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**Approval body for construction products
and types of construction**

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments

European Technical Assessment

ETA-14/0300
of 7 November 2014

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	induo-Anker
Product family to which the construction product belongs	induo-Anker for use in timber constructions or connecting timber components to steel or concrete components
Manufacturer	induo Systemholztechnik GmbH & Co. KG An der Blankstraße 20 41352 Korschenbroich DEUTSCHLAND
Manufacturing plant	7061, 641 020
This European Technical Assessment contains	25 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	Guideline for European technical approval of "Three-dimensional nailing plates", ETAG 015, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.

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This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission according to Article 25 Paragraph 3 of Regulation (EU) No 305/2011.

Specific part

1 Technical description of the product

induo-Anker M12, M20 and M30 are manufactured from cast iron in accordance with Annex 1. They comprise a body with a square cross-sectional area, on which conical dowels are arranged. For dowels arranged on two sides the body is manufactured as a full cast iron body or as a hollow profile with or without a connecting thread, depending on the application. For dowels arranged on one side the anchors and anchors with thread only have a hollow profile body.

The types, shape and dimensions of the induo-Anker can be found in Annex 1.

induo-Anker products are used for connecting timber members together or connecting timber components to steel or concrete components.

2 Specification of the intended use in accordance with the applicable European assessment Document

The performances given in section 3 are only valid if the induo-Anker is used in compliance with the specifications and conditions given in the Annexes 1 to 3.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of working life of the induo-Anker of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Load-bearing capacities	See Annex 3
Stiffness	See Annex 3
Ductility in cyclic testing	No performance determined

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	induo-Anker products are made from steel classified as Euroclass A1 in accordance with EC Decision 96/603/EC, amended by EC Decision 2000/605/EC.
Resistance to fire	No performance determined (NPD) The resistance to fire is determined for complete structural elements with any associated finishes, but not for a single connector.

3.3 Hygiene, health and the environment (BWR 3)

According to the Technical Report TR 034[1] the construction product neither contains nor releases any dangerous substances, except:

Cadmium: the induo-Anker products contain 0.01% by weight of cadmium.

In addition to the specific clauses relating to dangerous substances contained in this European technical assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of Regulation (EU) no. 305/2011, these requirements need also to be complied with, when and where they apply.

3.4 Safety and accessibility (BWR 4)

Not applicable

3.5 Protection against noise (BWR 5)

Not applicable

3.6 Energy economy and heat retention (BWR 6)

Not applicable

3.7 Sustainable use of natural resources (BWR 7)

The performance of this product in terms of the sustainable use of natural resources has not been investigated.

3.8 General aspects

Evidence of the durability is a part of the test of the essential characteristics. Durability and serviceability are only guaranteed if the special provisions on the intended use according to Annexes 1 to 3 are adhered to.

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[1] TR 034, issue March 2012   General ER 3 Checklist for ETAGs/CUPAs/ETAs - Content and/or release of dangerous substances in products/kits

4   **Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base**

According to Decision 97/638/EC of the Commission of 19 September 1997 (Official Journal of the European Communities L 268/36 of 1/10/1997) the system of assessment and verification of constancy of performance (see Annex V and Article 65 Paragraph 2 to Regulation (EU) No 305/2011) given in the following table applies.

Product	Intended use	Level or class	System
Three-dimensional nailing plates (with fasteners specified)	For structural timber products	Reaction to fire class and resistance to fire classes according to EN 13501-2	2+

5   **Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD**

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 11 November 2014 by Deutsches Institut für Bautechnik

Uwe Bender
Head of Department

beglaubigt:

Dewitt

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Annex 1 Product details

Table 1.1 Material specification of the induo-Anker

Material name (Code)	Material number	Specification of the cast iron	Characteristic tensile strength of the cast iron [N/mm²]	Mean thickness of the zinc coating [μm]	
				Hot dip galvanised	Electrogalva-nised
EN-GJS-400-15	5.3106	EN 1563[1]	390	80	5

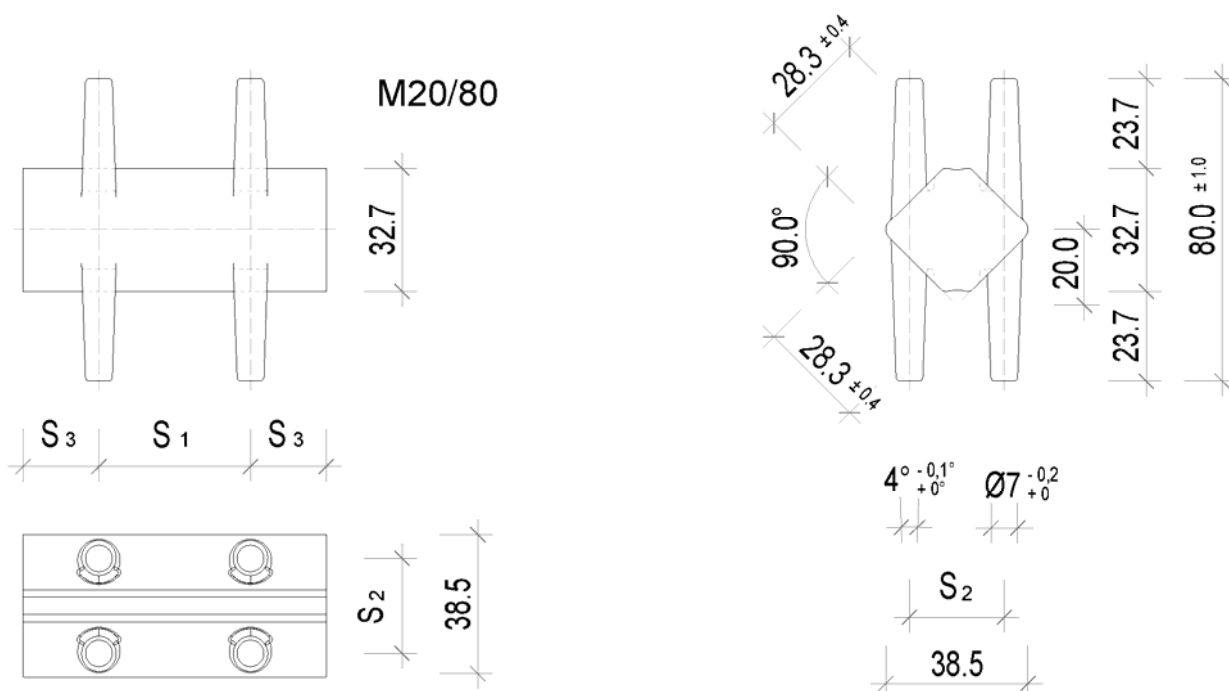[1] EN 1563:2011   Founding – Spheroidal graphite cast irons

induo-Anker

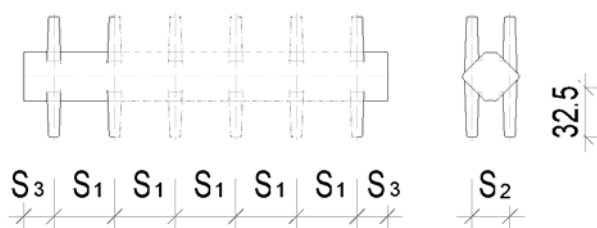Product details

Annex 1

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$S_1 = 40.0 \ \pm 0.4$
$S_2 = 25.0 \ \pm 0.4$
$S_3 = 0.5 * S_1$

