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Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
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European Technical Assessment ETA 17/0244 of 19/04/2017

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011:	**VTT Expert Services LTD**
Trade name of the construction product	**Arras Purlin Anchors**
Product family to which the construction product belongs	**Three-dimensional nailing plate**
Manufacturer	**Arras Construction Furniture OÜ Veerme 23 11625 Talinn Estonia www.arrascf.eu**
Manufacturing plant	**Arras Construction Furniture OÜ Veerme 23 11625 Talinn Estonia**
This European Technical Assessment contains	**21 pages including 2 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	**ETAG 015, Edition November 2012, used as European Assessment Document (EAD)**

II Specific Part

1 Technical description of the product and intended use

Arras Purlin Anchors type 72101 Right, 72102 Left, 72103 Right, 72104 Left, 72105 Right, 72106 Left, 72107 Right, 72108 Left, 72109 Right, 72110 Left, 72111 Right and 72112 Left are one piece, non-welded, face-fixed purlin anchors to be used in timber to timber connections. The type of the connector and the typical use of the purlin anchors are shown in Figure 1. The purlin anchors are connected to the timber members by anchor nails or screws.

The purlin anchors are made from pre-galvanized steel DX51D+Z275 or S250GD+275Z according to EN 10346:2015 with minimum yield strength R_{eL} or R_{p02} of 250 N/mm^2 and minimum tensile strength R_m of 330 N/mm^2. Dimensions and hole position of the connectors are shown in Annex A. Arras Purlin Anchors are made from steel with tolerances according to EN 10143.

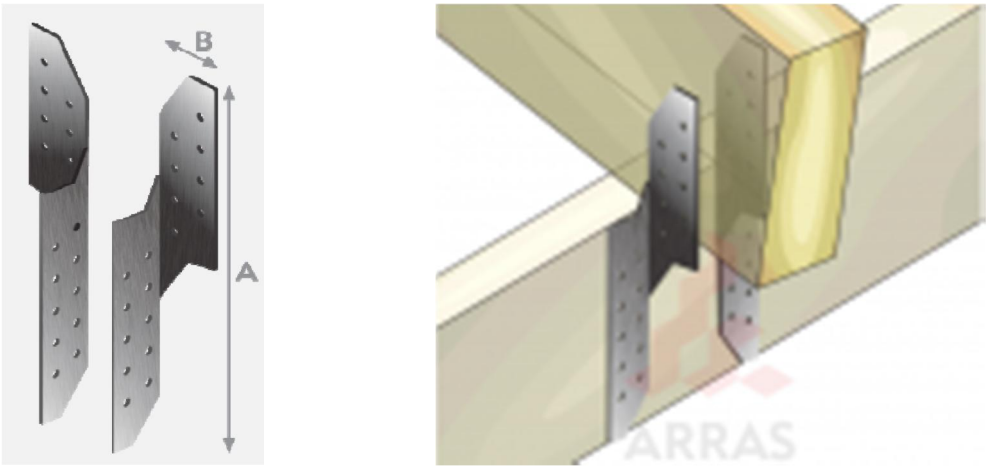


Figure 1. Types of right and left hand purlin anchors and the typical use of connectors.

2 Specification of the intended use in accordance with the applicable European Assessment Document, EAD

The purlin anchors are intended for use in making connections in load bearing timber structures, as a connection between a beam and a purlin, where requirements for mechanical resistance and stability and safety in use in the sense of the Basic Works Requirements 1 and 4 of Regulation (EU) 305/2011 shall fulfilled.

Two same sizes of connectors with the same number of fasteners are always used symmetrically at both sides of the purlin (see Figure 1).

The Purlin Anchors are used as a purlin to beam or purlin to column connection subjected to a tension load parallel to the length direction of the connector (see Annex B). The Purlin Anchors are not assumed to have any load-carrying capacity for lateral forces perpendicular to the length direction of the connector.

The static and kinematic behaviour of the timber members or the supports shall be as described in Annex B. The wood members can be solid timber according to EN 14081, glued laminated timber according to EN 14081 or LVL (Laminated Veneer Lumber) according to EN 14374. The characteristic density ρ_k of the timber shall not be greater than 500 kg/m^3. Timber parts are not pre-bored for the fasteners. Nails and screws shall be inserted perpendicular to the grain direction of wood. Purlin anchors shall not be fixed to the edge face of a LVL member.

The Purlin Anchors shall be fixed by anchor nails or screws according to EN 14592 (see Figure 2). The diameter of the anchor nails *d* shall be 4,0 mm and the profiled length shall be at least 24 mm. The diameter of the smooth part of the anchor screws *d* shall be 4,5…5,0 mm and the inner diameter of the threaded part $d_s \geq 3{,}0$ mm. The length of the threaded part of the screw shall be at least 6*d*.

Figure 2. Fasteners: a) anchor nail and b) anchor screw.

The design of the connections shall be in accordance with Eurocode 5. The timber members shall have a thickness which is larger than the penetration depth of fasteners into members.

The purlin anchors are intended for use for connections subject to static and quasi-static loading.

The purlin anchors are for use in timber structures subject to the dry, internal conditions defined by the service classes 1 and 2 of EN 1995-1-1:2014. The scope of the brackets regarding resistance to corrosion shall be defined according to national provisions that apply at the installation site considering environmental conditions.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the connectors of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body. They should only be regarded as a means for the 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

Table 1. Handling of basic requirements for construction works

Basic requirement and essential characteristics	Assessment of characteristic
BWR 1. Mechanical resistance and stability*)	
Characteristic load-carrying capacity	See Annex B
Stiffness	No performance assessed
Ductility in cyclic testing	No performance assessed
BWR 2. Safety in case of fire	
Reaction to fire	The purlin anchors are made from steel classified as **Euroclass A1** in accordance with EN 1350-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
BWR 3. Hygiene, health and the environment	
Influence on air quality	No dangerous materials**)
BWR 7. Sustainable use of natural resources	
Aspects of sustainable of natural resources	No performance assessed
General aspects related to the performance	
Durability and serviceability	The purlin anchors have been assessed as having satisfactory durability and serviceability, when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1 and 2.
Identification	See Annex A

*) See additional information in sections 3.1 – 3.4.

**) In addition to the specific clauses relating 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 national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.1 Methods of verification

The characteristic load-carrying capacities are based on the characteristic values of the fastener connections and the steel plates. To obtain design values the capacities have to be multiplied with different partial factors for the material properties, in addition the fastener connection with coefficient k_{mod}.

According to EN 1880 (Eurocode – Basis of design) paragraph 6.3.5 the design value of load carrying capacity can be determined by reducing the characteristic values of load-carrying capacity with different partial factors. Thus, the characteristic values of the load-carrying capacity are determined also for timber failure $F_{Rk,H}$ (obtaining the embedment strength of fasteners subjected to shear or the withdrawal capacity of the most loaded fastener, respectively) as well for steel plate failure $F_{Rk,S}$. The design value of the load-carrying capacity is the smaller value of both load-carrying capacities:

$$F_{\mathrm{Rd}} = \min \begin{cases} \dfrac{k_{\mathrm{mod}} \cdot F_{\mathrm{Rk,H}}}{\gamma_{\mathrm{M,H}}} \\ \dfrac{F_{\mathrm{Rk,S}}}{\gamma_{\mathrm{M,S}}} \end{cases}$$

Therefore, for timber failure the load duration class and service class are included. The different partial factors γ_M for steel or timber, respectively, are also correctly taken into account.

3.2 Mechanical resistance and stability

See Annex B for the characteristic load-carrying capacity in tension loading of the connection parallel to the longer side of the connectors.

The characteristic capacities of purlin anchors are determined by calculation as described in the EOTA Guideline 015 clause 2.4.1.1.1. They should be used for designs in accordance with Eurocode 5.

