

# ALU START

## ALUMINIUM SYSTEM FOR THE CONNECTION OF BUILDINGS TO THE GROUND

### THIRD-PARTY APPROVED

The profile transfers shear, tension, and compression forces into the foundation. Its strengths are tested, calculated, and verified by an independent third party.

### ELEVATION FROM THE FOUNDATION

The profile allows to eliminate contact between the timber panels (CLT or TIMBER FRAME) and the concrete substructure. Excellent durability of the building connection to the ground.

### BASE LEVELLING

Thanks to the special assembly templates, the supporting surface level is easy to adjust. The "leveling" of the entire building is simple, precise and fast.



### USA DESIGN VALUES

CANADA, EU and more design values available online.



VIDEO



CALCULATION TOOL



### SERVICE CONDITION

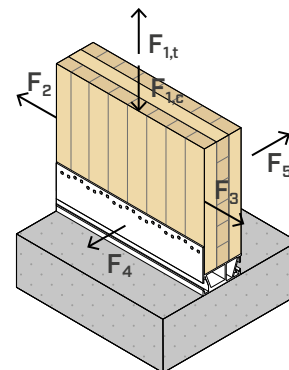


### MATERIAL



EN AW-6060 aluminium alloy

### EXTERNAL LOADS



### VIDEO

Scan the QR Code and watch the video on our YouTube channel



### FIELDS OF USE

Ground attachment system for timber walls. The aluminium profiles are positioned and levelled before the walls are installed. Fastening with LBA nails, LBS screws and concrete anchors.

Can be applied to:

- TIMBER FRAME walls
- CLT and LVL panel walls



## DURABILITY

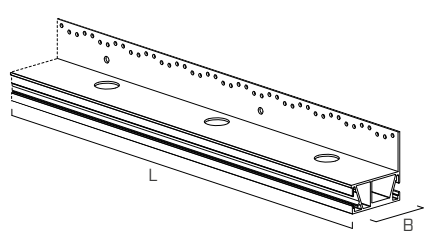
Thanks to the elevation from the foundation and the aluminium material, the building base is protected against capillary moisture. The ground connection improves durability and protects the structure.

## CERTIFIED STRENGTH

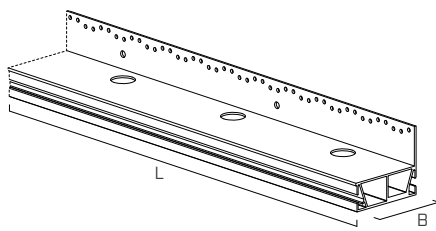
Thanks to the side flange, the profile can be fastened to the timber wall by means of nails or screws which guarantee excellent strength in all directions certified by CE marking according to ETA.

## CODES AND DIMENSIONS

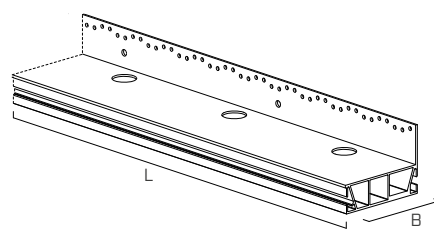
### ALU START



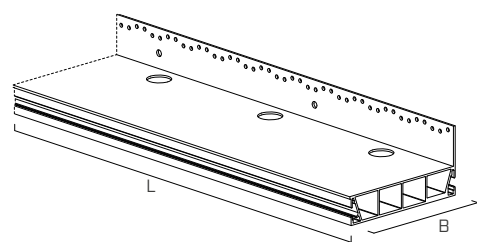
ALU START 80



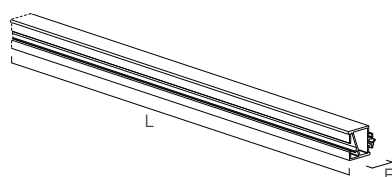
ALU START 100



ALU START 120



ALU START 175



ALU START 35

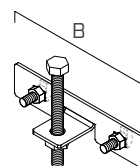
| CODE           | B<br>[in] | L<br>[in] |  | pcs |
|----------------|-----------|-----------|---------------------------------------------------------------------------------------|-----|
| ALU START 80   | 3 1/8     | 94 1/2    | ●                                                                                     | 1   |
| ALU START 100  | 4         | 94 1/2    | ●                                                                                     | 1   |
| ALU START 120  | 4 3/4     | 94 1/2    | ●                                                                                     | 1   |
| ALU START 175  | 6 7/8     | 94 1/2    | ●                                                                                     | 1   |
| ALU START 35 * | 1 3/8     | 94 1/2    | ●                                                                                     | 1   |

\* Lateral extension for ALU START profiles.

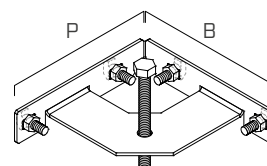
### ASSEMBLY ACCESSORIES - JIG START TEMPLATES

| CODE        | description                        | B<br>[in] | P<br>[in] | pcs |
|-------------|------------------------------------|-----------|-----------|-----|
| JIG START I | leveling template for linear joint | 6 1/4     | -         | 25  |
| JIG START L | leveling template for angle joint  | 6 1/4     | 6 1/4     | 10  |

The templates are supplied complete with M12 bolt for height adjustment, ALU BOLT bolts and MUT 93410 nuts.



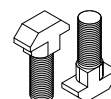
JIG START I



JIG START L

### COMPLEMENTARY PRODUCTS

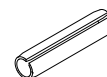
| CODE      | description                                    | pcs |
|-----------|------------------------------------------------|-----|
| ALU BOLT  | hammer head bolt for template fastening        | 100 |
| MUT 93410 | hammer bolt nut                                | 500 |
| ALU PIN   | ISO 8752 spring pins for ALU START 35 assembly | 50  |



ALU BOLT



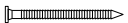
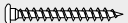
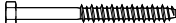
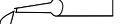
MUT 93410



