

DS/EN 1995-1-1 DK NA:2014

National Annex to

Eurocode 5: Design of timber structures – Part 1-1: General - Common rules and rules for buildings

Foreword

This national annex (NA) is a revision of DS/EN 1995-1-1 DK NA:2013 and replaces the latter on 2014-12-15. In the complementary information, clause 4.2(2) has been deleted as the text is included in DS/EN 1995-1-1/A2:2014. The complementary information in clause 9.2.5.3 has been clarified and the complementary information on wood-based panels for roofs, floors and walls has been adapted to the new edition of EN 12871, the requirements remaining unchanged, and finally the requirements for finger jointed timber have been updated.

Previous versions of and addenda to this NA as well as an overview of all NAs can be found at www.eurocodes.dk

This NA lays down the conditions for the implementation in Denmark of EN 1995-1-1 for construction works in conformity with the Danish Building Act or the building legislation. Other parties can put this NA into effect by referring thereto.

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

This NA includes:

- an overview of possible national choices and clauses containing complementary information;
- national choices;
- complementary, non-contradictory information.

Overview of possible national choices and 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 National Annex.

Clause	Subject	National choice ¹	Complementary information
2.3.1.2(2)P	Load-duration classes	National choice	
2.3.1.3(1)P	Service classes	National choice	
2.4.1(1)P	Design value of material property	National choice	
6.1.7(2)	Shear	National choice	
6.4.3(8)	Double tapered, curved and pitched cambered beams	National choice	
7.2(2)	Limiting values for deflections of beams	National choice	
7.3.3(2)	Vibrations - Residential floors	National choice	
8.3.1.2(4)	Nailed timber-to-timber connections: Rules for nails in end grain	National choice	
8.3.1.2(7)	Nailed timber-to-timber connections: Species sensitive to splitting	National choice	
9.2.2(2)	Trusses with punched metal plate fasteners - requirements		Complementary information
9.2.2(4)	Trusses with punched metal plate fasteners – minimum overlap		Complementary information
9.2.4.1(7)	Wall diaphragms - General	National choice	
9.2.5.3(1)	Bracing of beam or truss systems Modifikationsfaktorer	National choice	Complementary information
10.9.2(3)	Special rules for trusses with punched metal plate fasteners: Erection, maximum bow	National choice	Complementary information
10.9.2(4)	Special rules for trusses with punched metal plate fasteners:	National choice	Complementary information

Clause	Subject	National choice ¹	Complementary information
	Erection, maximum deviation from true vertical alignment		
Annex A	Block shear and plug shear failure at multiple dowel-type steel-to-timber connections	To be applied (normative)	
Annex B	Mechanically jointed beams	To be applied (normative)	
Annex C	Built-up columns	To be applied (normative)	
	Clarification of requirements for materials		Complementary information
	Prefabricated wall, floor and roof elements		Complementary information
	Structural finger-jointed solid timber		Complementary information
	Wood-based panels for structural roofs, floors and walls		Complementary information

1)

Unchanged: The recommendation in the Eurocode is followed.

No choice made: The Eurocode does not recommend values or methods, but allows the option of determining national values or methods.

Not applicable: The Annex is not applicable.

Applicable: The Annex is applicable in Denmark and has the same status as specified in the Eurocode.

National choice: A national choice has been made.

Not relevant for building structures: See the National Annexes published by the Danish Road Directorate and Banedanmark.

National choices

2.3.1.2(2)P Load-duration classes

Examples of assignment of actions to load-duration classes in Denmark appear from Table 2.2 DK NA.