No performance has been determined in relation to ductility of a joint under cyclic testing. The contribution to the performance of structures in seismic zones, therefore, has not been assessed.

No performance has been determined in relation to the joint's stiffness properties – to be used for the analysis of the serviceability limit state.

3.3 Aspect related to the performance of the product

For the corrosion protection in service classes 1 and 2, the purlin anchors have a zinc coating weight of min Z275. The steel employed is DX51D or S250GD with min Z275 according to General aspects related to fitness for use of the product

Arras Purlin Anchors are manufactured in accordance with the provisions of this European Technical Assessment using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation.

The following provisions apply:

- The nailing pattern may be determined by case by case. However, at least two fasteners shall be used in both flanges of the connector.
- All minimum spacings and edge/end distances in accordance with Eurocode 5 shall be complied with.
- The splitting resistance of the timber members shall be verified according to Eurocode 5.
- The cross section of the connected timber members shall have a plane surface without wane against the purling anchor.

- There are no specific requirements relating to preparation of the timber members
- In service class 2, the nails and screws shall have an electroplated zinc coating according to EN ISO 2081 at least of type and thickness Fe/Zn 12 c, or they shall be hot dip zinc coated according to EN ISO 1461, thickness at least 39 µm.
- The purlin anchors shall not be used without adequate protection for connections where resistance to fire is required.

4 Assessment and verification of constancy of performance (AVCP)

According to the Decision 97/638/EC of the European Commission, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V to the regulation (EU) No 305/2011) is 2+.

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

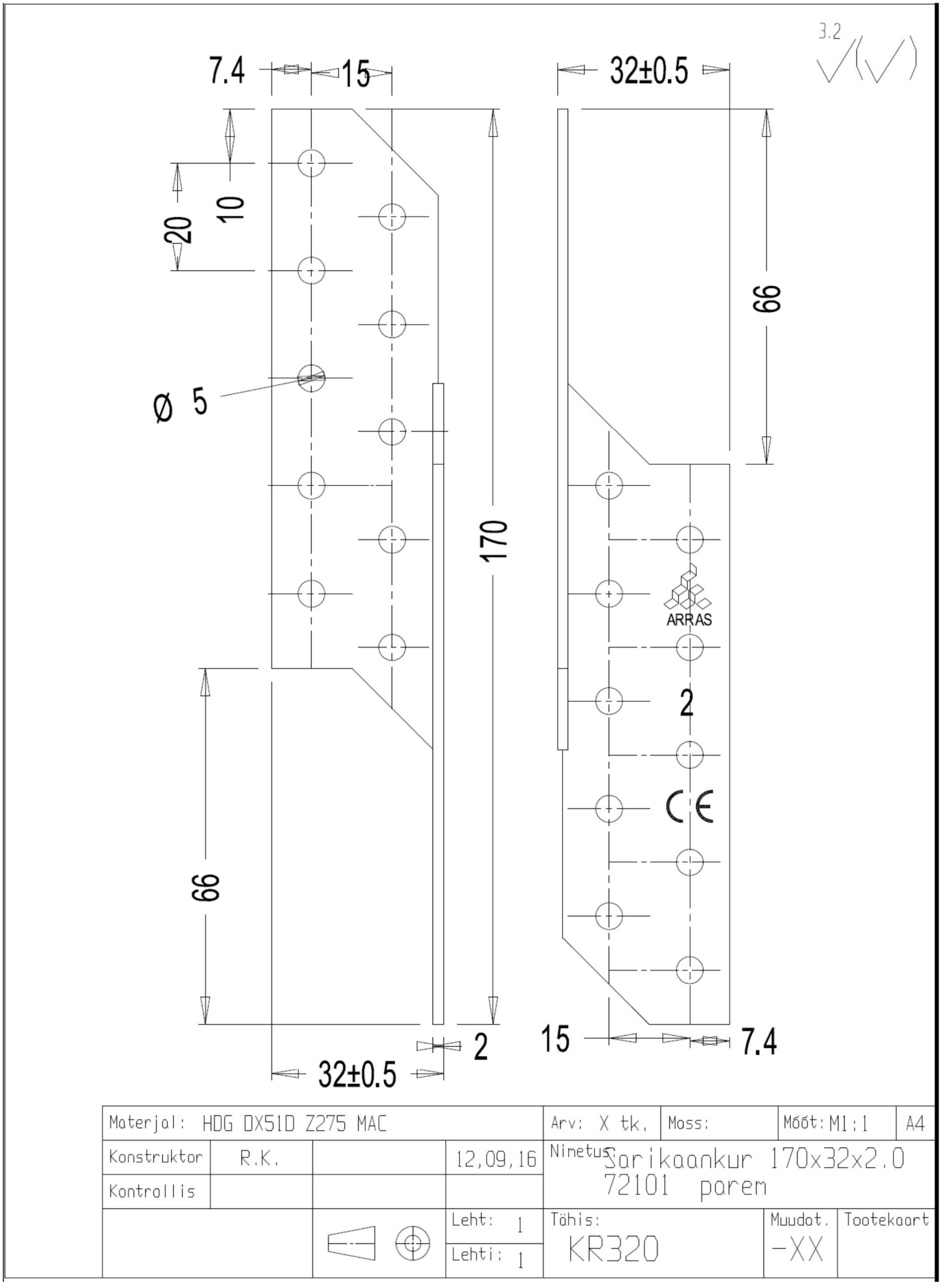
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at VTT Expert Services Ltd[1].

