account the uncertainty related to the design model;
γ_3 takes into account the extent of checking;
γ_4 takes into account the variation of the strength parameter or resistance.

When determining γ_1, the following types of failure have been assumed:
γ_{M1}: Warning of failure without residual resistance
γ_{M2}: No warning of failure

For accidental and seismic design situations the following values are used:
$\gamma_{Mi}=1{,}0$ for all i's in EN 1999-1-x

8.1.1(2) Design of joints – Introduction

The following values are used:

γ_{M2} =	$1{,}35 \cdot \gamma_0 \cdot \gamma_3$	
γ_{Mp} =	$1{,}35 \cdot \gamma_0 \cdot \gamma_3$	
γ_{Mw} =	$1{,}35 \cdot \gamma_0 \cdot \gamma_3$	
γ_{M3} =	$1{,}35 \cdot \gamma_0 \cdot \gamma_3$	(ultimate limit)
γ_{M3} =	$1{,}10 \cdot \gamma_0 \cdot \gamma_3$	(serviceability, fatigue – see 8.5.9.3)
γ_{Ma} =	$3{,}0 \cdot \gamma_0 \cdot \gamma_3$	
γ_{M4} =	$1{,}10 \cdot \gamma_0 \cdot \gamma_3$	
γ_{M5} =	$1{,}10 \cdot \gamma_0 \cdot \gamma_3$	
$\gamma_{M6,ser}$ =	$1{,}00 \cdot \gamma_0 \cdot \gamma_3$	
γ_{M7} =	$1{,}20 \cdot \gamma_0 \cdot \gamma_3$	

C.3.4.1(2) Special design rules for castings

The following values are used:

$\gamma_{Mo,c}$ =	$1{,}2 \cdot \gamma_0 \cdot \gamma_3$
$\gamma_{Mu,c}$ =	$2{,}2 \cdot \gamma_0 \cdot \gamma_3$

C.3.4.1(3) Special design rules for castings

The following values are used:

$\gamma_{M2,co}$ =	$1{,}2 \cdot \gamma_0 \cdot \gamma_3$
$\gamma_{M2,cu}$ =	$2{,}2 \cdot \gamma_0 \cdot \gamma_3$

K.3(1) Shear lag effects in member design - Shear lag at ultimate limit states

The recommended Method a is used. Consequently, no limiting value for plastic strain is given for the use of Method c.

(Non-contradictory) complementary information

7.2.1(1) Serviceability limit states for buildings - Vertical deflection

For *beams*, the following values of the maximum deflection (w_3 in EN 1990, Figure A1.1) due to one variable action without allowance for impact, if any, may serve as guidance as to what may be regarded as acceptable deflections:

floors	$l/400$
roofs and external walls	$l/200$

Where

l span of simply supported and continuous beams; twice the projection of cantilevered structures.

The values apply both to main and secondary elements, but only the deflection of the member considered is to be used in the assessment.

For secondary sheeting in the form of uninsulated roof sheeting and for facade sheeting, the deflection due to permanent and variable actions should not exceed $l/90$.

For roof sheeting with external insulation and roofing felt, the deflection due to permanent and variable actions should not exceed:

$l/150$	for	$l < 4500$ mm
30 mm	for	4500 mm $\leq l <$ 6000 mm
$l/200$	for	6000 mm $\leq l$

7.2.2(1) Serviceability limit states for buildings - Horizontal deflection

For *columns*, the following numerical values of the maximum deflection of the column head due to one variable action may serve as guidance to what may be regarded as acceptable deflections:

frames in buildings without cranes	$h/150$
columns in single-storey skeleton structures	$h/300$
columns in multi-storey skeleton structures	for each storey $h/300$
	for the total height $h_e/500$

Where

h is the height of the individual column

h_e is the total height of the building.