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Anchor type M12

Annex 1

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M 1:2

M20/80

S_3 S_1 S_3

S_2 38.5

32.7

28.3 ±0.4

28.3 ±0.4

90.0°

20.0

23.7

32.7

23.7

80.0 ±1.0

$4°\ ^{-0,1°}_{+0°}$ $Ø7\ ^{-0,2}_{+0}$

S_2

38.5

M 1:5

S_3 S_1 S_1 S_1 S_1 S_1 S_3 S_2

32.5

$S_1 = 40.0\ ^{±0.4}$
$S_2 = 25.0\ ^{±0.4}$
$S_3 = 0.5 * S_1$

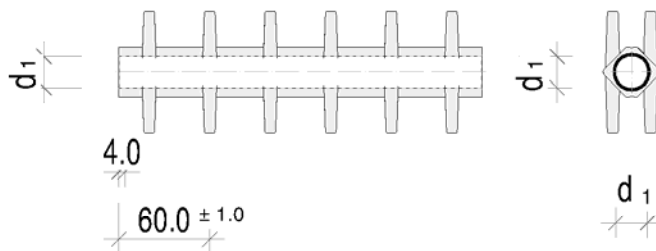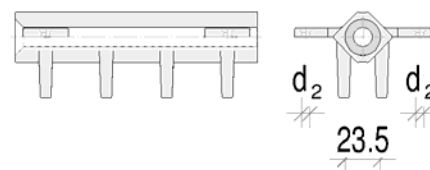| anchor version	bolts in a row	overall lenght
M20 / 80	2 Stck. (1x S 1)	80,0 mm
M20 / 120	3 Stck. (2x S 1)	120,0 mm
M20 / 160	4 Stck. (3x S 1)	160,0 mm
M20 / 240	6 Stck. (5x S 1)	240,0 mm

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Anchor type M20

Annex 1

Z26686.14

8.06.03-827/13

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M 1:2

M30/120

42.4 ± 0.4

$90.0°$

42.4 ± 0.4

46.6

43.8

46.6

134.0 ± 1.0

30.0

43.8

S_3 S_1 S_3

$4° {}^{-0,1°}_{+0°}$ $Ø10 {}^{-0,2}_{+0}$

S_2

57.5

S_2

57.5

M 1:5

S_3 S_1 S_1 S_1 S_1 S_1 S_1 S_1 S_3 S_2

$S_1 = 60.0 \ \pm 0.4$
$S_2 = 44.0 \ \pm 0.4$
$S_3 = 0.5 * S_1$

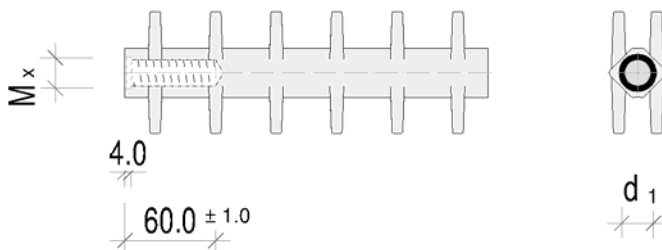| anchor version	bolts in a row		overall length
M30 / 120	2 Stck.	(1x S 1)	120,0 mm
M30 / 240	4 Stck.	(3x S 1)	240,0 mm
M30 / 360	6 Stck.	(5x S 1)	360,0 mm
M30 / 480	8 Stck.	(7x S 1)	480,0 mm

induo-Anker

Anchor type M30

Annex 1

R - Roh Anker

D - Durchsteck Anker
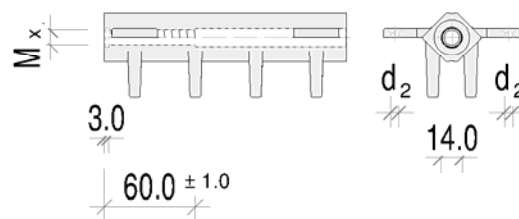
d_1

4.0

60.0 ± 1.0

d_1

d_1

ED - Einseitiger Durchsteck Anker

d_2 d_2

23.5

G - Gewinde Anker

M_x

4.0

60.0 ± 1.0

d_1

DG - Durchsteck Gewinde Anker

M_x

4.0

60.0 ± 1.0

d_1

d_1'

EDG - Einseitiger Durchsteck Gewinde Anker

M_x

3.0

60.0 ± 1.0

d_2 d_2

14.0
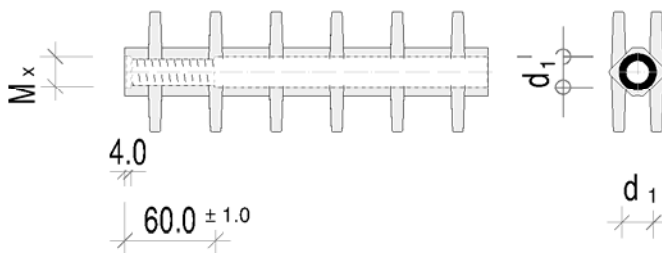
Ankergröße	M_x	**M20**	**M30**		**M12**
Durchmesser 1	d_1	$21{,}0 \ {\pm 0.2}$	$31{,}0 \ {\pm 0.2}$		$12{,}5 \ {\pm 0.2}$
Durchmesser 2	d_2				$5{,}5 \ {\pm 0.1}$

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Induo-Anker versions

Annex 1

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Annex 2   Specifications of intended use

Use of the induo-Anker only for:

− Static and quasi-static loads
− Axial loading of the induo-Anker

Base materials

The induo-Anker products are used for connecting timber components and for connecting concrete or steel components in load-bearing timber constructions. The induo-Anker products may be used for joining or connecting the following timber materials:

− Solid timber of softwood according to EN 14081-1[1],

− Glued laminated timber of softwood according to EN 14080[2],

− Laminated veneer lumber LVL of softwood or beechwood according to EN 14374[3] or equivalent softwood or beechwood laminated veneer lumber usable according to the national provisions applicable to the location of installation, for which fasteners with dowels are permitted; In LVL with some veneer layers running perpendicular to the longitudinal axis of the structural member the dowels shall only be inserted perpendicular to the veneer layer plane. The dowels shall not be inserted in the edge surface of LVL.

− Glued solid timber of softwood according to EN 14080 or equivalent softwood glued solid timber usable according to the national provisions applicable to the location of installation, for which fasteners with dowels are permitted.

The local provisions at the place of installation apply for concrete and steel components.

Use Conditions (environmental conditions)

The corrosion protection of the induo-Anker products is specified in Annex 1. With regards to the use and the environmental conditions, the national provisions of the place of installation apply.

Installation provisions

EN 1995-1-1[4] in conjunction with the respective national annex applies for the installation.

The induo-Anker products may be installed individually, behind one another or next to one another in a connection. induo-Anker anchor type M12 may be installed individually or next to one another.

For the combination of connections with anchors the threaded anchor shall be oriented according to load type as in figure A.3.4. For compression loading the threaded anchor shall be on the side of the load application and for tensile loading it shall be on the opposite side. The orientation of the anchor shall be planned by an engineer and labelled clearly on the installation drawings.

Threaded bolts of at least strength class 8.8 according to EN ISO 898-1[5] shall be used for the connection to the induo-Anker products. For anchor types M12 and M20 the depth to which the threaded bolts are screwed in shall be at least 20 mm and for anchor type M30 at least 30 mm. The threaded bolts shall be designed. If threaded bolts of a higher strength class than 8.8 are used, the 0.2 % yield strength and the tensile strength of threaded bolts of the strength class 8.8 shall be taken into account regardless of the actual strength class of the threaded bolts.