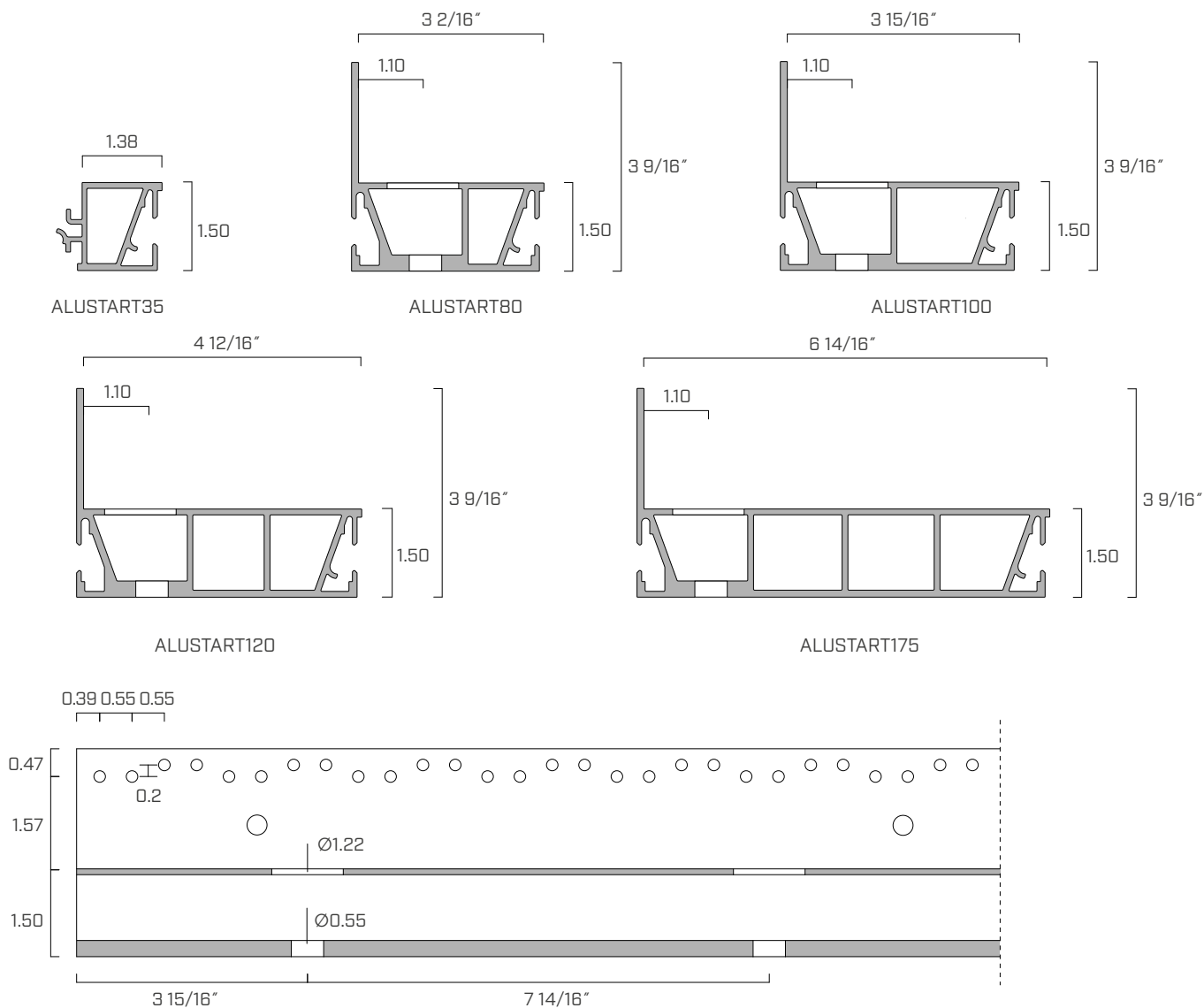
ALU PIN

ALU BOLT and ALU PIN can be ordered separately from the templates as spare parts.

## FASTENERS

| type    | description                 |                                                                                    | d<br>[in]  | support                                                                             |
|---------|-----------------------------|------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------|
| LBA     | high bond nail              |  | 0.16       |  |
| LBS     | round head screw            |  | 0.2        |  |
| SKR     | screw-in anchor             |  | 0.48       |  |
| AB1     | CE1 expansion anchor        |  | 0.48 (M12) |  |
| VIN-FIX | vinyl ester chemical anchor |  | 0.48 (M12) |  |
| HYB-FIX | hybrid chemical anchor      |  | 0.48 (M12) |  |

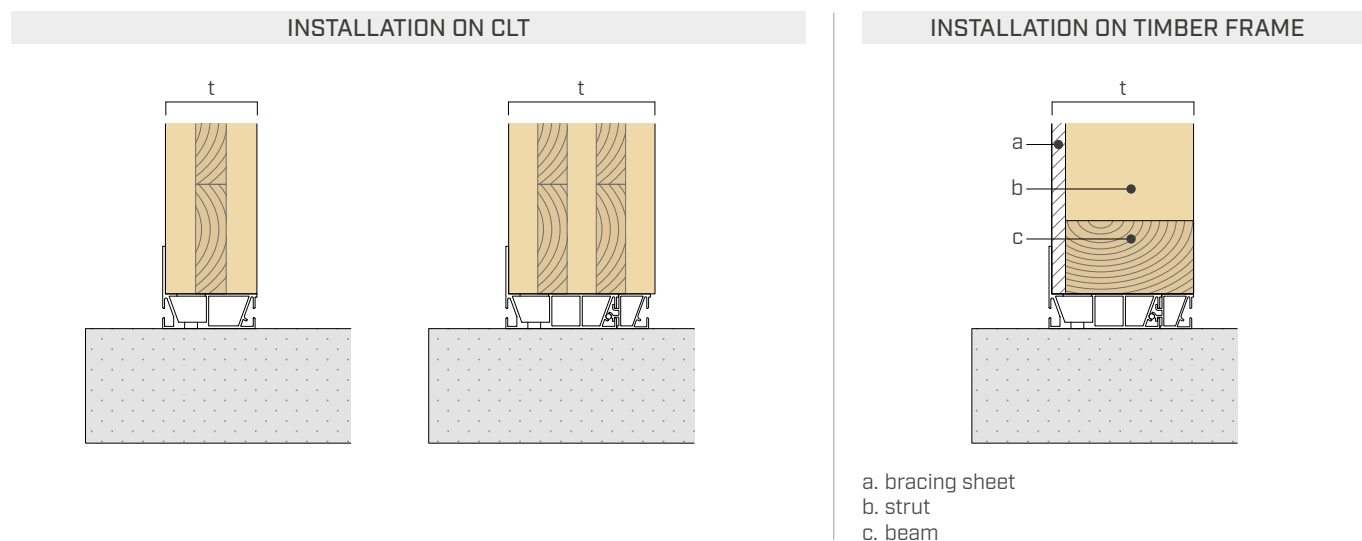
## GEOMETRY



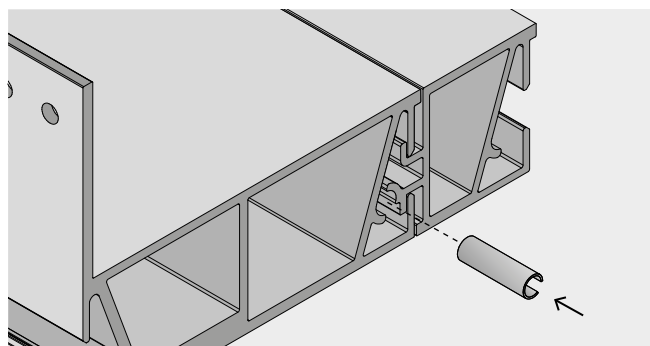
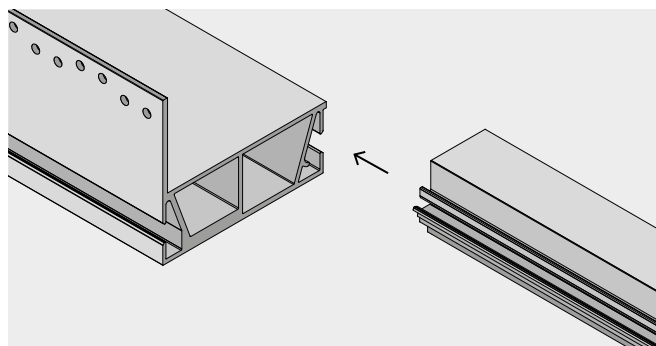
| CODE          | B<br>[in] | H<br>[in] | L<br>[in] | n <sub>v</sub> Ø0.2<br>[pcs] | n <sub>H</sub> Ø0.55<br>[pcs] |
|---------------|-----------|-----------|-----------|------------------------------|-------------------------------|
| ALU START 80  | 3 1/8     | 3 9/16    | 94 1/2    | 171                          | 12                            |
| ALU START 100 | 3 15/16   | 3 9/16    | 94 1/2    | 171                          | 12                            |
| ALU START 120 | 4 3/4     | 3 9/16    | 94 1/2    | 171                          | 12                            |
| ALU START 175 | 6 7/8     | 3 9/16    | 94 1/2    | 171                          | 12                            |
| ALU START 35  | 1 3/8     | 1 1/2     | 94 1/2    | -                            | -                             |

## ■ INSTALLATION

ALU START is an extruded aluminium profile designed to house the walls and to solve the foundation-to-wall interface in timber. The profile is certified to withstand all the stresses typical for a timber wall, i.e.  $F_1$ ,  $F_{2/3}$ ,  $F_4$  and  $F_5$ . ALU START profiles are designed to fit both CLT and Timber Frame walls. The use of the lateral extension ALUSTART35 allows its use with CLT and Timber Frame walls having greater thickness.