Issued in Espoo on 2017-04-19
by VTT Expert Services Ltd

Pertti Jokinen
Product Manager

Ari Kevarinmäki
Leading Expert

[1] The control plan is a confidential part of the European technical assessment and only handed over to the notified body or bodies involved in the procedure of attestation of conformity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Arv: X tk.
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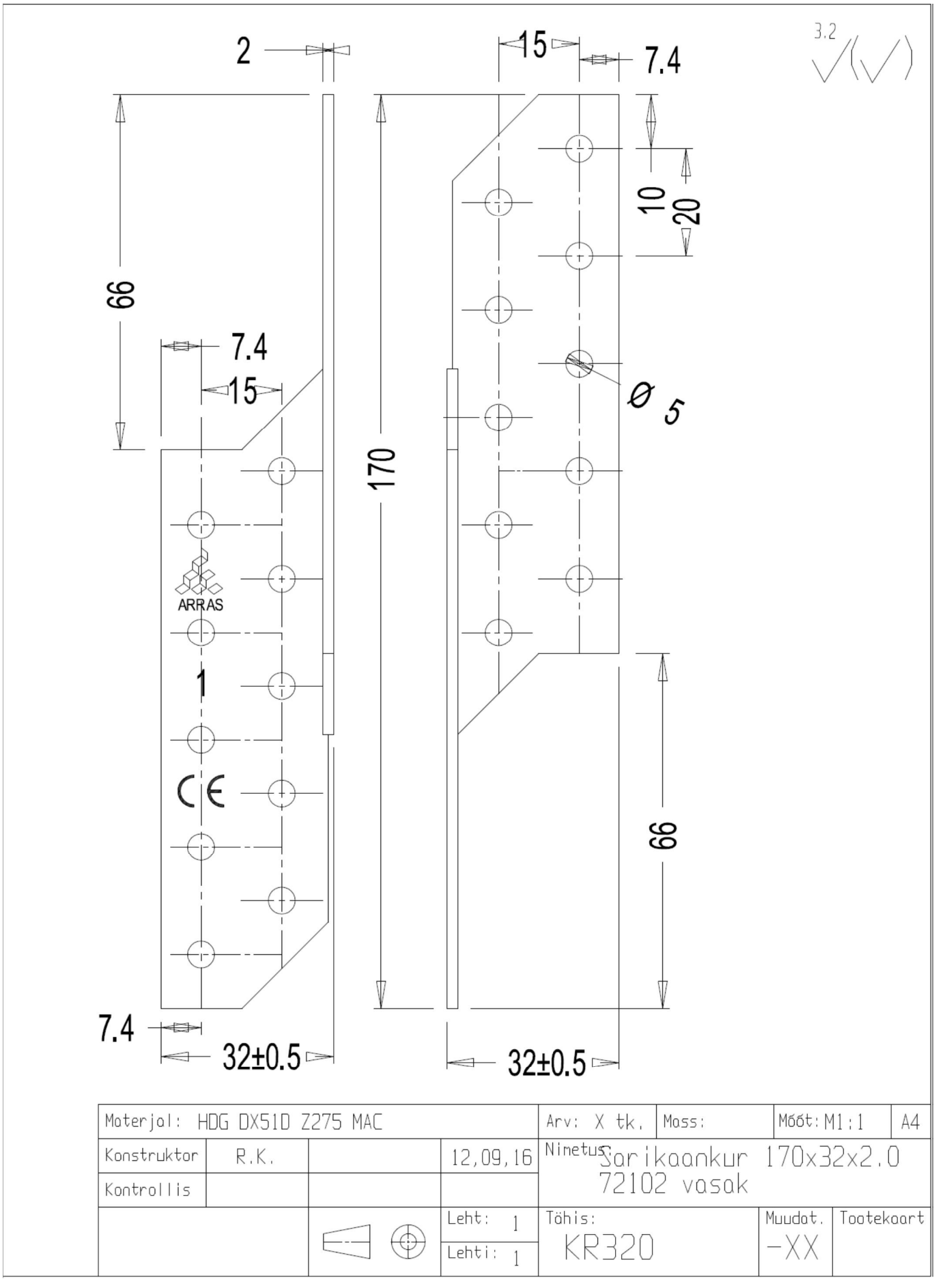
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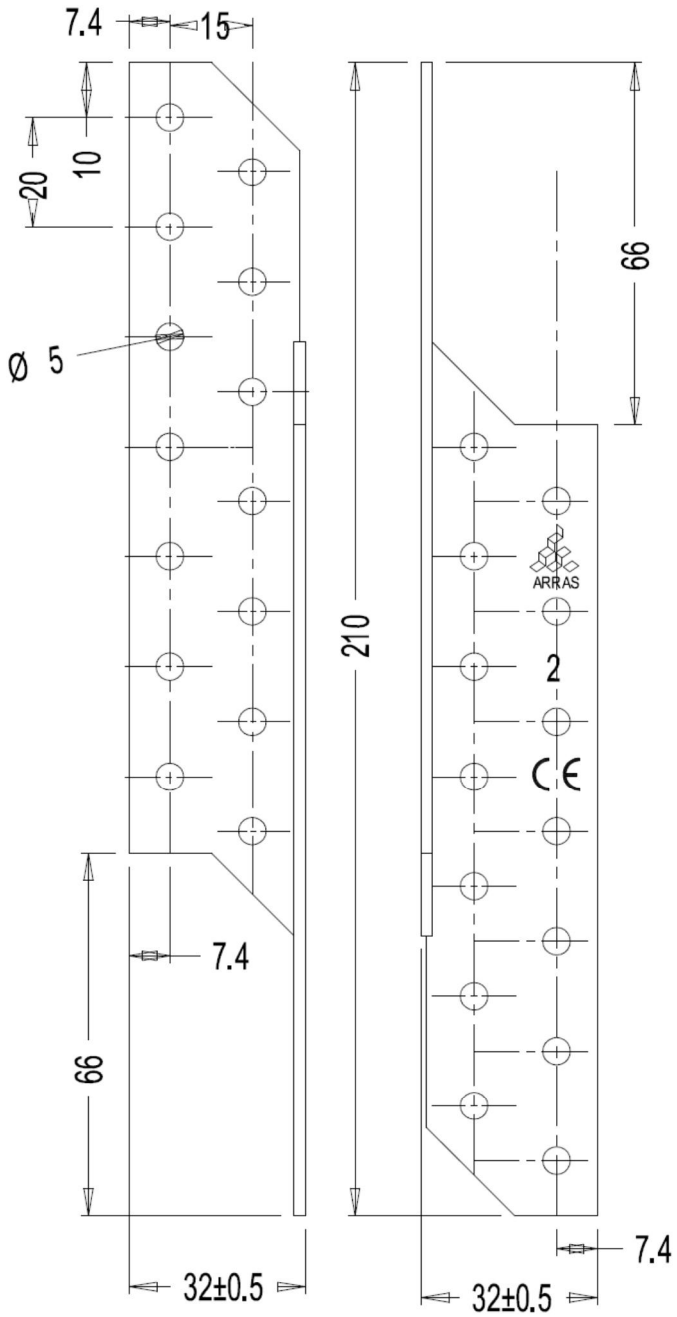

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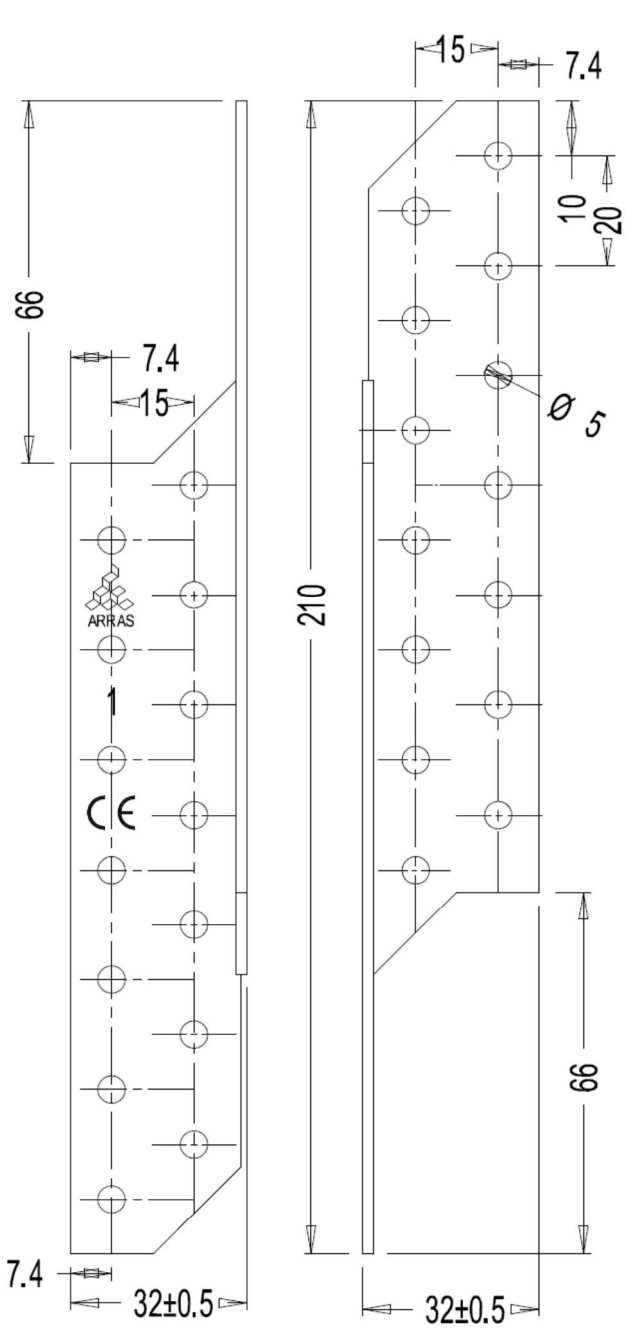