[1]	EN 14081-1:2005+A1:2011	Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements
[2]	EN 14080:2013	Timber structures - Glued laminated timber and glued solid timber - Requirements
[3]	EN 14374:2004	Timber structures - Structural laminated veneer lumber - Requirements
[4]	EN 1995-1-1:2004+A1:2008+A2:2014	Eurocode 5: Design of timber structures – Part 1-1: General - Common rules and rules for buildings
[5]	EN ISO 898-1:2013	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

induo-Anker		Annex 2
Specifications of intended use		

Installation of the induo-Anker products

Special attention shall be paid to the accurate marking and drilling of the holes for the dowels. If the joining is not performed with CNC-controlled machinery, the predefined drill templates and special drill bit with a depth stop from induo Systemholztechnik GmbH & Co. KG shall be used for the exact positioning and drilling of the holes.

The workshop assembly involves at least the following work steps:

  – Milling a groove in the timber components with dimensions according to the following figure, where the length of the groove ℓ_K = length of anchor + 120 mm.

Anchor M12 - M20
(2,1 cm milling depth)

41
20,5
40
20,5
73

Anchor M30
(3,1 cm milling depth)

61
30,5
68
30,5
116

| Anchor M12 - M20 | 105mm depth stop |
| Anchor M30 | 175mm depth stop |

  – Drilling the holes for the dowels in the timber component using a drilling template, whereby a depth stop on the drill bit shall be used according to the figure above.
    The depth of the drilled holes specified by the manufacturer for the dowels of the induo-Anker products shall be adhered to precisely, in order to guarantee sufficient fit accuracy and initial stiffness of the connections with induo-Anker products.

The assembly at the construction site involves the following work steps:

  – Installing the induo-Anker products and connecting the timber components. The position securing required according to Annex 3 shall be installed.

When installing several anchors one behind the other, the contact between the anchors shall be slip-free.

| induo-Anker | Annex 2 |
| Installation of the induo-Anker products | |
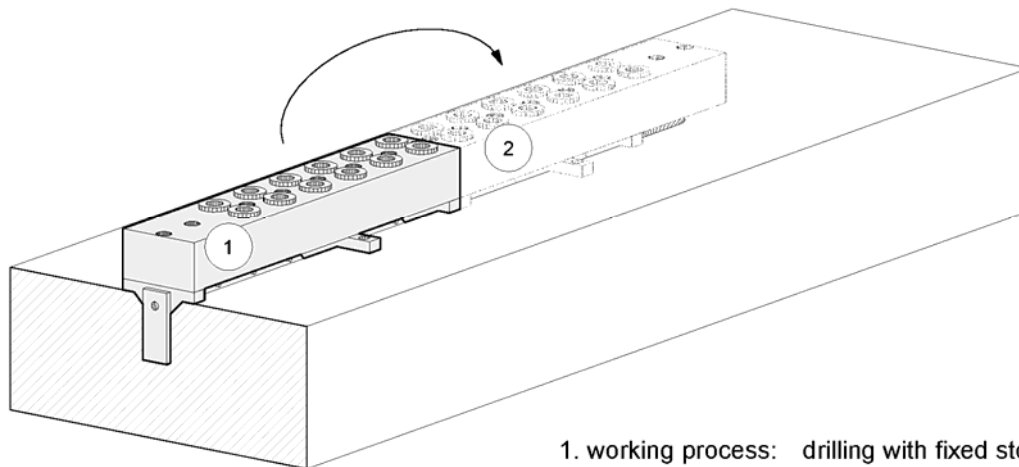
1. working process: drilling with fixed stop for the
                     correct end grain distance

if two or more induo-anchor are placed one after another

2. working process: place a second template in a mirror
                     inverted manner at the end of the first
                     template
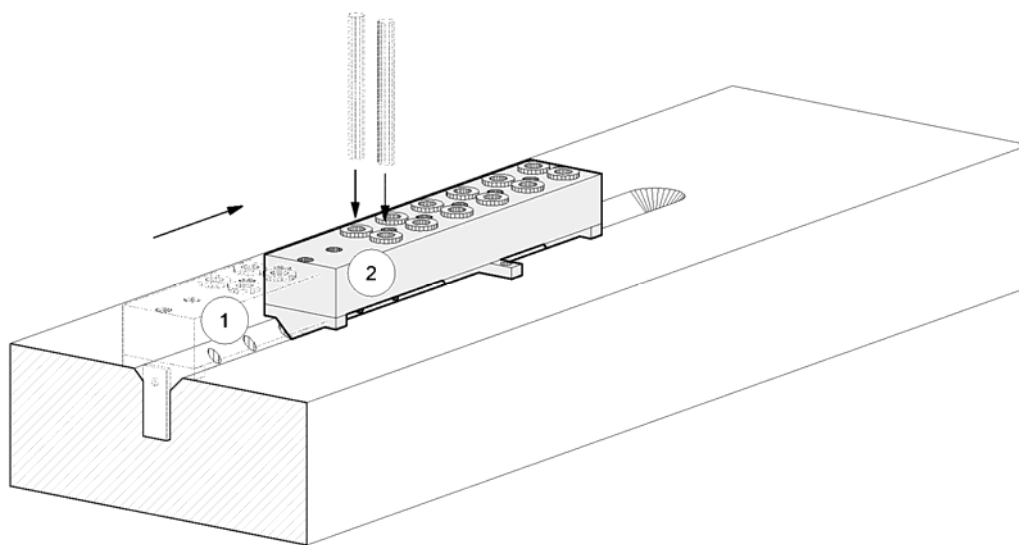
alternative
2. working process: fix the template with drill bits in the
                     pin holes drilled during the first stage
                     and then drill the next holes

induo-Anker	Annex 2
Installation of the induo-Anker products	

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Annex 3   Characteristic load-bearing capacity values of the induo-Anker products and design provisions

A.3.1   Shear connections

The load-bearing capacity of induo-Anker type M20 and M30 anchors loaded with a shear force in their axial direction can be determined by assuming a numerical model of a single-shear timber-timber connection. The load-bearing capacity shall be determined per shear plane and fastener according to EN 1995-1-1:2004+A1:2008+A2:2014, section 8.2.2, equation (8.6) with $F_{ax,Rk}$ = 0.

The load-bearing capacity of the type M12 anchor with a shear load in its axial direction can be determined by assuming a numerical model of a single-shear timber-steel connection. The load-bearing capacity shall be determined per shear plane and fastener according to EN 1995-1-1:2004+A1:2008+A2:2014, section 8.2.3, equation (8.10) with $F_{ax,Rk}$ = 0.

The characteristic value of the yield moment $M_{y,Rk}$, the mean diameter of the dowels d and the embedment depth t_1/t_2 of the dowels in the timber component according to table A.3.1 shall be used.

Table A.3.1   Characteristic values of the yield moment $M_{y,Rk}$ of the pins, which are regarded as dowels

Anchor type	Mean diameter d of the dowels in mm	$M_{y,Rk}$ in Nm	Embedment depth t_1/t_2 of the dowels in the timber component in mm
M12 and M20	8	26	33
M30	12	75	60

For timber members a maximum characteristic density of 500 kg/m³ shall be used to determine the characteristic embedment strength $f_{h,i,k}$.

When determining the embedment strength of laminated veneer lumber the national provisions applicable to the location of installation shall be considered.