The ALUSTART35 side extension is easily inserted into the ALU START profiles. The compound profile is then secured in position by two ALUSPIN pins to be inserted at the ends. It is possible to install up to two ALUSTART35 profiles on a profile with a nailed flange.



### PROFILE SELECTION

| profile                     | reference width<br>[in] | recommended thickness t |                 |
|-----------------------------|-------------------------|-------------------------|-----------------|
|                             |                         | minimum<br>[in]         | maximum<br>[in] |
| ALUSTART80                  | 3 1/8                   | 3                       | 3 3/4           |
| ALUSTART100                 | 3 15/16                 | 3 9/16                  | 4 1/2           |
| ALUSTART120                 | 4 3/4                   | 4 1/2                   | 5 5/16          |
| ALUSTART100 + ALUSTART35    | 5 5/16                  | 5 5/16                  | 6 1/8           |
| ALUSTART120 + ALUSTART35    | 6 1/8                   | 6 1/8                   | 6 7/8           |
| ALUSTART175                 | 6 7/8                   | 6 1/8                   | 7 11/16         |
| ALUSTART120 + 2x ALUSTART35 | 7 1/2                   | 7 1/16                  | 8 7/16          |
| ALUSTART175 + ALUSTART35    | 8 1/4                   | 7 11/16                 | 9 1/4           |
| ALUSTART175 + 2x ALUSTART35 | 9 5/8                   | 9 1/4                   | 10 5/8          |

# INSTALLATION

## NAILING

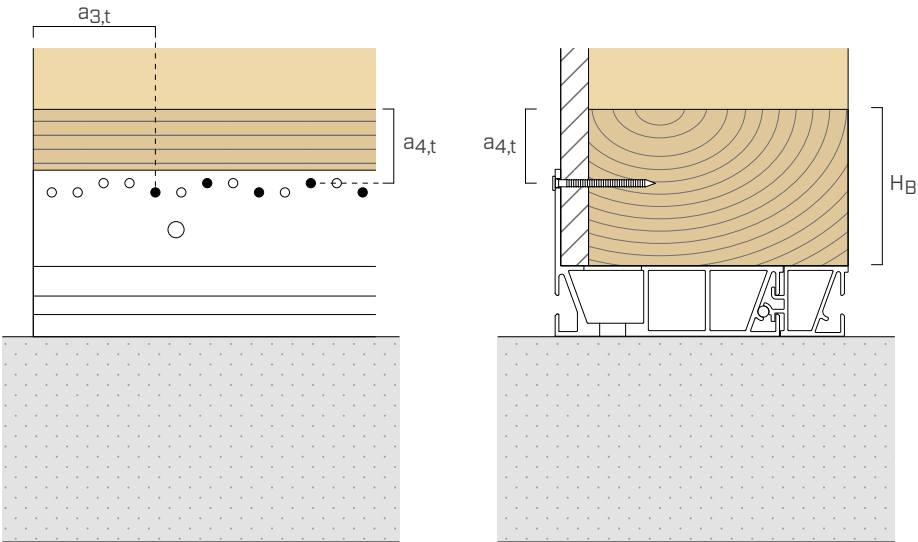
ALU START profiles can be used for different building systems (CLT / Timber Frame). Depending on the construction technology, different nailings can be used in accordance with the minimum distances.

## MINIMUM DISTANCES

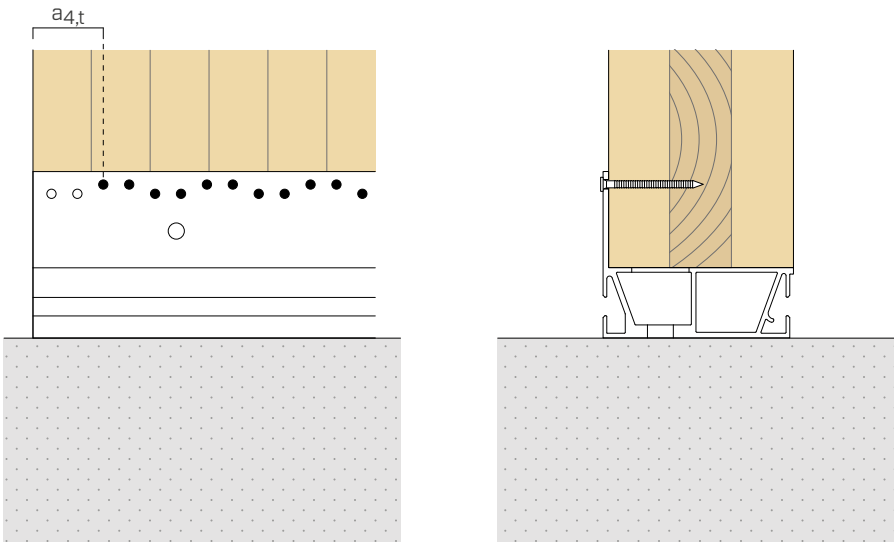
| TIMBER<br>minimum distances |                       | nails<br>LBA Ø0.16" | screws<br>LBS Ø0.2" |
|-----------------------------|-----------------------|---------------------|---------------------|
| C/GL                        | a <sub>4,t</sub> [in] | ≥ 1 9/16            | -                   |
|                             | H <sub>B</sub> [in]   | ≥ 3 5/8             | -                   |
|                             | a <sub>3,t</sub> [in] | ≥ 2 3/8             | -                   |
| CLT                         | a <sub>4,t</sub> [in] | ≥ 1 9/16            | ≥ 1 15/16           |

- C/GL: minimum distances for solid timber or glulam consistent with timber specific gravity < 0.55.

## SOLID TIMBER (C) OR GLULAM (GL)



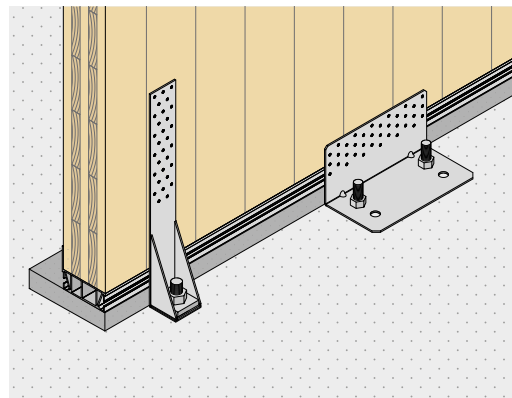
## CLT



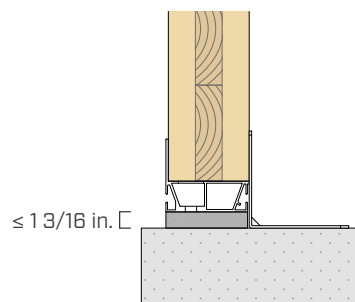
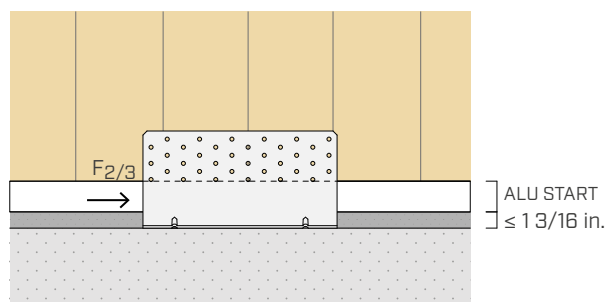
## ■ ADDITIONAL CONNECTION SYSTEMS

The ALU START geometry allows the use of additional connection systems such as TITAN TCN and WHT, even with a grout between the profile and the foundation.

Certified partial nailings are available for TITAN TCN installation which allow laying bedding grout with a thickness up to  $1 \frac{3}{16}$  in.