Table 2.2 DK NA - Examples of load-duration assignment

Load-duration class	Examples of loads
Permanent action	Self-weight
Long-term action	Actions on silos Storage, Category E, see DS/EN 1990
Medium-term action	Other variable actions
Short-term action	Snow loads Variable loads on concrete forms Variable loads on scaffolding and temporary structures Short-term forces due to temperature and moisture exposure
Instantaneous action	Accidental actions Wind actions Impact forces, including impact allowance Random person loads (concentrated loads) on roofs and similar loads Mooring forces from ships Short-term actions on quays Braking and acceleration forces Wave and ice pressures

2.3.1.3(1)P Service classes

Examples of structures assigned to the service classes described in (2)P, (3)P and (4)P:

- **Service class 1**
 - structures in heated buildings where moisture is not added to the air, e.g. dwellings, offices and shops.
- **Service class 2**
 - structures in ventilated, not permanently heated buildings, e.g. weekend cottages, unheated garages and storehouses;
 - ventilated structures protected against precipitation, e.g. ventilated roof structures.

- **Service class 3**

- structures in moist rooms;
- structures exposed to precipitation or water, including concrete forms and outdoor scaffolding;
- timber frames for felted roofs if these are not designed in such a way that they may be assigned to Service class 2.

2.4.1 (1)P Design value of material property

Instead of Table 2.3 in EN 1995-1-1, the following table is used:

Table 2.3 DK NA – Partial factors (γ_M) for the ultimate limit state for material properties and resistances

Persistent and transient design situations	
Glued laminated timber, LVL and panels	$\gamma_M = 1,30 \gamma_0 \gamma_3$
Solid timber	$\gamma_M = 1,35 \gamma_0 \gamma_3$
Dowel-type fasteners, e.g. nails, screws, bolts, dowels	$\gamma_M = 1,35 \gamma_0 \gamma_3$
Glued joints, including glued-in bolts	$\gamma_M = 1,50 \gamma_0 \gamma_3$
Connections made with punched metal plate fasteners	$\gamma_M = 1,35 \gamma_0 \gamma_3$
Accidental design situation	
	$\gamma_M = 1,00$

The partial factors in Table 2.3 DK NA have been determined in accordance with Annex F in DS/EN 1990 DK NA.

$\gamma_M = \gamma_1 \gamma_2 \gamma_3 \gamma_4$ where

- 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:

Glued laminated timber, LVL and panels	Warning of failure without residual resistance
Solid timber	Warning of failure without residual resistance
Connections with metal fasteners	Warning of failure without residual resistance
Glued joints	No warning of failure
Connections made with punched metal plate fasteners	Warning of failure without residual resistance

With respect to the determination of γ_3 , factory-made composite members subject to external inspection such as structural timber elements and prefabricated timber members made with punched metal plate fasteners may be assigned to the extended level of checking.

The following values of γ_3 depending on the extent of checking are used.

Sub-partial factor depending on the extent of checking

Level of checking	Extended	Normal	Reduced
γ_3	0,95	1,0	1,10

The factor γ_0 appears from DS/EN 1990 DK NA, Table A1.2(B+C) DK NA. For combinations of actions 1 and 2 that apply to all structures above ground, $\gamma_0 = 1$.

6.1.7(2) Shear

$k_{cr} = 1,0$ is applied for all wood materials.

6.4.3(8) Double tapered, curved and pitched cambered beams

Expression (6.55) is used.

7.2(2) Limiting values for deflections of beams

The table below specifies the recommended values. The client may specify other values, higher or lower.

Table 7.2 DK NA - Examples of limiting values for deflections of beams

Deflections which normally secure satisfactory deformation conditions for simply supported structures of service classes 1 and 2. For cantilevered structures, the deflection should be only half of the values given.

	Action	w_{inst}	$w_{fin}^{1)}$
<i>Roof structures</i> dwellings and offices	Self-weight, structures without camber		$l/400$
	Self-weight, structures with camber ²⁾		$l/250$
	Characteristic snow loads	$l/400$	
	Characteristic wind actions	$l/250$	
<i>Floor structures</i> in residential multi-storey buildings		Concentrated load 1 kN	
		1,7 mm	
	in single family houses	Uniformly distributed load 1,5 kN/m ²	$l/600$

1. w_{fin} is calculated according to 2.2.3(5).