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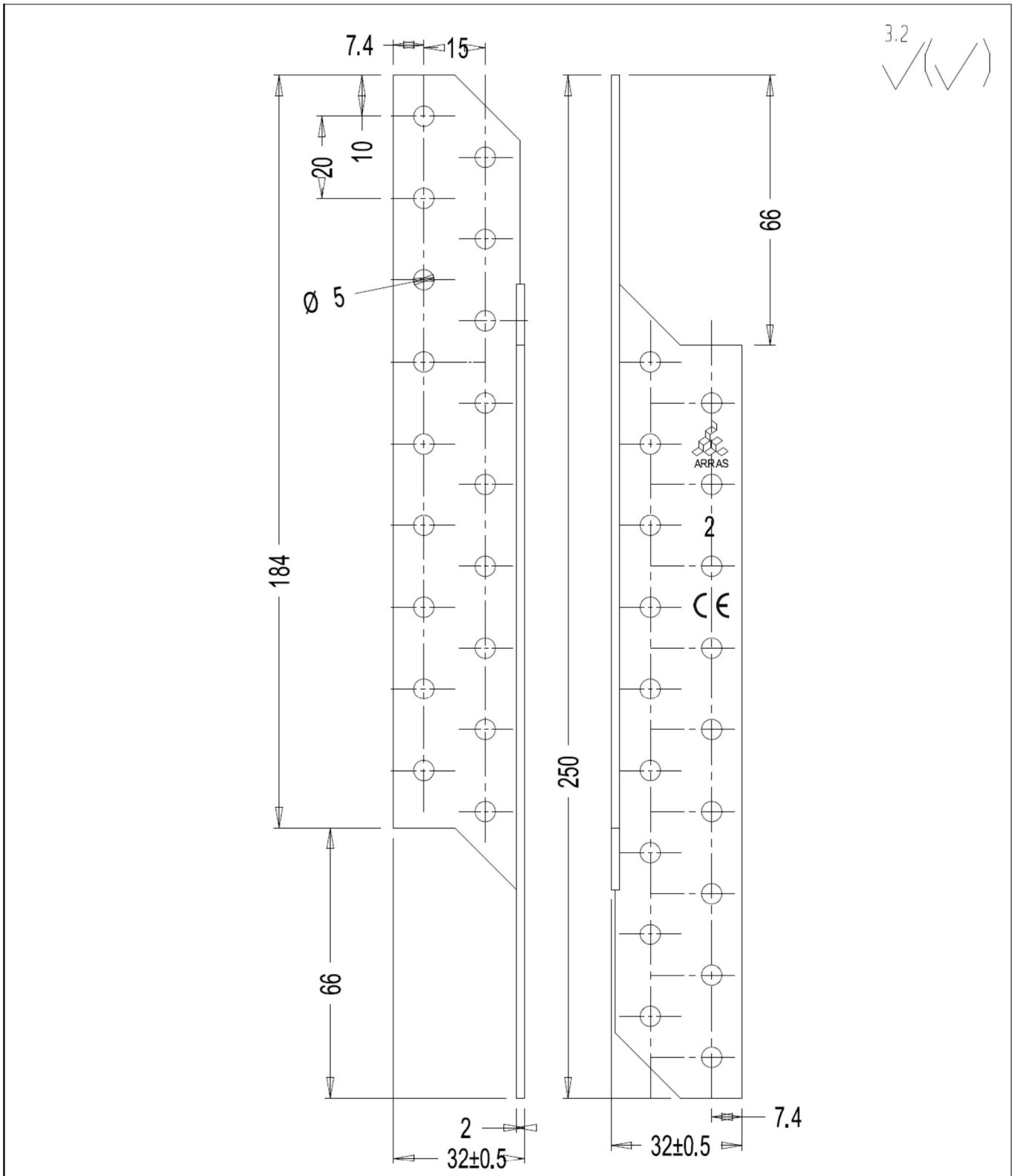