For the case of several dowels aligned behind one another the effective number n_{ef} shall be determined as follows:

$$n_{ef} = \left[\min \left\{ \begin{array}{l} n \\ n^{0,9} \cdot \sqrt[4]{\dfrac{a_1}{10 \cdot d}} \end{array} \right\} \cdot \frac{90-\alpha}{90} + n \cdot \frac{\alpha}{90} \right]$$

(3.1)

With:
a_1   Distance between dowels in grain direction;
d   Mean diameter of the dowels;
n   Number of dowels in one row;
α   Angle between force direction and grain direction.

induo-Anker	Annex 3
Characteristic load-bearing capacities $F_{V,Rk}$ for induo-Anker products under shear load parallel to grain (0°)	

For the induo-Anker products shear loaded in their axial direction the characteristic load-bearing capacity values given in tables A.3.2 to A.3.4 may be used as an alternative to calculation according to the characteristic density of the timber components to be joined.

Table A.3.2   Characteristic load-bearing capacities $F_{V,Rk}$ for individual induo-Anker type M20 anchors and combinations thereof under shear load parallel to grain (0°)

1	2	3	4	5	6	7	8
Anchor type M20 and combinations	**Total anchor length**	**Load-bearing capacity values for solid timber and glued laminated timber relative to the characteristic density in kg/m³**					
		350	**380**	**400**	**430**	**460**	**480**
G M20/80	80 mm	9.1 kN	9.8 kN	10.4 kN	11.1 kN	11.9 kN	12.4 kN
G M20/120	120 mm	13.1 kN	14.1 kN	14.9 kN	16.0 kN	17.2 kN	17.9 kN
G M20/160	160 mm	16.9 kN	18.3 kN	19.3 kN	20.8 kN	22.2 kN	23.2 kN
G M20/120 + D M20/80	200 mm	20.7 kN	22.4 kN	23.6 kN	25.4 kN	27.2 kN	28.3 kN
G M20/240	240 mm	24.4 kN	26.4 kN	27.8 kN	29.9 kN	32.0 kN	33.4 kN
G M20/160 + D M20/120	280 mm	28.0 kN	30.3 kN	32.0 kN	34.4 kN	36.8 kN	38.4 kN
G M20/240 + D M20/80	320 mm	31.6 kN	34.2 kN	36.1 kN	38.8 kN	41.5 kN	43.3 kN
G M20/240 + D M20/120	360 mm	35.1 kN	38.0 kN	40.1 kN	43.1 kN	46.1 kN	48.1 kN
G M20/240 + D M20/160	400 mm	38.6 kN	41.8 kN	44.1 kN	47.4 kN	50.7 kN	52.9 kN
G M20/240 + D M20/120 + D M20/80	440 mm	42.1 kN	45.6 kN	48.0 kN	51.7 kN	55.2 kN	57.6 kN
G M20/240 + D M20/240	480 mm	45.5 kN	49.3 kN	51.9 kN	55.9 kN	59.7 kN	62.3 kN

Table A.3.3   Characteristic load-bearing capacities $F_{V,Rk}$ for individual induo-Anker type M30 anchors and combinations thereof under shear load parallel to grain (0°)

1	2	3	4	5	6	7	8
Anchor type M30 and combinations	**Total anchor length**	**Load-bearing capacity values for solid timber and glued laminated timber relative to the characteristic density in kg/m³**					
		350	**380**	**400**	**430**	**460**	**480**
G M30/120	80 mm	23.6 kN	25.3 kN	26.0 kN	26.9 kN	27.9 kN	28.5 kN
G M30/240	240 mm	44.1 kN	47.3 kN	48.6 kN	50.2 kN	52.0 kN	53.1 kN
G M30/240 + D M30/120	360 mm	63.5 kN	68.1 kN	70.0 kN	72.4 kN	74.9 kN	76.5 kN
G M30/240 + D M30/240	480 mm	82.3 kN	88.2 kN	90.7 kN	93.8 kN	97.0 kN	99.1 kN
G M30/240 + D M30/240 + D M30/120	600 mm	100 kN	108 kN	111 kN	114 kN	118 kN	121 kN
G M30/240 + D M30/240 + D M30/240	720 mm	118 kN	127 kN	131 kN	135 kN	140 kN	143 kN

induo-Anker	Annex 3
Characteristic load-bearing capacities $F_{V,Rk}$ for induo-Anker products under shear load parallel to grain (0°)	

Table A.3.4   Characteristic load-bearing capacities $F_{V,Rk}$ for induo-Anker type M12 anchors under shear load parallel to grain (0°)

1	2	3	4	5	6	7	8
Anchor type	**Anchor length**	**Load-bearing capacity values for solid timber and glued laminated timber relative to the characteristic apparent density in kg/m³**					
		350	**380**	**400**	**430**	**460**	**480**
ED M12/160	160 mm	23.1 kN	24.6 kN	25.6 kN	27.0 kN	28.5 kN	29.5 kN
EDG M12/160	160 mm	23.1 kN	24.6 kN	25.6 kN	27.0 kN	28.5 kN	29.5 kN

The threaded bolts shall be designed according to Annex 2.

For induo-Anker products used as shear connectors loaded in tension, the net cross-sectional area in the connection area shall be used for the design of the timber components. For connections with induo-Anker products the verification of block shear failure of the timber components shall be carried out in accordance with EN 1995-1-1: 2004+A1:2008+A2:2014, Annex A. The net shear plane in the grain direction of the timber $A_{net,v}$ shall be calculated for this using equation (A.3) and the effective height t_{ef} for thick steel plates using equation (A.7) for the failure modes (d) or (g). If the net cross-sectional area $A_{net,t}$ is not calculated more accurately, this can be assumed for individual anchors or anchors aligned one behind another using:

$A_{net,t}$ = 400 mm²   for anchor types M12 and M20,

$A_{net,t}$ = 1440 mm²   for anchor type M30.

If the induo-Anker are installed with alignment of the dowels parallel to the veneer layer of LVL the block shear failure of the timber components shall be verified using the shear strength value for flatwise loading. Instead of the factor 1,5 in equation (A.1) according to EN 1995-1-1: 2004+A1:2008+A2:2014 the factor 1,0 shall be used in this case.
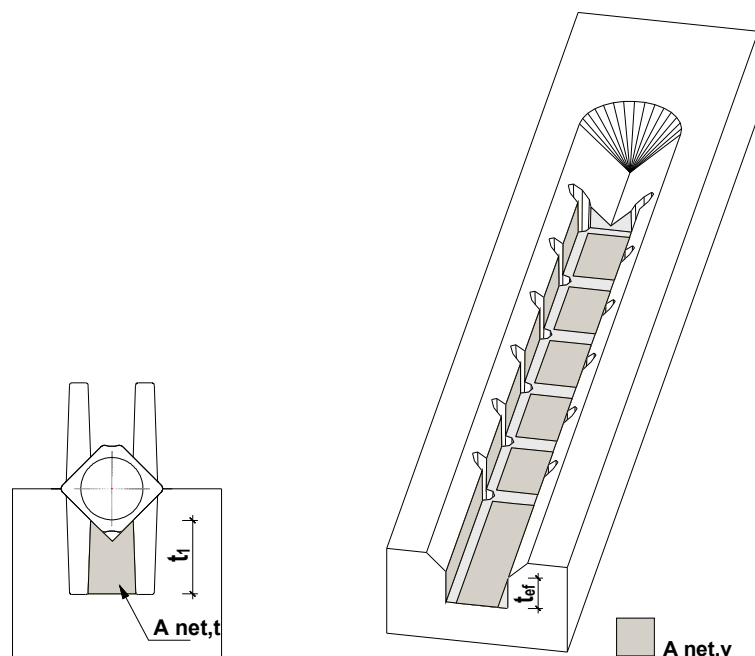

Figure A.3.1   Net cross-sectional area $A_{net,t}$ and net shear plane $A_{net,v}$ of the induo-Anker products

Verification of the compression stress perpendicular to the grain caused by Fv in conjunction with the twisting of the anchor body in the components to be connected is not necessary.

induo-Anker	Annex 3
Characteristic load-bearing capacities $F_{V,Rk}$ for induo-Anker products under shear load parallel to grain (0°)	

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Measure to avoid bending of components loaded on one side in shear connections

For symmetrical shear connections with induo-Anker products the additional moment when verifying the load-bearing capacity of components loaded on one side can be considered in a simplified manner by reducing the design value of the tensile load-bearing capacity by one third.