2. Provided that the camber is at least 80% of w_{fin} .

7.3.3(2) Vibrations - Residential floors

The recommendation in the note regarding a and b should be followed for residential floors; it is recommended, however, to use only that part of the curve in Figure 7.2 where $a \leq 2$ mm/kN. Experience has shown that satisfactory vibration conditions for conventional timber beams having spans up to 6 m are achieved when the deflection requirements of Table 7.2 DK NA are fulfilled.

For floors in single family houses, relaxed vibration requirements may be applied. Experience has shown that satisfactory vibration conditions for conventional timber beams having spans up to 5 m are achieved when the deflection requirements of Table 7.2 DK NA are fulfilled.

8.3.1.2(4) Nailed timber-to-timber connections: Rules for nails in end grain

The alternative to 8.3.1.2(3) may be applied, but not, however, for smooth nails.

8.3.1.2(7) Nailed timber-to-timber connections: Species sensitive to splitting

Addition:

For timber with a moisture content less than 10% at the time of erection, the recommendation in EN 1995-1-1 should be observed.

Pre-drilling may be omitted for wood with a moisture content larger than 10% when $d < 5$ mm.

9.2.4.1(7) Wall diaphragms – General

Both methods may be applied.

9.2.5.3(1) Bracing of beam or truss systems: Modification factors

The following Danish modification factors in Table 9.2 DK NA for the determination of stiffness and resistance of stabilising structures are recommended:

Table 9.2 DK NA

Factor	Value
k_s	3,0
$k_{f,1}$	80
$k_{f,2}$	100
$k_{f,3}$	50

NOTE - See also "Complementary, non-contradictory information".

10.9.2(3) Special rules for trusses with punched metal plate fasteners: Erection, maximum bow

$a_{\text{bow,perm}} \leq 10$ mm.

NOTE - See also "Complementary, non-contradictory information".

10.9.2(4) Special rules for trusses with punched metal plate fasteners: Erection, maximum deviation from true vertical alignment

$a_{\text{dev, perm}} \leq 10$ mm.

NOTE - See also "Complementary, non-contradictory information".

Complementary, non-contradictory information

9.2.2(2) Trusses with punched metal plate fasteners – Requirements

Punched metal plate fasteners should not be used for permanent structures of service class 3.

NOTE - A heavily varying moisture content may in time cause the panels to loosen.

9.2.2(4) Trusses with punched metal plate fasteners – Minimum overlap

Where a punched metal plate fastener is utilised to no more than 80% of its load-bearing capacity, the requirement for a minimum overlap of one third of the height of the timber member may be disregarded. It is to be verified that the timber is not subject to splitting.

NOTE 1 - This guidance is based on the Danish requirements for increased insulation thicknesses and the associated increased timber dimensions.

NOTE 2 - The requirement for a minimum overlap of 40 mm is an absolute requirement, and in design erection tolerances have to be added. Where the requirement for one third of the height of the timber member is decisive, it is not necessary to add tolerances if the splitting capacity can be verified for the actual position.

9.2.5.3(1) Bracing of beam or truss systems: Modification factors

Where at least 8 equal, closely spaced solid timber members in compression are supported by closely spaced transverse bracings, e.g. braced by battens, half of the bending stiffness and the bending strength of the timber members may be used to resist and transfer q_d .

For less than 8 members, $n/16$ of the bending stiffness and the bending strength may be used.

For truss elements and other structures for which it can be assumed that the initial deviations are not unilateral, the following expression may be used for the calculation of q_d in expression (9.37) instead of n

$$n_{ef} = \min[3\sqrt{n}; n]$$

When the initial deviations are not unilateral, the accumulated force F_{akku} in the transverse bracing member supporting n members in compression may be taken as

$$F_{akku} = \min[\sqrt{n} F_d; 3F_d]$$

where F_d is the design stabilising force according to expression (9.35).