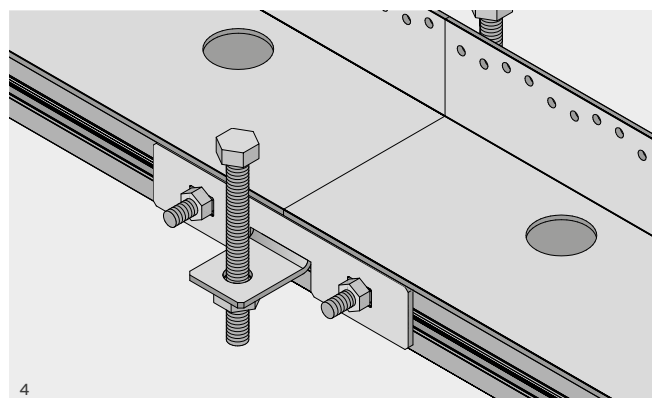
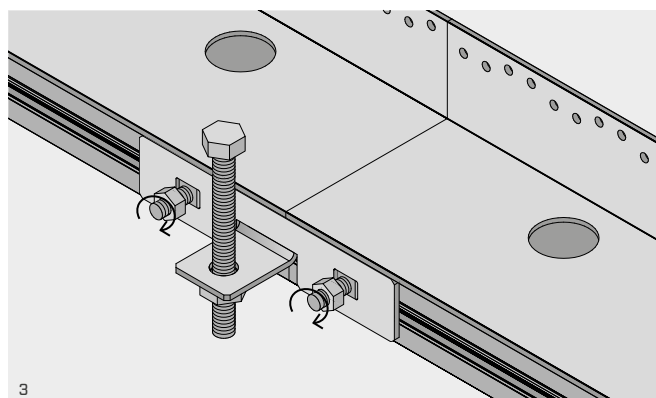
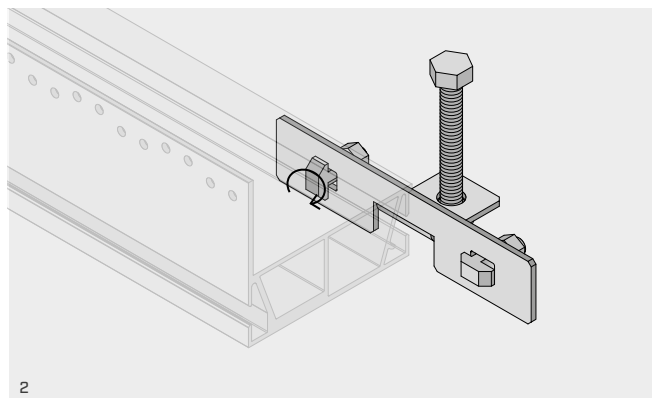
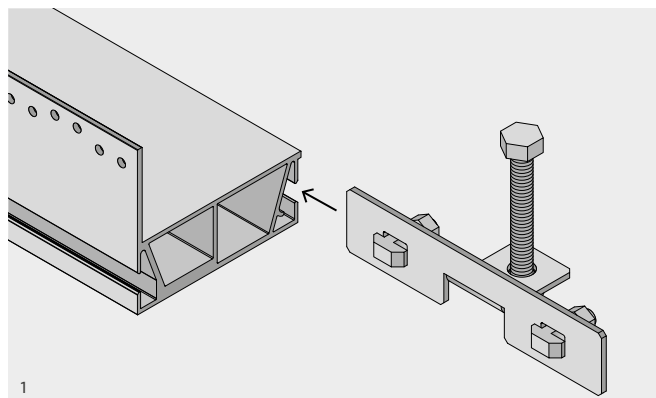


EXAMPLE OF INSTALLATION WITH TITAN TCN240



## ■ POSITIONING

Assembly includes the use of special JIG START templates for the height leveling of the profiles, for the linear joint and for creating 90° angles.

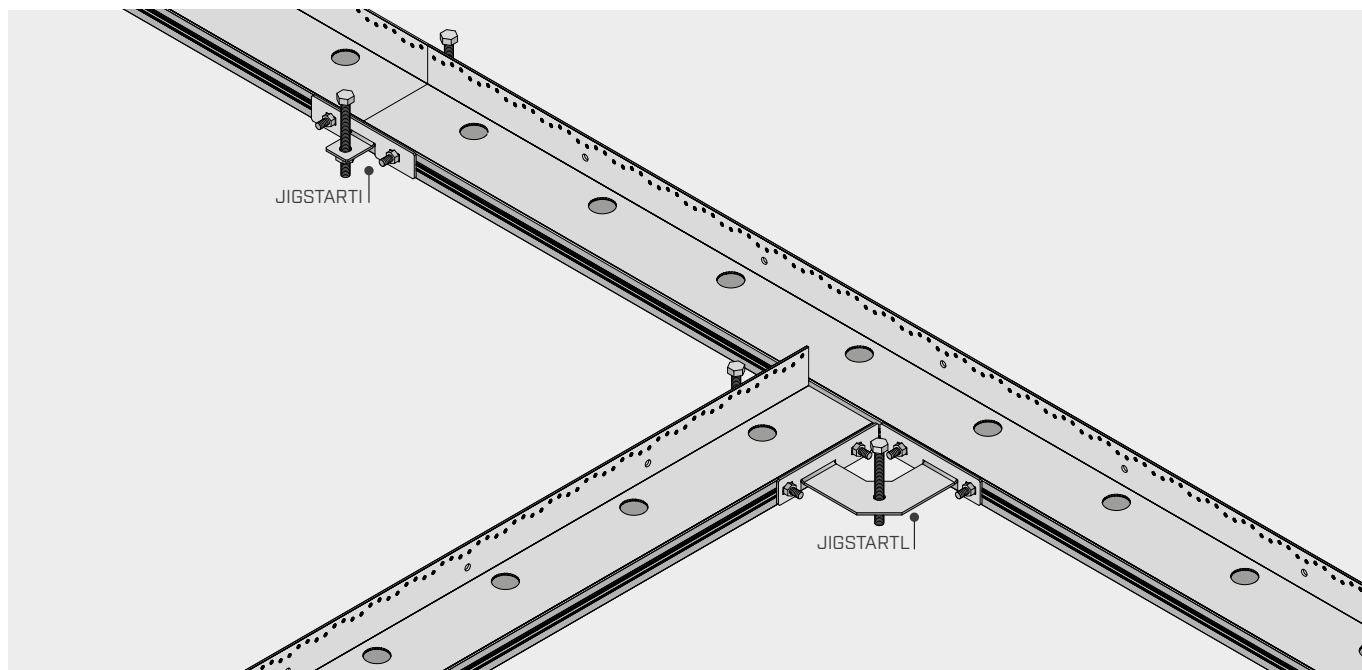


## POSITIONING

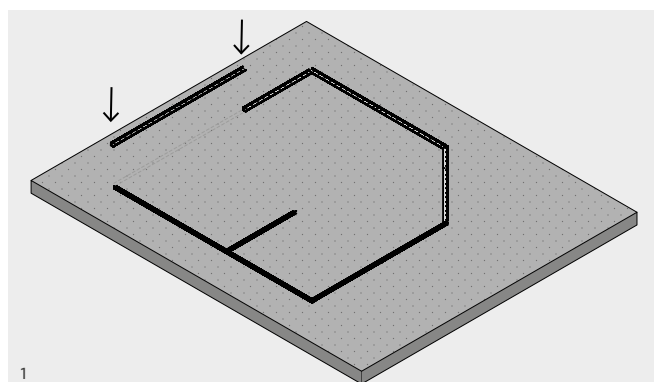
JIGSTARTI templates can connect two consecutive profiles and must be positioned on both sides of ALU START, without positioning constraints along the development.

The 90° angle bracket connection is carried out through the JIGSTARTL jigs.