The bending of the components loaded on one side is then avoided by the use of fasteners that are resilient to being pulled out, which are additionally arranged in front of or behind the connection in question.
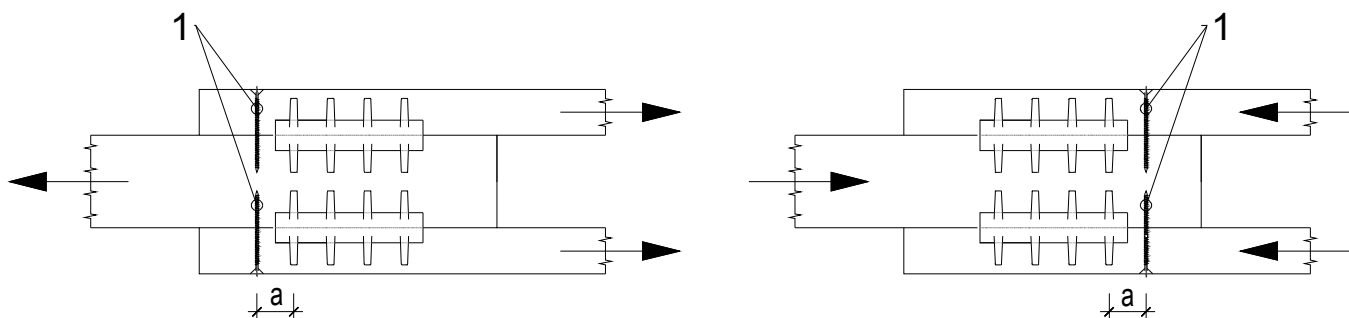
Legend
1   Additional fasteners that are resilient to being pulled out
a = 40 mm for all M20 anchors
a = 60 mm for all M30 anchors

Figure A.3.2   Securing the position of the M20 and M30 induo-Anker products that are subjected to shear loads in their axial direction

The fasteners that are resilient to being pulled out shall be designed for their tensile force $F_{ax,d}$ effective in the direction of the fasteners. The provisions in EN 1995-1-1 in conjunction with the respective national annex or in the European Technical Approval respective Assessment for the spacings, end and edge distances of the fastener as well as for the minimum thickness of the wood based material apply.

$$F_{ax,d} = \frac{e_v}{e_c} F_{v,d} \qquad\qquad (3.2)$$

Where
$F_{v,d}$ The axial force in the component loaded on one side
e_v 20 mm for induo-Anker of anchor type M12
         40 mm for induo-Anker of anchor type M20
         60 mm for induo-Anker of anchor type M30
e_c $0.75 \cdot \ell_{Anker}$

For a combination of M20 or M30 induo-Anker types the individual anchors shall be secured in their position close to their touching surfaces with such a fastener. The specifications in figures A.3.6 to A.3.9 for the outer thread diameter of the screws and the distance of the screws from the edges shall be adhered to according to anchor type. The position of the fasteners for the M12 induo-Anker type is specified by the existing screw holes.

induo-Anker	Annex 3
Characteristic load-bearing capacities $F_{V,Rk}$ for induo-Anker products under shear load parallel to grain (0°)	

In the case of non-symmetrical connections with induo-Anker products, the loading in the components to be connected caused by the eccentricity shall be accordingly verified.

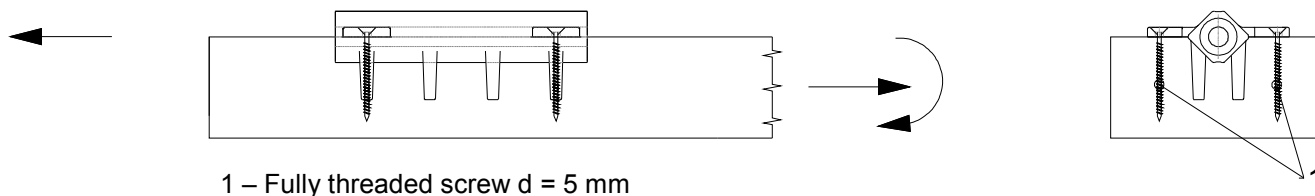1 – Fully threaded screw d = 5 mm

Figure A.3.3   Securing the position of a M12 induo-Anker type that is subjected to shear loads in its axial direction

At the limit of serviceability per dowel and per shear plane, the calculated value of the slip modulus K_{ser} for systematically shear-loaded induo-Anker products is:

for type M12 anchors: $K_{ser} = 1.2 \cdot \rho_m^{1.5} \cdot d / 23$ [N/mm]   (3.3)

for type M20 and M30 anchors: $K_{ser} = 0.5 \cdot \rho_m^{1.5} \cdot d / 23$ [N/mm]   (3.4)

Whereby:

d   Mean diameter of the dowels on the induo-Anker product [mm]
         M12/ M20:   d =   8 mm
         M30:   d = 12 mm

ρ_m Mean density of the timber components [kg/m³].

induo-Anker	Annex 3
Characteristic load-bearing capacities $F_{V,Rk}$ for induo-Anker products under shear load parallel to grain (0°)	

A.3.2 Tensile and compression connections

The load-bearing capacity of induo-Anker products loaded with a tensile or compression force in their axial direction can be determined by assuming a numerical model of a double-shear connection with an inner steel plate as for dowels according to EN 1995-1-1:2004+A1:2008+A2:2014, section 8.2.3, equation (8.11). For this the characteristic value of the yield moment $M_{y,Rk}$ and the embedment depth t_1/t_2 of the dowels according to table A.3.1 shall be used. For timber members a maximum characteristic density of 500 kg/m³ shall be used to determine the characteristic embedment strength $f_{h,i,k}$.