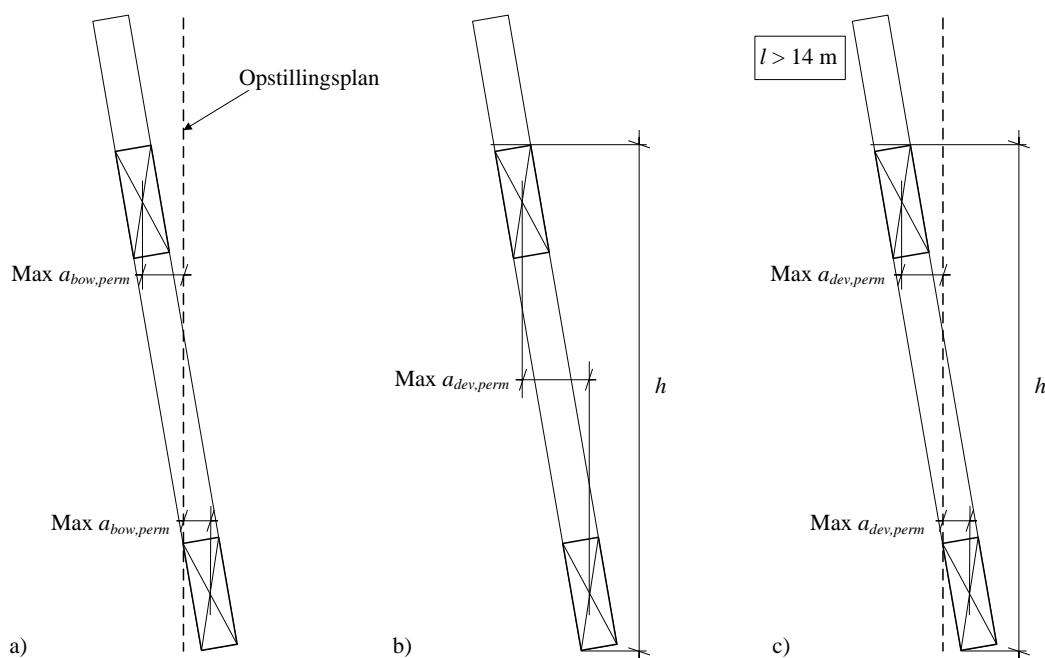
10.9.2(3) Special rules for trusses with punched metal plate fasteners: Erection, maximum bow

For spans $l > 5$ m, $a_{bow,perm}$ may be increased to $\pm l/500$, with a maximum of ± 45 mm, where l is the maximum horizontal dimension and a_{bow} is measured in relation to the erection plane aimed at, see

figure 10.9.2 DK NA a). The local deflection measured with a 3 m straightedge is in no place to exceed 15 mm.

10.9.2(4) Special rules for trusses with punched metal plate fasteners: Erection, maximum deviation from true vertical alignment

For structure heights >1 m, $a_{dev,perm}$ may be increased to $h/100$, with a maximum of 45 mm, where h is the height of the structure of the vertical plane considered, and a_{dev} is measured as the local difference between the deflection at the top and bottom in this plane, see figure 10.9.2 DK NA b). Furthermore, for $l > 14$ m the deviation in any point from the erection plane aimed at is to be no more than $a_{dev,perm}$, see Figure 10.9.2 DK NA c).



Opstillingsplan: Erection plane

Figure 10.9.2 DK NA - Erection tolerances for trusses with punched metal plate fasteners

Clarification of requirements for materials

In order to secure continuity until the requirement for CE marking has become mandatory and to ensure integrity of the Eurocode system, the following products

- structural finger-jointed solid timber (EN 15497)
- timber elements (EN 14732)

are to be either

- CE marked when the transition period expires for the relevant DS/EN standard

or

- manufactured according to the requirements of Annex ZA of the relevant standard, and the manufacture/product is to be certified to the requirements of Annex ZA. The certification

body and the testing laboratory is to be either notified or accredited for the relevant standards.