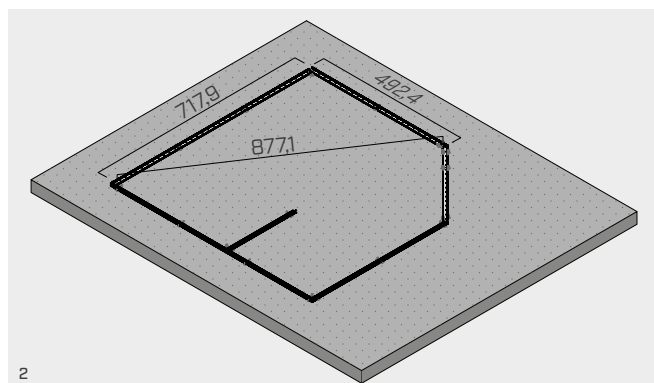
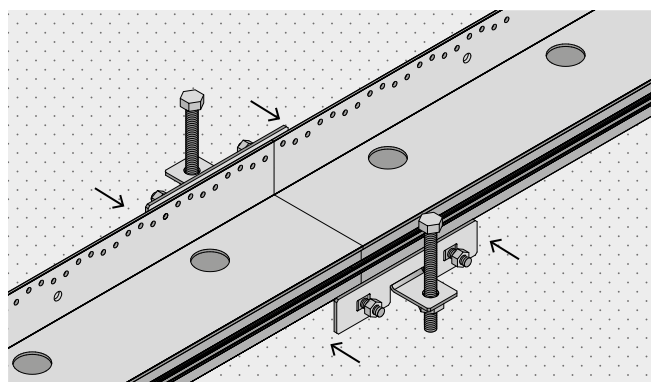
On each template there is a hexagonal head bolt, which allows the height adjustment of the aluminium profiles.



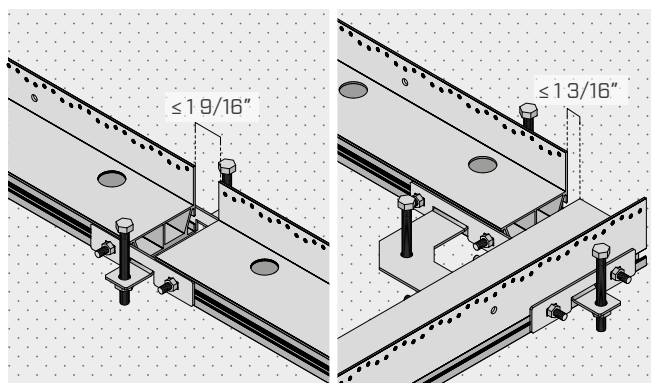
## MOUNTING



Preliminary positioning of the profiles on the laying surface using the templates and cutting the elements to size, if necessary.

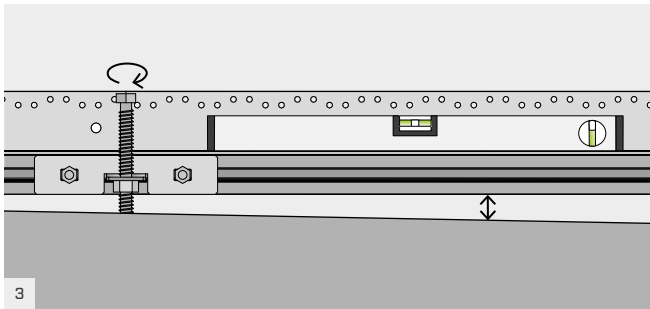


Finalize layout: verify overall dimensions and diagonals.

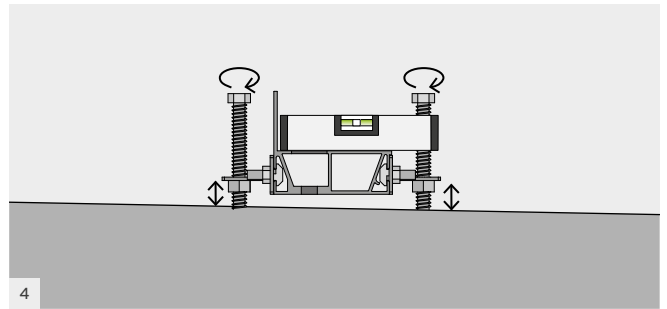


Fine adjustment with JIG START templates of the total length of the wall, compensating the tolerances of the profiles cut to size.

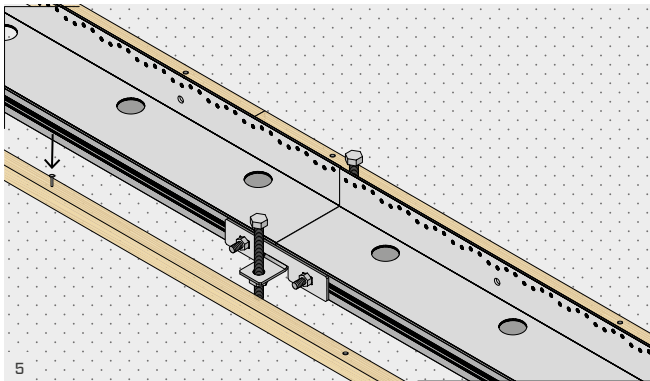
## MOUNTING



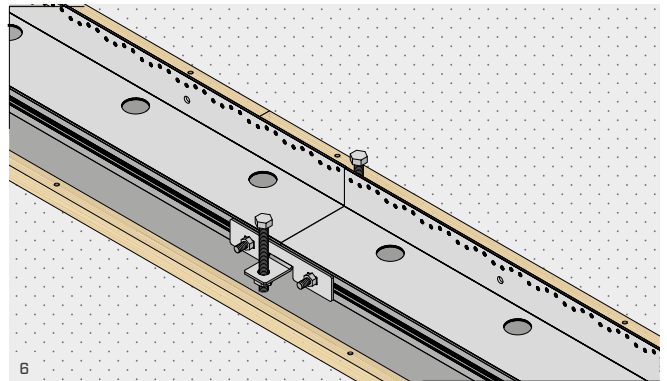
Longitudinal leveling of ALU START profile.



Lateral leveling of the ALU START profile.

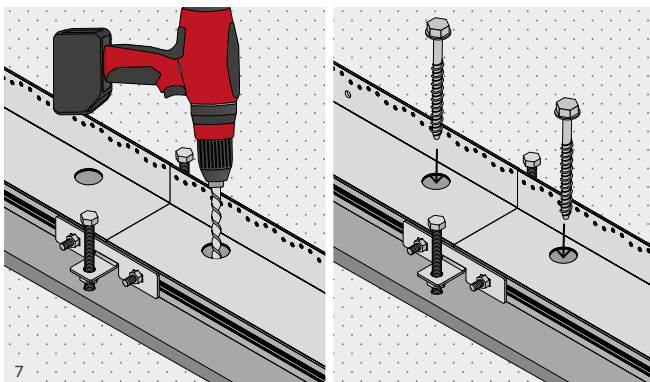


Construction of formwork with timber battens.

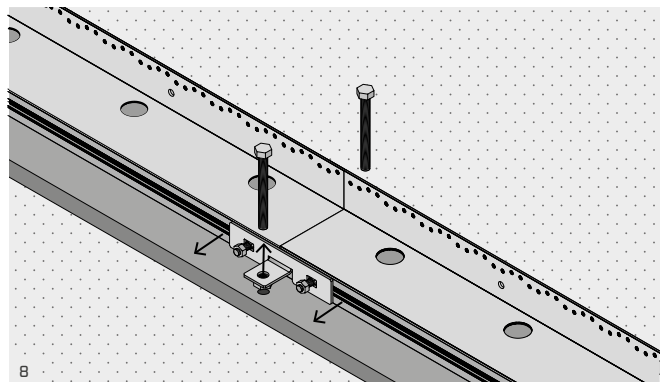


Pouring the grout between the profile and the concrete support.