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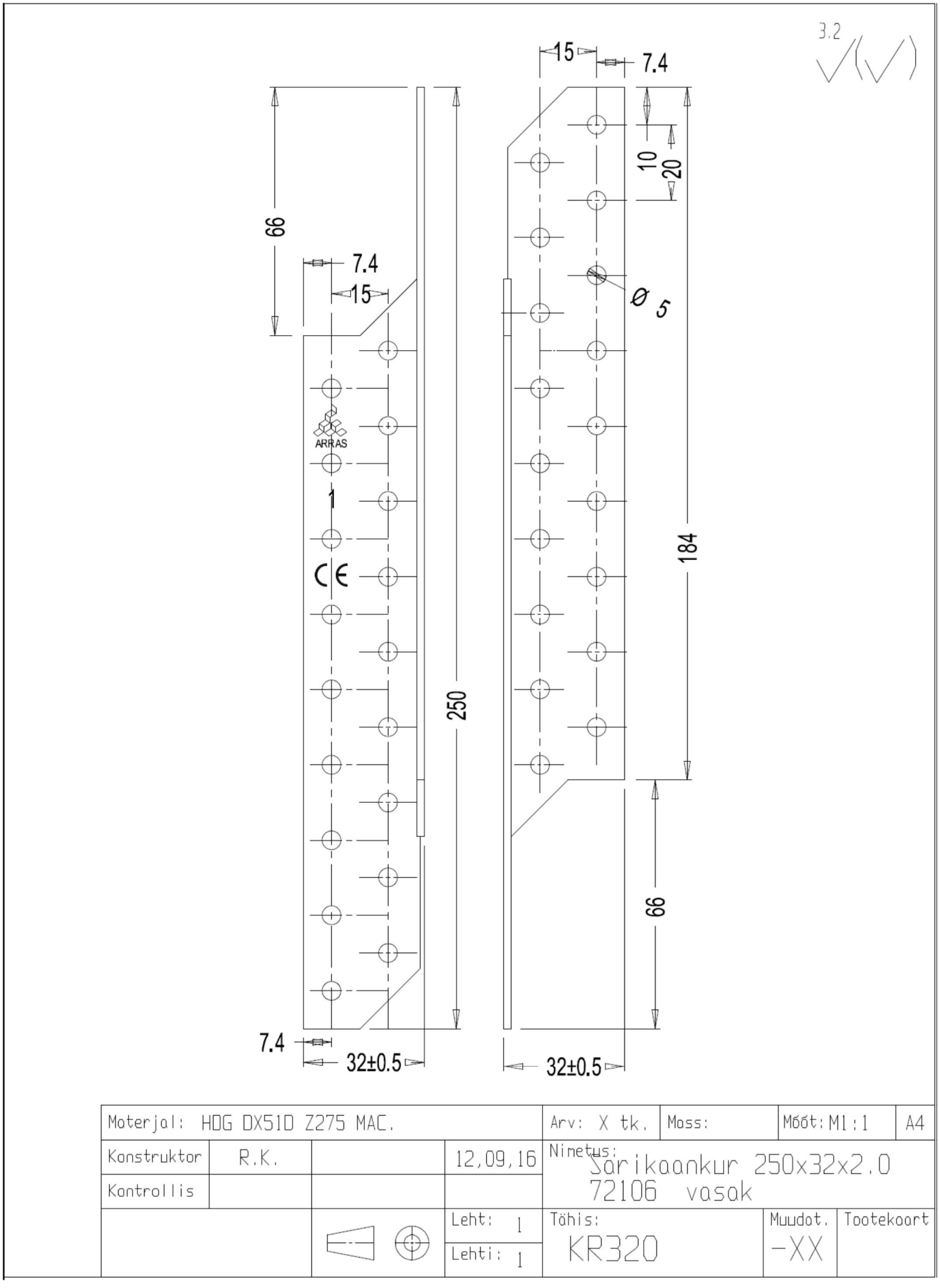
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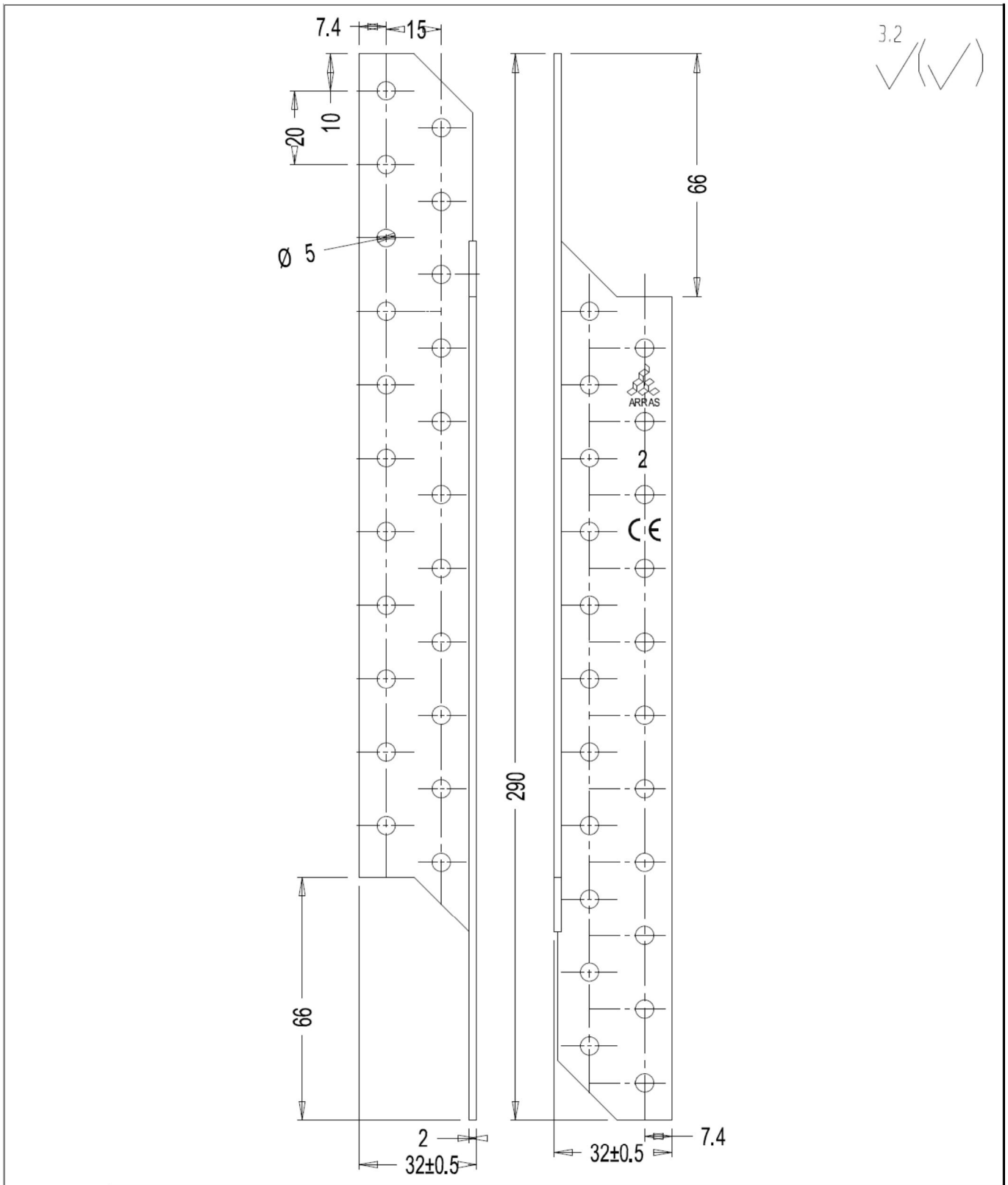

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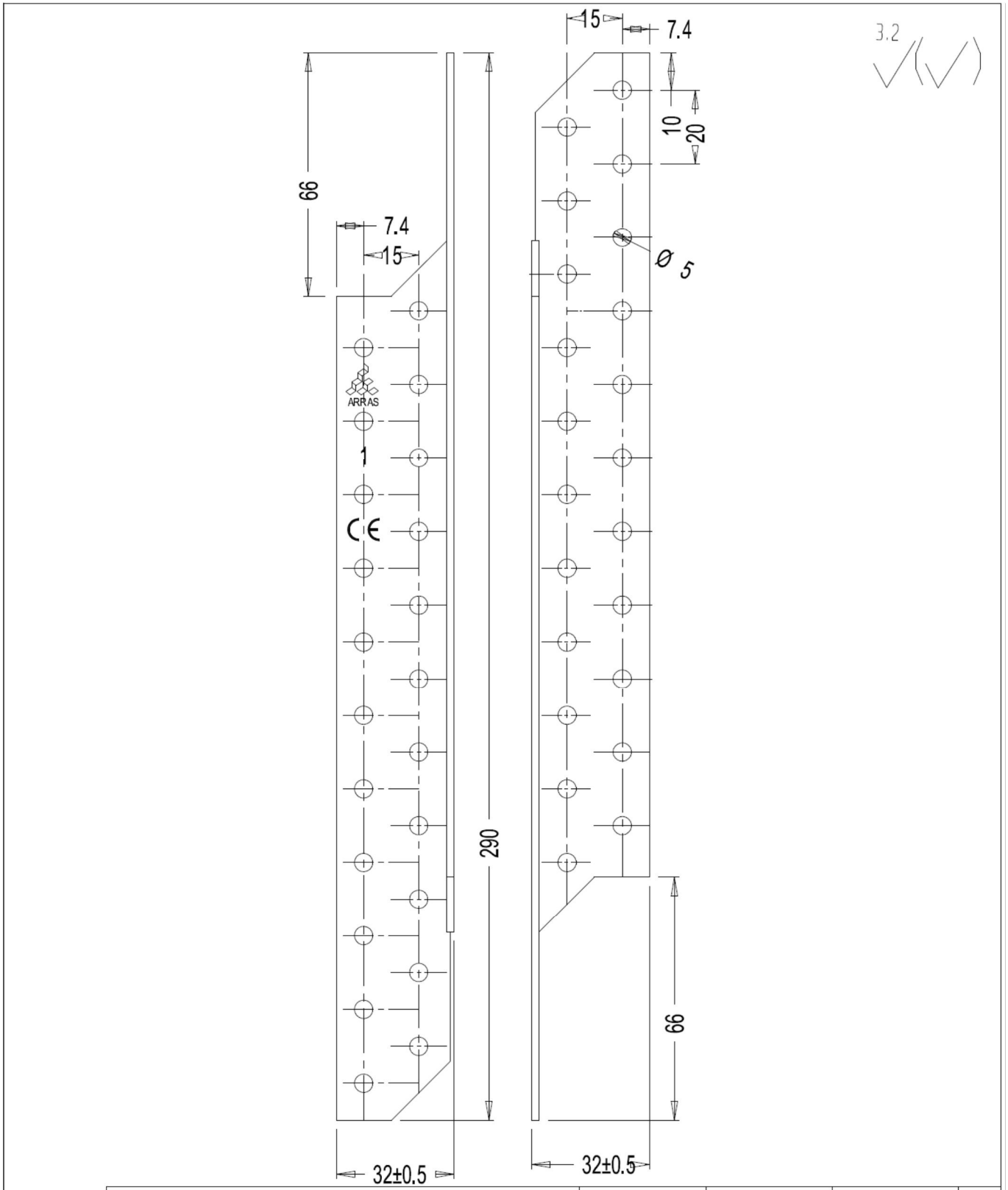
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Arv: X tk.
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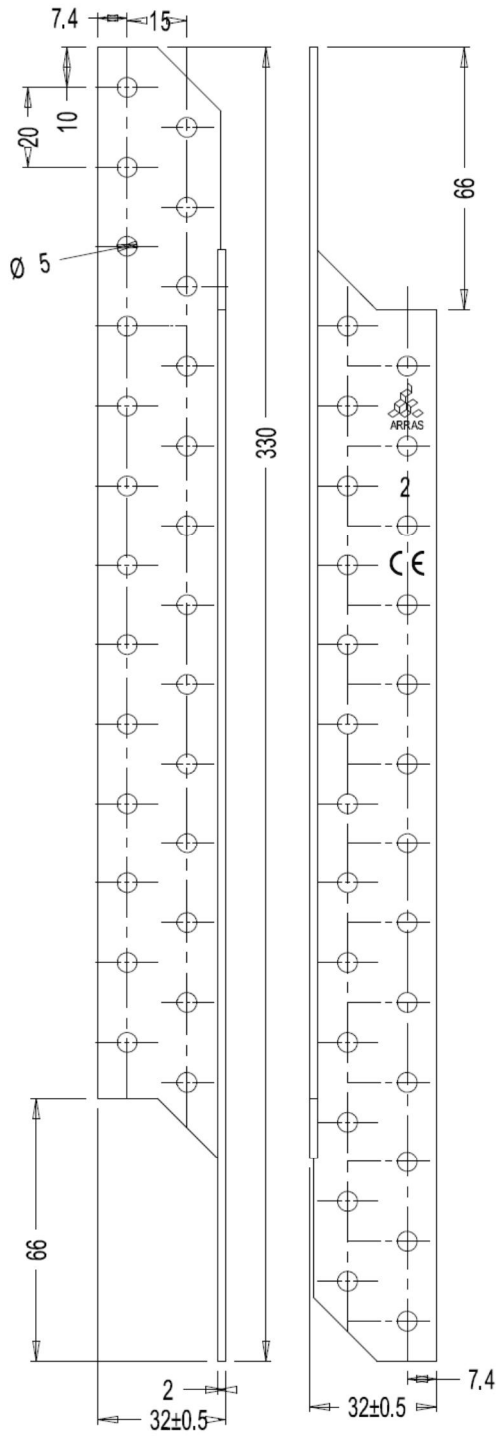