When determining the embedment strength of laminated veneer lumber the national provisions applicable to the location of installation shall be considered.
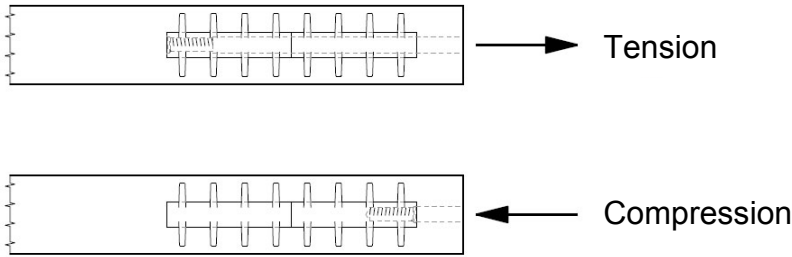

Figure A.3.4   Position of the inner thread of the induo-Anker products depending on the load direction

For induo-Anker products loaded in tension, the net cross-sectional area in the connection area shall be used for the design of the timber components. For connections with induo-Anker products the verification of block shear failure of the timber components shall be carried out in accordance with EN 1995-1-1:2004+A1:2008+A2:2014, Annex A. The net shear plane in the grain direction of the timber $A_{net,v}$ shall be calculated for this using equation (A.3) and the effective height t_{ef} for thick steel plates using equation (A.7) for the failure modes (d) or (g). If the net cross-sectional area $A_{net,t}$ is not calculated more accurately, this can be assumed for individual anchors or anchors aligned one behind another using:

$A_{net,t}$ = 400 mm²   for M20 anchor types,

$A_{net,t}$ = 1440 mm²   for M30 anchor type.

If the induo-Anker are installed with alignment of the dowels parallel to the veneer layer of LVL the block shear failure of the timber components shall be verified using the shear strength value for flatwise loading. Instead of the factor 1,5 in equation (A.1) according to EN 1995-1-1: 2004+A1:2008+A2:2014 the factor 1,0 shall be used in this case.

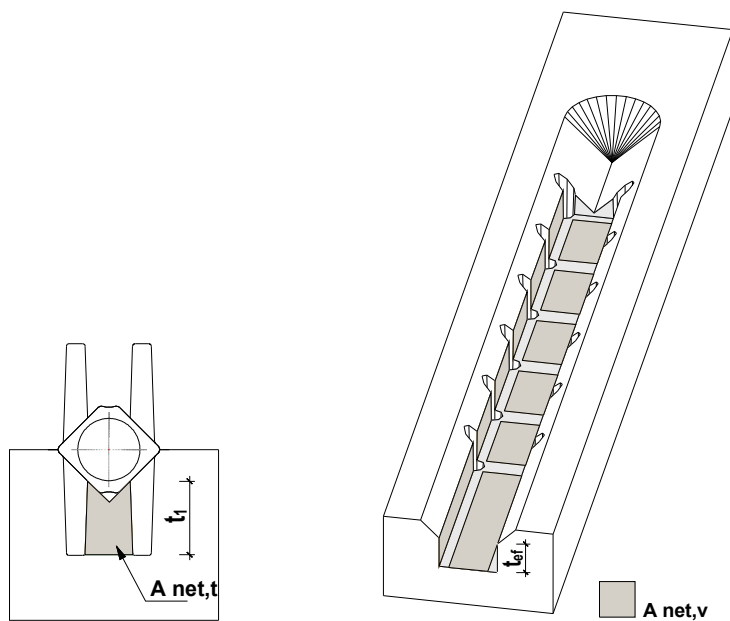| induo-Anker	Annex 3
Characteristic load-bearing capacities $F_{V,Rk}$ under axial loading parallel to grain (0°)	

Figure A.3.5   Net cross-sectional area $A_{net,t}$ and net shear plane $A_{net,v}$ of the induo-Anker products

induo-Anker	
Characteristic load-bearing capacities $F_{V,Rk}$ under axial loading parallel to grain (0°)	Annex 3

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For the induo-Anker products loaded in tension or compression in their axial direction the characteristic load-bearing capacity values given in tables A.3.5 and A.3.6 may be used as an alternative to calculation according to the characteristic density of the timber components.

Table A.3.5   Characteristic load-bearing capacities $F_{V,Rk}$ for individual induo-Anker type M20 anchors and combinations thereof under axial loading parallel to grain (0°)

1	2	3	4	5	6	7	8
Anchor type M20 and combinations	**Total anchor length**	**Load-bearing capacity values for solid timber and glued laminated timber relative to the characteristic density in kg/m³**					
		350	**380**	**400**	**430**	**460**	**480**
G M20/80	80 mm	24.8 kN	26.4 kN	27.4 kN	29.0 kN	30.6 kN	31.6 kN
G M20/120	120 mm	35.7 kN	38.0 kN	39.5 kN	41.7 kN	44.0 kN	45.5 kN
G M20/160	160 mm	46.2 kN	49.2 kN	51.1 kN	54.1 kN	57.0 kN	59.0 kN
G M20/120 + D M20/80	200 mm	56.5 kN	60.1 kN	62.5 kN	66.1 kN	69.7 kN	72.1 kN
G M20/240	240 mm	66.6 kN	70.8 kN	73.7 kN	77.9 kN	82.1 kN	84.9 kN
G M20/160 + D M20/120	280 mm	76.5 kN	81.4 kN	84.6 kN	89.5 kN	94.3 kN	97.6 kN
G M20/240 + D M20/80	320 mm	86.3 kN	91.8 kN	95.4 kN	101 kN	106 kN	110 kN
G M20/240 + D M20/120	360 mm	96 kN	102 kN	106 kN	112 kN	118 kN	122 kN
G M20/240 + D M20/160	400 mm	105 kN	112 kN	116 kN	123 kN	130 kN	134 kN
G M20/240 + D M20/120 + D M20/80	440 mm	115 kN	122 kN	127 kN	134 kN	142 kN	147 kN
G M20/240 + D M20/240	480 mm	124 kN	132 kN	137 kN	145 kN	153 kN	158 kN

Table A.3.6   Characteristic load-bearing capacities $F_{V,Rk}$ for individual induo-Anker type M30 anchors under axial loading parallel to grain (0°)

1	2	3	4	5	6	7	8
Anchor type M30 and combinations	**Total anchor length**	**Load-bearing capacity values for solid timber and glued laminated timber relative to the characteristic density in kg/m³**					
		350	**380**	**400**	**430**	**460**	**480**
G M30/120	120 mm	58.0 kN	62.1 kN	64.8 kN	68.9 kN	72.9 kN	75.6 kN
G M30/240	240 mm	108 kN	116 kN	121	128 kN	136 kN	141 kN
G M30/240 + D M30/120	360 mm	156 kN	167 kN	174 kN	185 kN	196 kN	203 kN
G M30/240 + D M30/240	480 mm	202 kN	216 kN	225 kN	240 kN	254 kN	263 kN
G M30/240 + D M30/240 + D M30/120	600 mm	247 kN	264 kN	276 kN	293 kN	310 kN	322 kN
G M30/240 + D M30/240 + D M30/240	720 mm	291 kN	311 kN	325 kN	345 kN	366 kN	379 kN

Threaded bolts shall be designed considering the provisions in Annex 2.