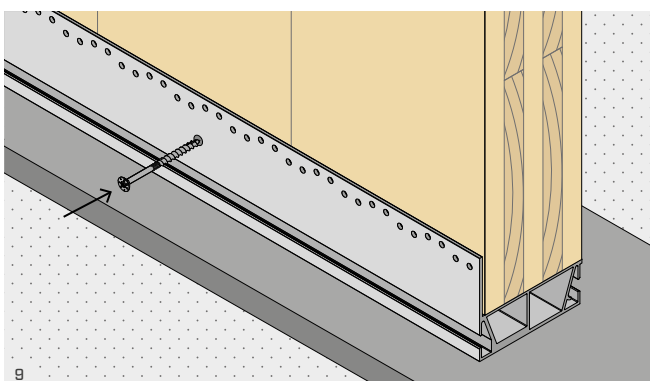
Before pouring grout between the profile and the concrete, always apply a moisture barrier such as STARTBAND, PROTECT, or a comparable separating membrane. This barrier prevents direct contact between the grout and the aluminium profile.



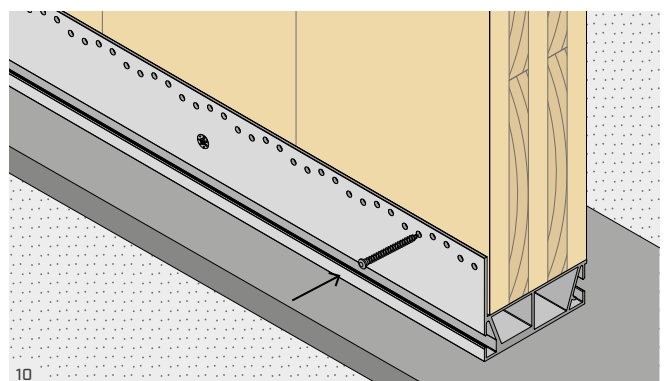
Insert the concrete anchors following the anchor installation instructions.



Removal of JIG START templates, which can be reused.



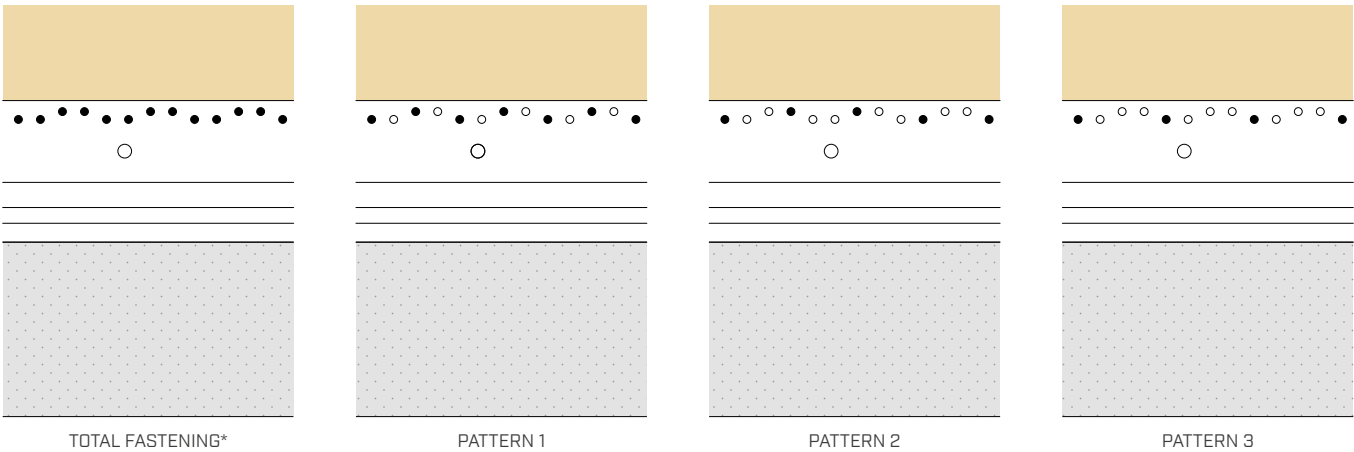
Positioning of the walls using Ø0.24 or Ø0.32 screws to pull the panel tight to the aluminium profile.



Profiles fastening with nails or screws.

## PARTIAL FASTENING PATTERNS

It is possible to apply partial nailing patterns according to the design and installation requirements of the walls.



\* This pattern is not suitable for solid timber/glulam in the presence of shear loads  $F_{2/3}$ .

| pattern   | type | fastening holes Ø0.2 |                            |
|-----------|------|----------------------|----------------------------|
|           |      | Ø x L<br>[in]        | n <sub>v</sub><br>[pcs/ft] |
| total     |      |                      | 22                         |
| pattern 1 | LBA  | Ø0.16 x 2 3/8        | 11                         |
| pattern 2 | LBS  | Ø0.2 x 1 31/32       | 8                          |
| pattern 3 |      |                      | 6                          |

## STRUCTURAL VALUES | TIMBER-TO-CONCRETE | $F_{1,c}$

It is possible to cut the profiles according to the design requirements; profiles with length less than 23 5/8" are to be considered for compressive strength only.

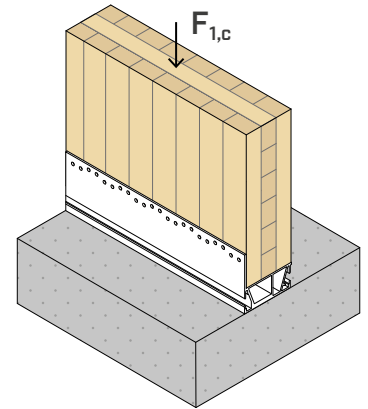
### STRENGTH ON ALUMINIUM SIDE

| configuration               | reference width<br>[in] | ALUMINIUM                 |                                         |
|-----------------------------|-------------------------|---------------------------|-----------------------------------------|
|                             |                         | $R_{1,c,ASD}$<br>[lbf/ft] | $P_{1,c,ASD}$<br>[psi]                  |
| ALUSTART35                  | 1 3/8                   | 5087                      | 308                                     |
| ALUSTART80                  | 3 1/8                   | 15421                     | 404                                     |
| ALUSTART100                 | 3 15/16                 | 19225                     | 404                                     |
| ALUSTART120                 | 4 3/4                   | 23920                     | 422                                     |
| ALUSTART100 + ALUSTART35    | 5 5/16                  | 24190                     | 404 <sup>(1)</sup> + 308 <sup>(2)</sup> |
| ALUSTART120 + ALUSTART35    | 6 1/8                   | 29007                     | 422 <sup>(1)</sup> + 308 <sup>(2)</sup> |
| ALUSTART175                 | 6 7/8                   | 34543                     | 439                                     |
| ALUSTART120 + 2x ALUSTART35 | 7 1/2                   | 32327                     | 422 <sup>(1)</sup> + 308 <sup>(2)</sup> |
| ALUSTART175 + ALUSTART35    | 8 1/4                   | 38393                     | 439 <sup>(1)</sup> + 308 <sup>(2)</sup> |
| ALUSTART175 + 2x ALUSTART35 | 9 5/8                   | 44692                     | 439 <sup>(1)</sup> + 308 <sup>(2)</sup> |

<sup>(1)</sup> Value referred to the main profile.

<sup>(2)</sup> Value referred to ALUSTART35 extension.

For walls of different widths to the reference width, the compression strength of the aluminium profile can be calculated by multiplying the parameter  $F_{1,c,ASD}$  by the actual width of the wall.