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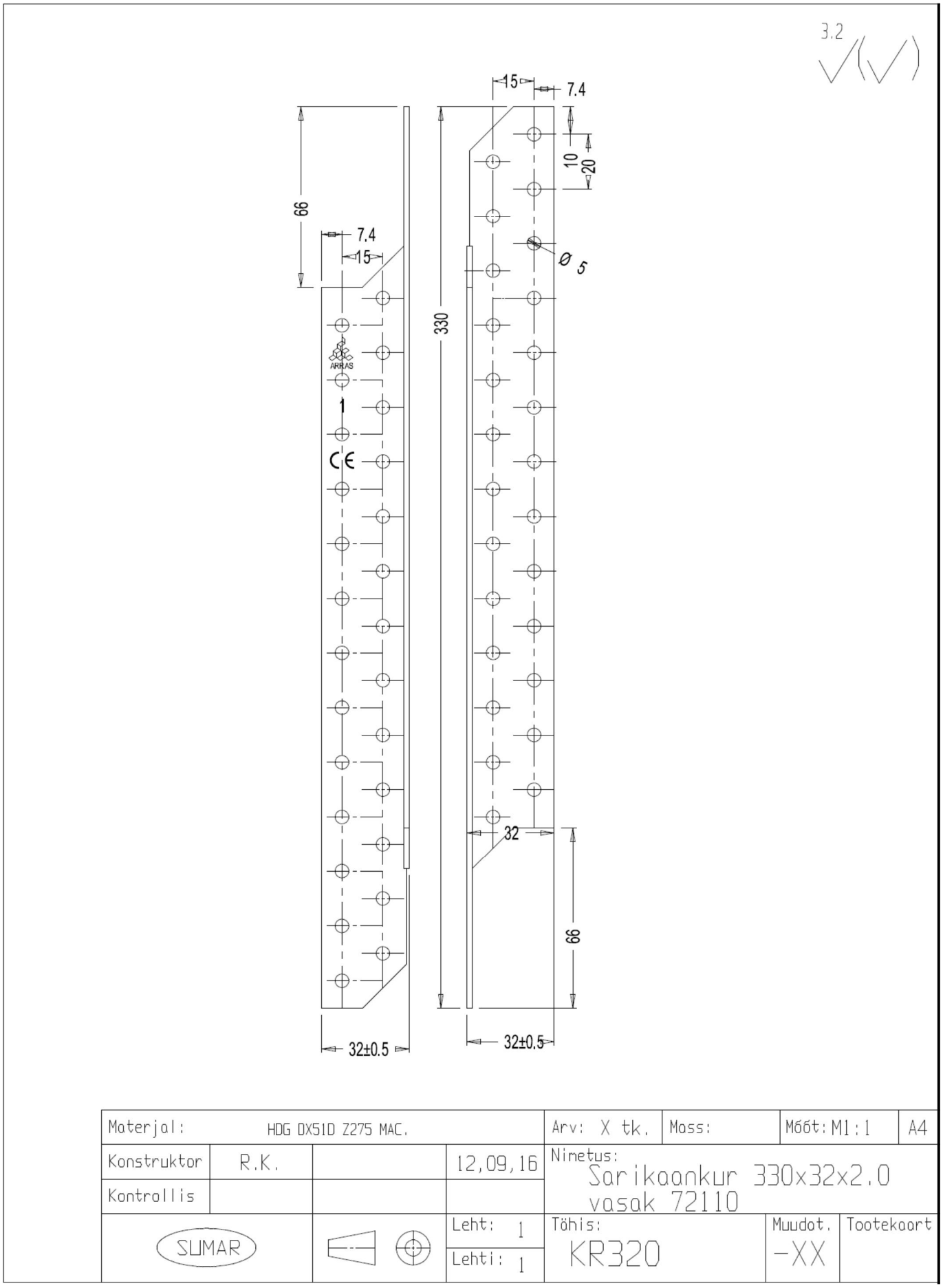