induo-Anker	
Characteristic load-bearing capacities $F_{V,Rk}$ under axial loading parallel to grain (0°)	Annex 3

induo-Anker products loaded in their axial direction in tension or compression shall be secured in their position according to the following figures.
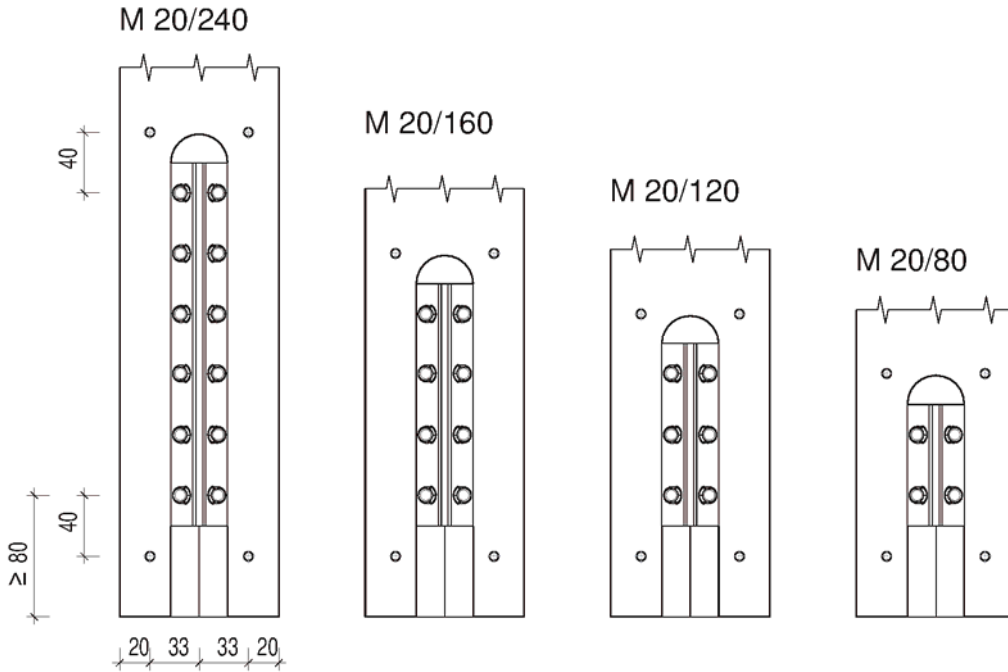

Figure A.3.6   Securing the position of the M20 induo-Anker type that is subjected to tensile or compression loads in its axial direction, dimensions in mm
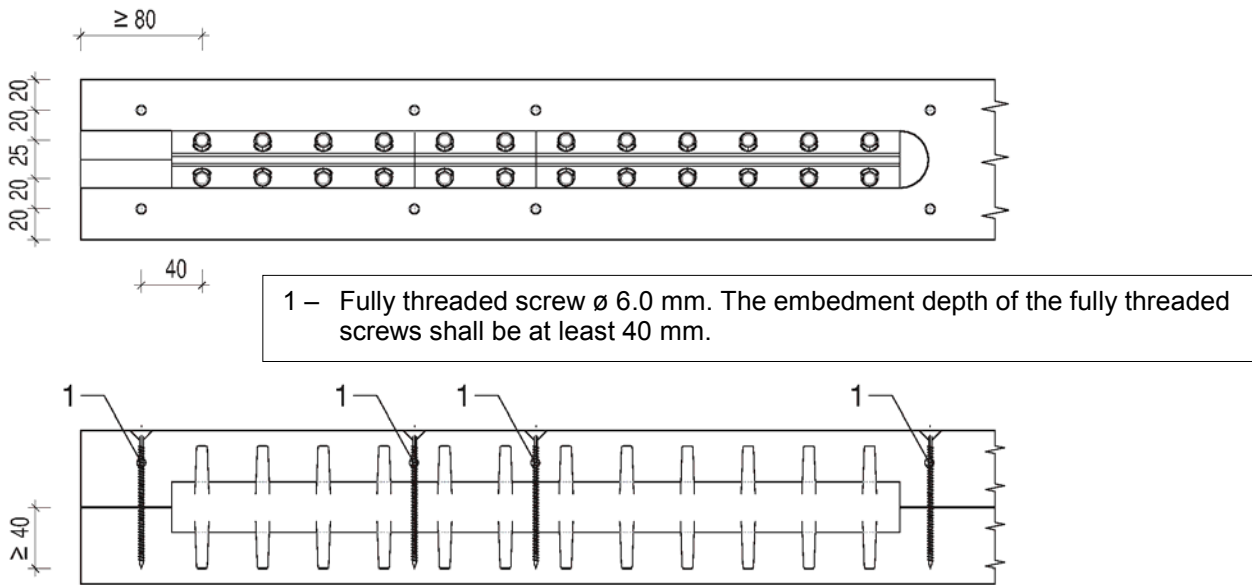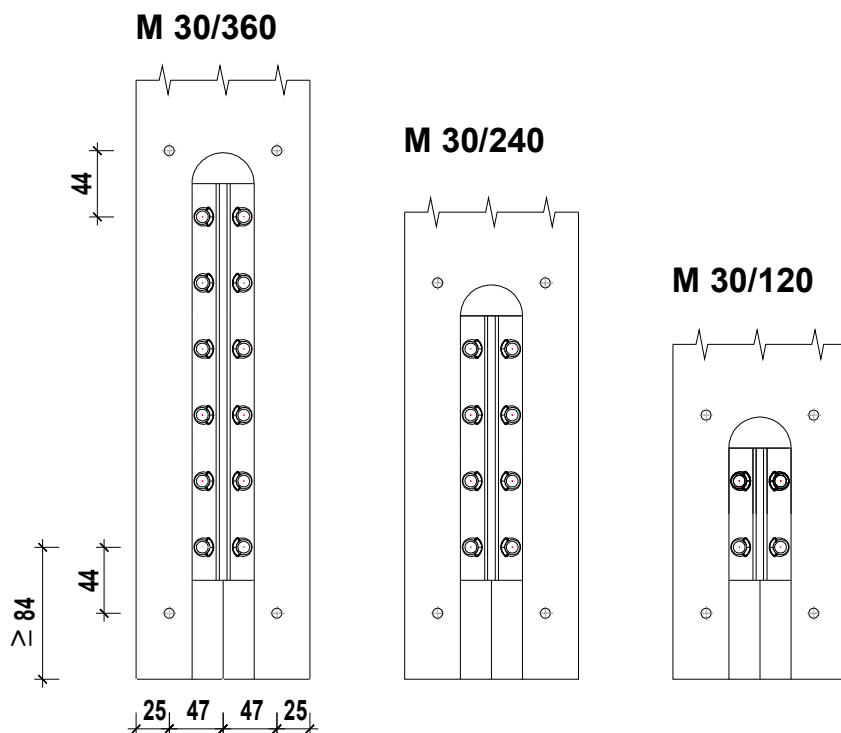

1 –   Fully threaded screw ø 6.0 mm. The embedment depth of the fully threaded screws shall be at least 40 mm.

Figure A.3.7   Securing the position of M20 induo-Anker products arranged behind one another that are subjected to tensile or compression loads in their axial direction, dimensions in mm

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Characteristic load-bearing capacities $F_{V,Rk}$ under axial loading parallel to grain (0°)	Annex 3