## STRUCTURAL VALUES | TIMBER-TO-CONCRETE | $F_{1,t}$

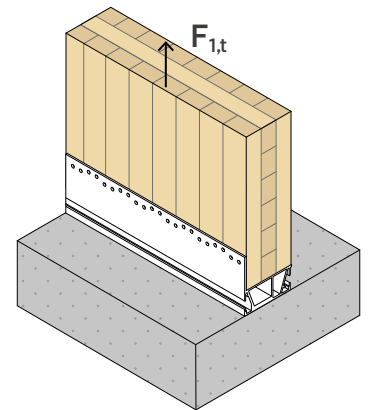
### STRENGTH ON TIMBER-TO-ALUMINIUM SIDE

|             |           | TIMBER                                                    | ALUMINIUM                           | CONCRETE                           |                                      |
|-------------|-----------|-----------------------------------------------------------|-------------------------------------|------------------------------------|--------------------------------------|
| profile     | pattern   | R <sub>1,t,ASD timber</sub> <sup>(1) (2)</sup><br>[lb/ft] | R <sub>1,t,ASD alu</sub><br>[lb/ft] | k <sub>t, overall</sub><br>[lb/ft] | K <sub>1,t ser</sub><br>[lb/in-1/ft] |
| ALUSTART80  | total     | 3938                                                      | 3530                                | 1,88                               | 10780                                |
|             | pattern 1 | 1941                                                      |                                     |                                    |                                      |
|             | pattern 2 | 1275                                                      |                                     |                                    |                                      |
|             | pattern 3 | 942                                                       |                                     |                                    |                                      |
| ALUSTART100 | total     | 3938                                                      |                                     | 1,62                               |                                      |
|             | pattern 1 | 1941                                                      |                                     |                                    |                                      |
|             | pattern 2 | 1275                                                      |                                     |                                    |                                      |
|             | pattern 3 | 942                                                       |                                     |                                    |                                      |
| ALUSTART120 | total     | 3938                                                      |                                     | 1,44                               |                                      |
|             | pattern 1 | 1941                                                      |                                     |                                    |                                      |
|             | pattern 2 | 1275                                                      |                                     |                                    |                                      |
|             | pattern 3 | 942                                                       |                                     |                                    |                                      |
| ALUSTART175 | total     | 3938                                                      |                                     | 1,23                               |                                      |
|             | pattern 1 | 1941                                                      |                                     |                                    |                                      |
|             | pattern 2 | 1275                                                      |                                     |                                    |                                      |
|             | pattern 3 | 942                                                       |                                     |                                    |                                      |

<sup>(1)</sup> If a rotation of timber element can be avoided please refer to general notes at the bottom of this datasheet.

<sup>(2)</sup> Load duration factor  $C_d = 1.6$  was considered in the calculations.

The installation of the ALUSTART35 extension, or the presence of a grout layer up to 1 3/16" with minimum class M10, do not affect the values in the table.

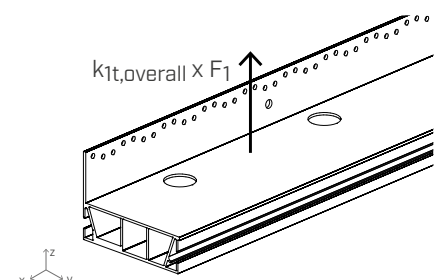


## ANCHORS VERIFICATION FOR STRESS LOADING $F_{1,t}$

Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the tabulated geometric parameters ( $k_t$ ).

The anchor group must be verified for:

$$N_{Ed,z,bolts} = F_{1,t} \times K_{1,t,overall}$$

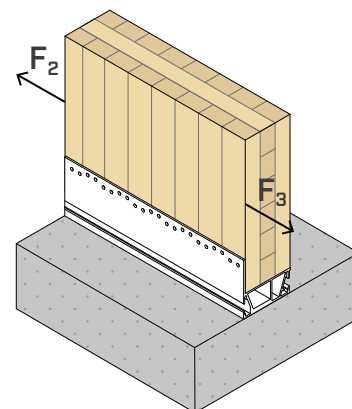


## STRUCTURAL VALUES | TIMBER-TO-CONCRETE | $F_{2/3}$

### STRENGTH ON TIMBER-TO-ALUMINIUM SIDE

| profile     | pattern   | TIMBER                          | CONCRETE      |               | $K_{2/3,ser}$<br>[lb/in-1/ft] |
|-------------|-----------|---------------------------------|---------------|---------------|-------------------------------|
|             |           | $R_{2/3,ASD}$ timber<br>[lb/ft] | $e_y$<br>[in] | $e_z$<br>[in] |                               |
| ALUSTART80  | total     | 2015                            | 1 3/16        | 3 3/16        | 20900                         |
|             | pattern 1 | 997                             |               |               | 10790                         |
|             | pattern 2 | 655                             |               |               | 6960                          |
|             | pattern 3 | 484                             |               |               | 5220                          |
| ALUSTART100 | total     | 1818                            |               |               | 20900                         |
|             | pattern 1 | 900                             |               |               | 10790                         |
|             | pattern 2 | 591                             |               |               | 6960                          |
|             | pattern 3 | 437                             |               |               | 5220                          |
| ALUSTART120 | total     | 1622                            |               |               | 20900                         |
|             | pattern 1 | 803                             |               |               | 10790                         |
|             | pattern 2 | 528                             |               |               | 6960                          |
|             | pattern 3 | 390                             |               |               | 5220                          |
| ALUSTART175 | total     | 1177                            |               |               | 20900                         |
|             | pattern 1 | 584                             |               |               | 10790                         |
|             | pattern 2 | 384                             |               |               | 6960                          |
|             | pattern 3 | 284                             |               |               | 5220                          |

The installation of the ALUSTART35 extension, or the presence of a grout layer up to 1 3/16" with minimum class M10, do not affect the values in the table.



## ANCHORS VERIFICATION FOR STRESS LOADING $F_{2/3}$

Fastening to concrete using alternative anchors must be verified on the basis of the load acting on the anchors, which depend on the fastening configuration. In order to consider an anchor effective, the edge distance to the profile must be at least 1 15/16 in.

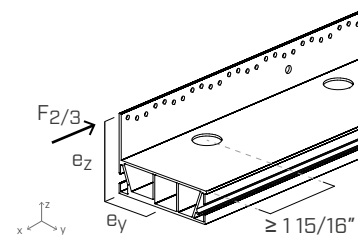
The anchor group must be verified for:

$$V_{Ed,x,bolts} = F_{2/3}$$

$$M_{Ed,z,bolts} = F_{2/3,d} \times e_y$$

$$M_{Ed,x,bolts} = F_{2/3,d} \times e_z$$

In which  $F_{2/3,d}$  represents the shear stress acting on the ALU START connector. The check is satisfied if the design shear strength of the anchor group is greater than the design stress:  $R_{2/3,d \text{ concrete}} \geq F_{2/3,d}$ .



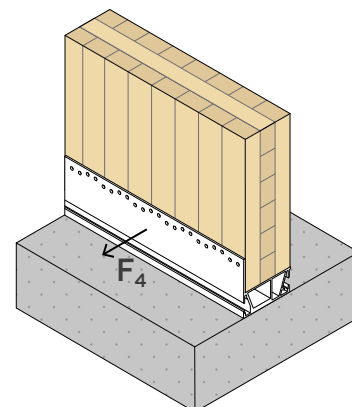
## STRUCTURAL VALUES | TIMBER-TO-CONCRETE | $F_4$

### STRENGTH ON TIMBER-TO-ALUMINIUM SIDE

| profile   | ALUMINIUM                  | CONCRETE          | $K_{4,ser}$<br>[lb/in-1/ft] |
|-----------|----------------------------|-------------------|-----------------------------|
|           | $R_{4,ASD}$ alu<br>[lb/ft] | $k_{4t, overall}$ |                             |
| ALUSTART* | 3648                       | 1,84              | 47000                       |

\* Applies to all profiles.

The installation of the ALUSTART35 extension, or the presence of a grout layer up to 1 3/16" with minimum class M10, do not affect the values in the table.



## ANCHORS VERIFICATION FOR STRESS LOADING $F_4$

Fastening to concrete using alternative anchors must be verified on the basis of the load acting on the anchors, which depend on the fastening configuration.