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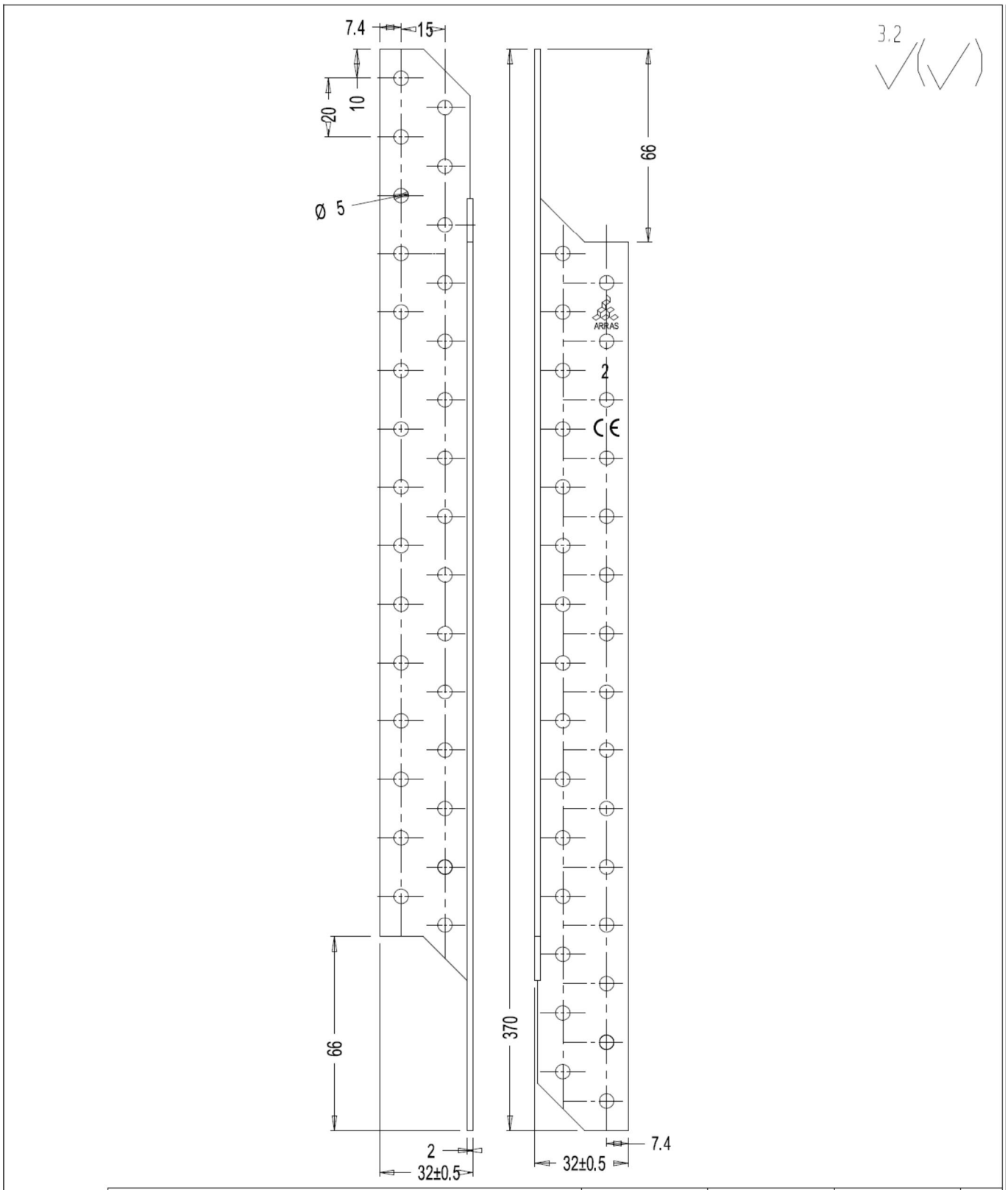

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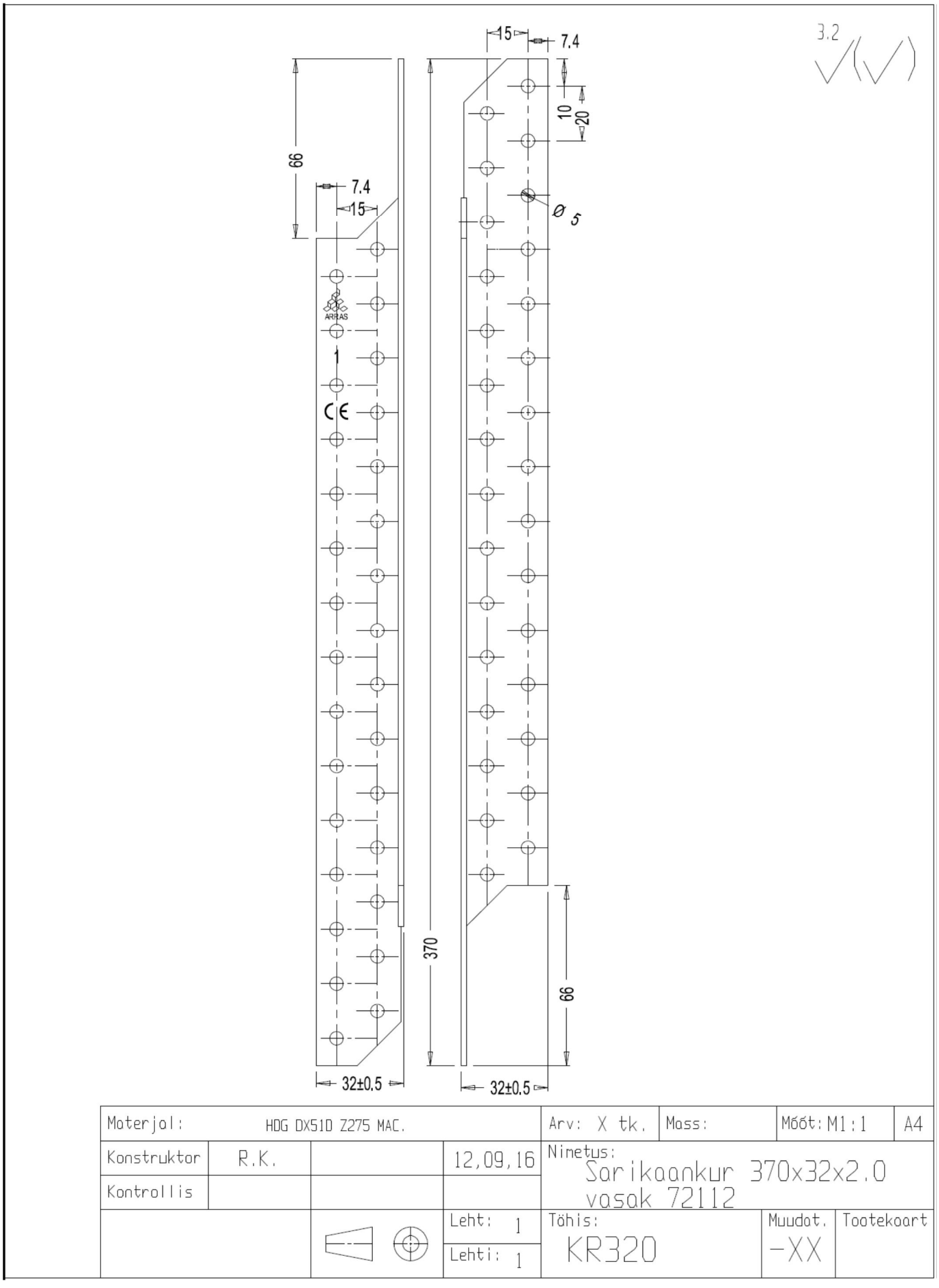
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Arv: X tk.
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Tootekaart

Lateral load-carrying capacity of fastener

The characteristic load-carrying capacity for nails and screws in Arras Purlin Anchor connections per fastener should be taken as the minimum value found from the following expressions:

- for a thick fastener $d \geq 4$ mm:

$$F_{v,Rk} = \min \begin{cases} 0{,}4\, f_{h,k} t_1 d & \text{(a)} \\ 1{,}15\sqrt{2 M_{y,Rk}\, f_{h,k} d} + \dfrac{F_{ax,Rk}}{4} & \text{(b)} \end{cases} \qquad (1)$$

- for a thin fastener $d \leq 2$ mm:

$$F_{v,Rk} = \min \begin{cases} f_{h,k} t_1 d & \text{(a)} \\ f_{h,k} t_1 d \left[\sqrt{2 + \dfrac{4 M_{y,Rk}}{f_{h,k} d\, t_1^2}} - 1 \right] + \dfrac{F_{ax,Rk}}{4} & \text{(b)} \\ 2{,}3\sqrt{M_{y,Rk}\, f_{h,k} d} + \dfrac{F_{ax,Rk}}{4} & \text{(c)} \end{cases} \qquad (2)$$

- for a fastener 2 mm < d < 4 mm, linear interpolation between equations (1) and (2) is used.