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M 30/360

M 30/240

M 30/120

Figure A.3.8   Securing the position of the M30 induo-Anker type that is subjected to tensile or compression loads in its axial direction, dimensions in mm
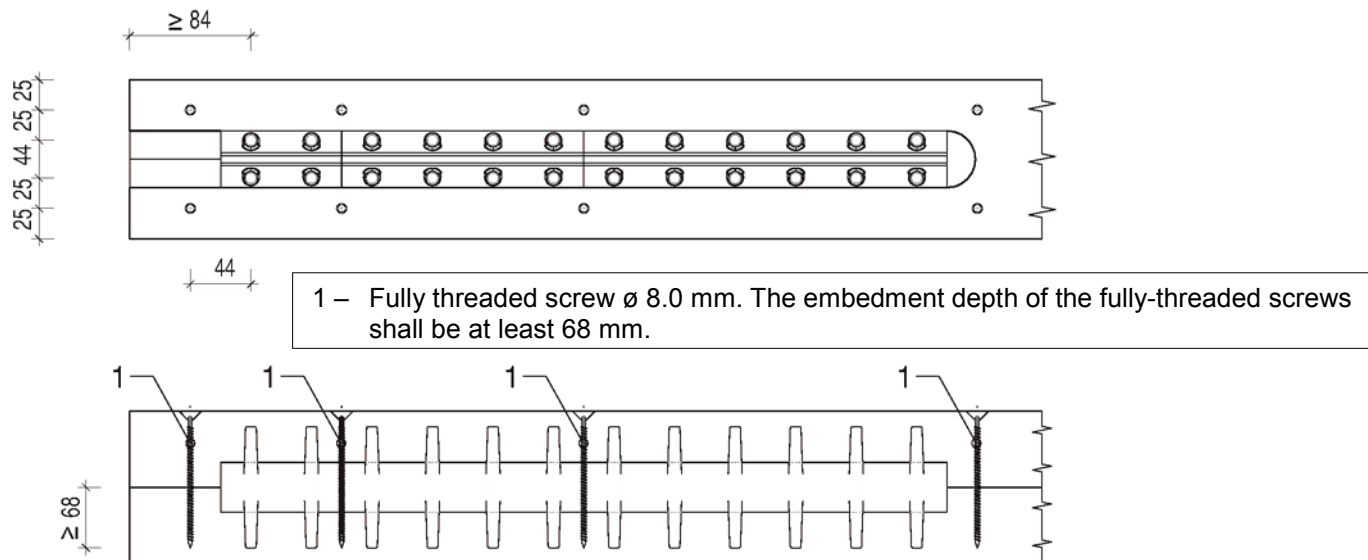
1 –   Fully threaded screw ø 8.0 mm. The embedment depth of the fully-threaded screws shall be at least 68 mm.

Figure A.3.9   Securing the position of M30 induo-Anker products arranged behind one another that are subjected to tensile or compression loads in their axial direction, dimensions in mm

induo-Anker	Annex 3
Characteristic load-bearing capacities $F_{V,Rk}$ under axial loading parallel to grain (0°)	

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At the limit of serviceability per dowel and per shear plane, the calculated value of the slip modulus K_{ser} for induo-Anker products loaded systematically in their axial direction is:

for M20 anchor type:	$K_{ser} = 1.2 \cdot \rho_m^{1.5} \cdot d / 23$	[N/mm]	(3.5)
for M30 anchor type:	$K_{ser} = 1.4 \cdot \rho_m^{1.5} \cdot d / 23$	[N/mm]	(3.6)

Whereby:

d   Mean diameter of the dowels on the induo-Anker product [mm]
        M20:   d =   8 mm
        M30:   d = 12 mm
ρ_m Mean density of the timber components [kg/m³].

A.3.3   Minimum component dimensions and minimum distances

The minimum dimensions of the timber components in table A.3.7 shall be complied with.

Table A.3.7   Minimum component dimensions according to installation type of the induo-Anker products

Anchor type	Mean diameter d of the dowels in mm	Minimum component thickness in mm			
		Single-sided installation of the induo-Anker products in timber component	Single-sided installation of the induo-Anker in LVL, alignment of the dowels parallel to the veneer layer and loaded in tension	Complete installation of the induo-Anker products in timber component	Complete installation of the induo-Anker in LVL, alignment of the dowels parallel to the veneer layer and loaded in tension
M12	8	40	50	-	-
M20	8	40	50	80	100
M30	12	68	75	136	150

During installation of the induo-Anker products the minimum distance values in EN 1995-1-1:2004+A1:2008+A2:2014, section 8.6, table 8.5 for the dowels shall be complied with. For this the mean diameter d of the dowels in table A.3.7 shall be used.
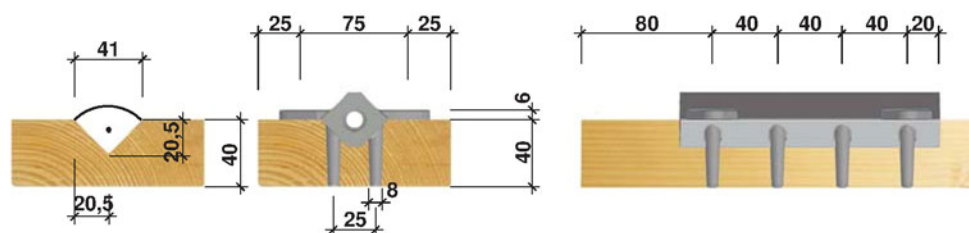

Figure A.3.10   Minimum component dimensions and required fastener distances for M12 induo-Anker type

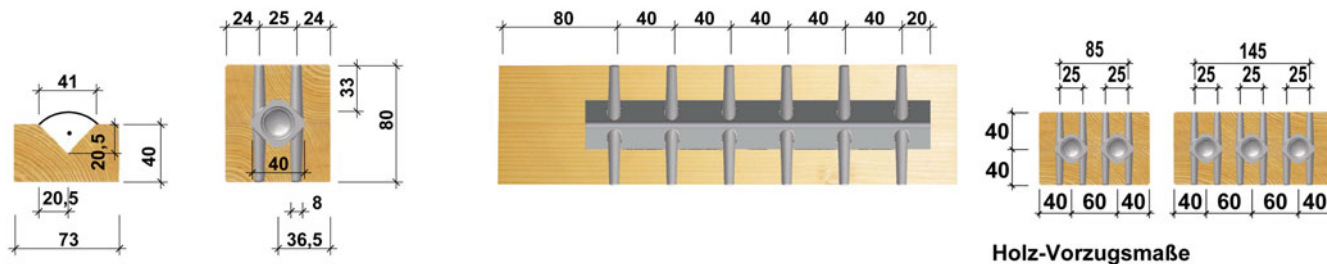| induo-Anker	Annex 3
Slip modulus, minimum component dimensions and minimum distances	

Figure A.3.11   Minimum component dimensions and required fastener distances for M20 induo-Anker type
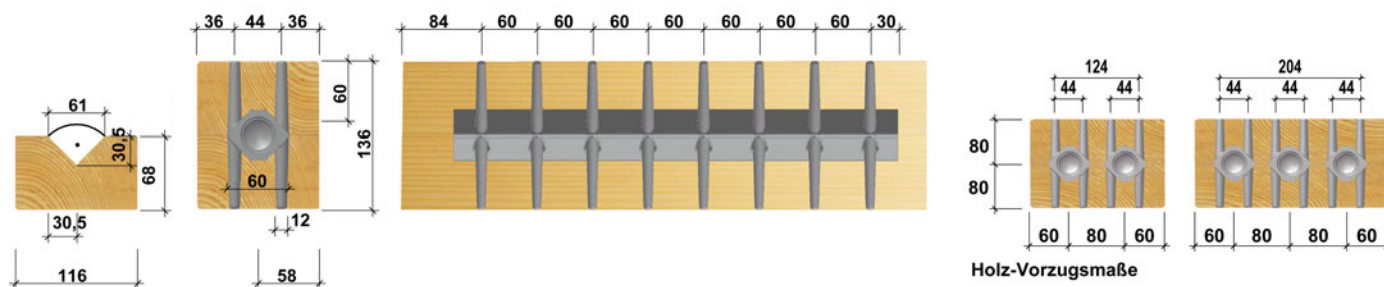

Figure A.3.12   Minimum component dimensions and required fastener distances for M30 induo-Anker type

If induo-Anker type M12 are installed next to one another the centre distance of the individual anchors shall be at least 120 mm.

induo-Anker	Annex 3
Minimum component dimensions and minimum distances	