NOTE - When the transition period for a European harmonised standard expires, a notified testing or certification body should be used, depending on the system for attestation of conformity. Danish bodies must fulfil the requirements of Executive Order No 182 of 26/02/2013 'Bekendtgørelse om DANAK's opgaver om notificerede organer, der udfører 3. partskontrol med byggevarer og tekniske vurderingsorganer' (Executive order on the tasks of DANAK regarding notified bodies performing third-party inspection of construction products and technical assessment bodies).

Prefabricated wall, floor and roof elements

Until the harmonised standard for timber elements is available as an EN for CE marking, *prEN 14732-1:2006, Timber structures — Prefabricated wall, floor and roof elements – Requirements* (published as DS/INF prEN 14732-1:2009) is to be used with the following exceptions, amendments and clarification as the basis of certification for inspection or certification schemes.

Amendments:

- clause ZA.2.2 Elements under attestation of conformity system 1 (adhesively bonded elements and mechanically fixed elements in reaction to fire Classes (A1 – C)):
Until EN 14732-1 enters into force, at least one FPC inspection is to be carried out per year.
- clause ZA.2.3 Elements under attestation of conformity system 2+ (mechanically fixed elements):
Until EN 14732-1 enters into force, at least one FPC inspection is to be carried out per year.

Exceptions:

The following clauses are replaced by the certificate and marking rules of the inspection or certification scheme:

- - ZA.2.4 EC Certificate and Declaration of conformity
- - ZA.3 CE marking and labelling.

Clarification:

prEN 14732-1:2006 specifies performance requirements for prefabricated structural (load-bearing) wall, floor and roof elements consisting of framing members of wood and/or wood based materials and one or both sided panels or boards connected to the joists by suitable adhesive bonding or mechanical fixing. The cavities of the elements may be filled entirely or partially with insulating materials. The exterior faces of the panels or boards may also be covered with insulation material. This standard applies to elements which require but do not include an external finishing layer when installed, such as brickwork or a roof covering. The standard also covers volume elements (boxes, attics and bays) of prefabricated structural wall, floor and roof elements assembled at the factory. The standard does not apply to elements incorporation doors, windows and services (cables, water mains etc.) and their installation.

NOTE - prEN 14732-1 does not apply to industrially manufactured timber house systems/building kits marketed as buildings and made of pre-designed and prefabricated components intended for production in series. ETAG 007 "Timber Frame Building Kits" applies to this type of kit.

Structural finger-jointed solid timber

Structural finger-jointed timber should not be used for key elements in structures of consequences class CC3.

Until the transition period for CE marking according to EN 15497, *Structural finger jointed solid timber – Performance requirements and minimum production requirements*, expires, prEN 15497:2006, *Finger jointed structural timber – Performance requirements and minimum production requirements*, may be used with the following exceptions and amendments as the basis of certification for the inspection or certification schemes.

Changes

Clause ZA.2.2, System of attestation of conformity: Until the product is CE marked, at least two FPC inspections are to be carried out per year.

Exceptions:

The following clauses of prEN 15497:2006 are replaced by the certificate and marking rules of the inspection or certification scheme:

- ZA.2.2 EC Certificate and Declaration of conformity
- ZA.3 CE marking and labelling.

Wood-based panels for structural roofs, floors and walls

The harmonised standard DS/EN 13986:2004, *Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking*, makes reference to requirements specified in DS/EN 12871, *Wood-based panels - Determination of performance characteristics for load bearing panels for use in floors, roofs and walls*.

The requirements specified in the informative Annex B in DS/EN 12871:2013 are applied with the following changes:

- Expression (B.3) is replaced by $R_{\text{mean}} \geq 6000 t/L$ [N/mm], where t and L are given in mm.
- In expression (B.5) $k_{\text{red}} = 0,7$
- Expression (B.6) applies to $\alpha \leq 40^\circ$
- The impact requirement for wood-based panels used for wall sheathing in B.3.2 does not apply, and the panels shall not be marked "Wall".

Products already placed on the market may be used when the requirements laid down in DS/EN 12871:2001 including DS/EN 13986/NA:2007 or DS/EN 12871:2010 including DS/EN 1995-1-1 DK NA:2013 have been fulfilled.