In equations (1) and (2) the penetration length of fastener in timber $t_1 = L - t$, when L is the length of fastener and t is the thickness of steel plate, d is the nominal diameter of nail or the effective diameter of screw = 1,1di, when di is the inner diameter of threaded part of screw, $M_{y,k}$ is the characteristic yield moment of the fastener determined according to standards EN 14952 and EN 409, $F_{ax,k}$ is the characteristic withdrawal capacity of the fastener with a limitation of term $F_{ax,k}/4$ at maximum to 1/3 with nails and to 1/2 with screws from the load-carrying capacity $F_{v,Rk}$ and the characteristic embedding strength

$$f_{h,k} = 0{,}082\, \rho_k\, d^{-0{,}3} \qquad \text{N/mm}^2 \qquad (3)$$

where ρ_k is the characteristic density of timber.

The capacity according to equation (2) may be used for anchor nails of diameter 4,0 mm provided, that it has a cone head with minimum conical part length of 4 mm and the minimum cone diameter of 5,2 mm at the head of nail.

Load-carrying capacity of Purlin Anchor connection

The Purlin Anchors are used as a purlin to beam or a purlin to column connection subjected to a tension load F_d parallel to the length direction of the connector (see Figure B.1). The Purlin Anchors are not assumed to have any load-carrying capacity for lateral forces perpendicular to the length direction of the connector. Two same sizes of connectors with the same number of fasteners are always used symmetrically at both sides of the beam for that a pure tension force would act on the plane of the flange of the connector without any eccentricity.

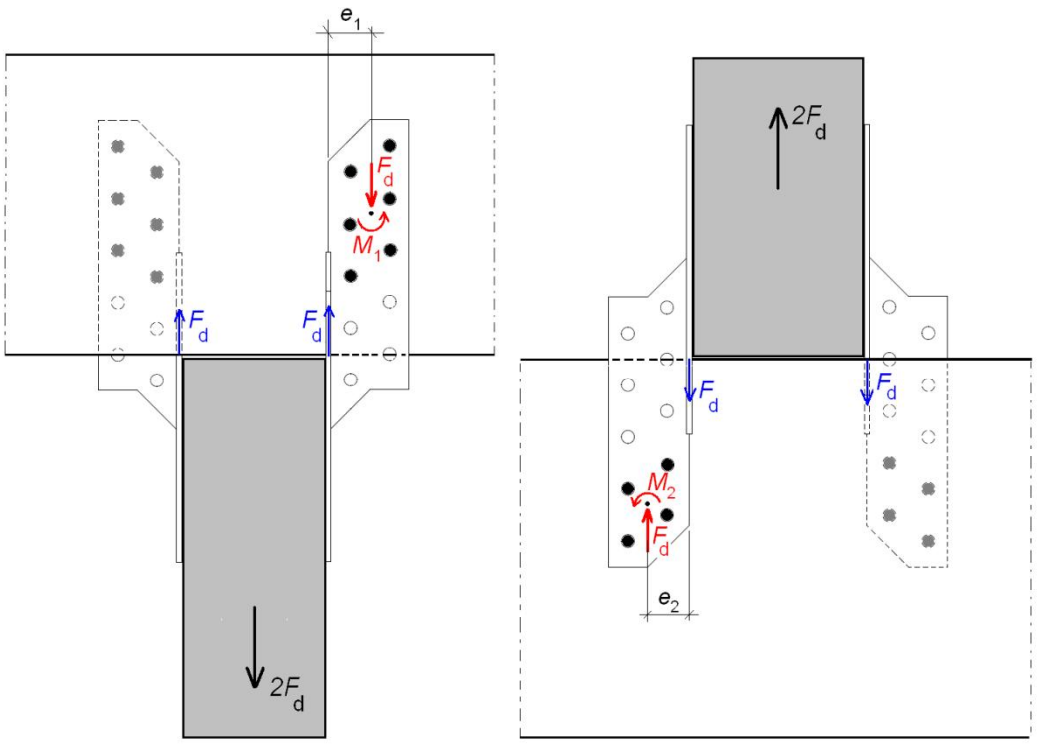

Figure B.1 Use of Purlin Anchors as tension connectors and the forces and moments acting in the Purlin Anchor.

The characteristic load-carrying capacity per purlin anchor should be taken as follows:

- for failure in steel:

$$F_{Rk,S} = 3{,}66 \text{ kN} \tag{4}$$

- for failure in nailed or screwed timber-to-steel connection:

$$F_{Rk,H} = \min \begin{cases} \dfrac{F_{v,Rk,1}}{\dfrac{1}{n_1} + \dfrac{e_1}{\sum_{i=1}^{n_1} r_{i,1}}} \\ \dfrac{F_{v,Rk,2}}{\dfrac{1}{n_2} + \dfrac{e_2}{\sum_{i=1}^{n_2} r_{i,2}}} \end{cases} \tag{5}$$

where:

$F_{v,Rk,j}$ is the characteristic lateral load-carrying resistance of the fastener in the timber member of flange j = 1 or 2 calculated according to expressions (1) and (2);

e_j is the eccentricity of the fastener group from the line of bent edge in the flange j = 1 or 2 (see Figure B.1);

$r_{i,j}$ is the distance of fastener i from the centroid of the fastener group in flange j;

n_j is the number of fasteners in flange j = 1 or 2.

Values of e_j and $\Sigma r_{i,j}$ for the certain number of fasteners n_1 and n_2 are presented in Table B.1, when the fasteners are inserted to the all holes from the ends of the connector (see Figure B.1).

Table B.1 Purlin Anchors – article numbers and nominal dimensions. Presented eccentricities e_j and moments arms $\Sigma r_{i,j}$ are valid for the given number of fasteners n_j.

Art. No.	size (mm)	e_1 (mm)	e_2 (mm)	n_1	n_2	$\Sigma r_{i,1}$ (mm)	$\Sigma r_{i,2}$ (mm)
72101 Right	170x32x2,0	16,1	16,1	6	4	103,8	51,6
72102 Left	170x32x2,0	16,1	16,1	6	4	103,8	51,6
72103 Right	210x32x2,0	16,1	16,1	8	6	175,4	103,8
72104 Left	210x32x2,0	16,1	16,1	8	6	175,4	103,8
72105 Right	250x32x2,0	16,1	16,1	10	8	266,6	175,4
72106 Left	250x32x2,0	16,1	16,1	10	8	266,6	175,4
72107 Right	290x32x2,0	16,1	16,1	12	10	377,6	266,6
72108 Left	290x32x2,0	16,1	16,1	12	10	377,6	266,6
72109 Right	330x32x2,0	16,1	16,1	14	12	508,5	377,6
72110 Left	330x32x2,0	16,1	16,1	14	12	508,5	377,6
72111 Right	370x32x2,0	16,1	16,1	16	14	659,2	508,5
72112 Left	370x32x2,0	16,1	16,1	16	14	659,2	508,5

Design condition

The following design condition shall be satisfied:

$$F_d \leq \min \begin{cases} \dfrac{k_{mod} \cdot F_{Rk,H}}{\gamma_M} \\ \dfrac{F_{Rk,S}}{\gamma_{M0}} \end{cases} \qquad (6)$$

where

F_d is the design tension force per connector according to Figure B.1;

k_{mod} is the modification factor according to Eurocode 5 taking into account the effect of the duration of the load and moisture content for the timber member;

γ_M is the partial safety factor for the resistance of connections according to the actual National annex of EN 1995-1-1;

$F_{Rk,H}$ is the characteristic load-carrying capacity of the connector according to the expression (5);

γ_{M0} is the partial safety factor for the resistance of steel cross-section according to the actual National annex of EN 1993-1-1;

$F_{Rk,S}$ is the characteristic load-carrying capacity of connector according to the expression (4).