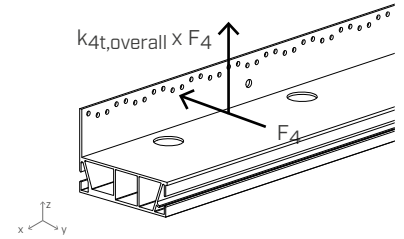
The anchor group must be verified for:

$$V_{Ed,y,bolts} = F_{4,Ed}$$

$$N_{Ed,z,bolts} = F_{4,Ed} \times k_{4t,overall}$$

In which  $F_{4,d}$  represents the shear stress acting on the ALU START connector.

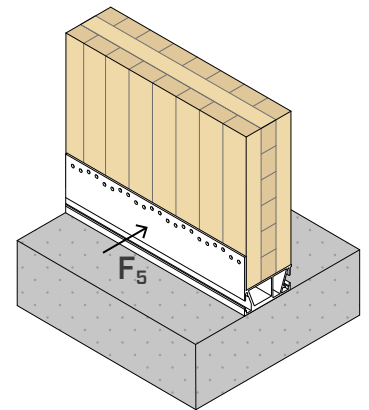
The check is satisfied if the design shear strength of the anchor group is greater than the design stress:  $R_{4,d} \geq F_{4,d}$ .



## STRUCTURAL VALUES | TIMBER-TO-CONCRETE | $F_5$

STRENGTH ON TIMBER-TO-ALUMINIUM SIDE

|             |           | TIMBER                               | ALUMINIUM                         | CONCRETE                           |                                    |
|-------------|-----------|--------------------------------------|-----------------------------------|------------------------------------|------------------------------------|
| profile     | pattern   | R <sub>5,ASD</sub> timber<br>[lb/ft] | R <sub>5,ASD</sub> alu<br>[lb/ft] | k <sub>5t,overall</sub><br>[lb/ft] | K <sub>5,ser</sub><br>[lb/in-1/ft] |
| ALUSTART80  | total     | 1987                                 | 996                               | 1,83                               | 9570                               |
|             | pattern 1 | 980                                  |                                   |                                    |                                    |
|             | pattern 2 | 640                                  |                                   |                                    |                                    |
|             | pattern 3 | 470                                  |                                   |                                    |                                    |
| ALUSTART100 | total     | 1987                                 |                                   | 1,53                               |                                    |
|             | pattern 1 | 980                                  |                                   |                                    |                                    |
|             | pattern 2 | 640                                  |                                   |                                    |                                    |
|             | pattern 3 | 470                                  |                                   |                                    |                                    |
| ALUSTART120 | total     | 1987                                 |                                   | 1,39                               |                                    |
|             | pattern 1 | 980                                  |                                   |                                    |                                    |
|             | pattern 2 | 640                                  |                                   |                                    |                                    |
|             | pattern 3 | 470                                  |                                   |                                    |                                    |
| ALUSTART175 | total     | 1987                                 |                                   | 1,28                               |                                    |
|             | pattern 1 | 980                                  |                                   |                                    |                                    |
|             | pattern 2 | 640                                  |                                   |                                    |                                    |
|             | pattern 3 | 470                                  |                                   |                                    |                                    |



The installation of the ALUSTART35 extension, or the presence of a grout layer up to 1 3/16" with minimum class M10, do not affect the values in the table.

## ANCHORS VERIFICATION FOR STRESS LOADING $F_5$

Fastening to concrete using alternative anchors must be verified on the basis of the load acting on the anchors, which depend on the fastening configuration.

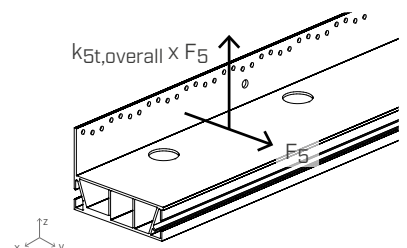
The anchor group must be verified for:

$$V_{Ed,y,bolts} = F_{5,Ed}$$

$$N_{Ed,z,bolts} = F_{5,Ed} \times k_{5t,overall}$$

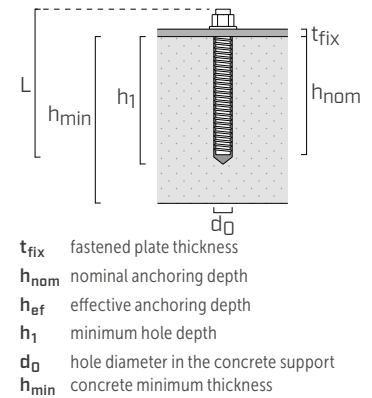
In which  $F_{5,d}$  represents the shear stress acting on the ALU START connector.

The check is satisfied if the design shear strength of the anchor group is greater than the design stress:  $R_{5,d} \geq F_{5,d}$ .



## ANCHOR INSTALLATION PARAMETERS

| profile    | anchor type |               | $t_{fix}$ | $h_{ef}$ | $h_{nom}$ | $h_1$   | $d_0$ | $h_{min}$ |
|------------|-------------|---------------|-----------|----------|-----------|---------|-------|-----------|
|            | type        | Ø x L [in]    | [in]      | [in]     | [in]      | [in]    | [in]  | [in]      |
| ALU START* | VIN-FIX 5.8 | M12 x 5 1/2   | 1/4       | 4 1/2    | 4 1/2     | 4 3/4   | 9/16  | 7 7/8     |
|            | VIN-FIX 8.8 | M12 x 5 1/2   | 1/4       | 4 1/2    | 4 1/2     | 4 3/4   | 9/16  |           |
|            | HYB-FIX 8.8 | M12 x 5 1/2   | 1/4       | 4 1/2    | 4 1/2     | 4 3/4   | 9/16  |           |
|            | SKR         | 12 x 3 9/16   | 1/4       | 2 1/2    | 3 1/4     | 4 1/8   | 3/8   |           |
|            | AB1         | M12 x 3 15/16 | 1/4       | 2 3/4    | 3 1/8     | 3 3/8   | 1/2   |           |
|            | VIN-FIX 5.8 | M12 x 7 11/16 | 1/4       | 6 1/2    | 6 1/2     | 6 11/16 | 9/16  |           |
|            | VIN-FIX 8.8 | M12 x 7 11/16 | 1/4       | 6 1/2    | 6 1/2     | 6 11/16 | 9/16  |           |
|            | HYB-FIX 8.8 | M12 x 7 11/16 | 1/4       | 6 1/2    | 6 1/2     | 6 11/16 | 9/16  |           |
|            | EPO-FIX 8.8 | M12 x 7 11/16 | 1/4       | 6 11/16  | 6 11/16   | 6 7/8   | 9/16  |           |



Precut INA threaded rod, with nut and washer.

MG5 threaded rod class 8.8 to be cut to size.

For further details, see the "PLATES AND CONNECTORS FOR TIMBER" catalogue, available in the "Catalogues" section of the website [www.rothoblaas.com](http://www.rothoblaas.com).

\* The values in the table are valid for all ALU START profiles.

## ALU START | COMBINED STRESSES

With regard to timber and aluminium, it is possible to combine the effect of the different actions through the following expressions:

$$\left(\frac{F_{1,t,Ed}}{R_{1,t,d}}\right)^2 + \left(\frac{F_{2/3,Ed}}{R_{2/3,d}}\right)^2 + \left(\frac{F_{4,Ed}}{R_{4,d}}\right)^2 \leq 1$$

$$\left(\frac{F_{1,t,Ed}}{R_{1,t,d}}\right)^2 + \left(\frac{F_{2/3,Ed}}{R_{2/3,d}}\right)^2 + \left(\frac{F_{5,Ed}}{R_{5,d}}\right)^2 \leq 1$$

Regarding checks on the anchor side, the results of the loads must be applied to the group of anchors, following the indications of the diagrams relating to each load direction.

### NOTES

<sup>(1)</sup> If rotation of timber element can't be avoided, the maximum applied tension load  $F_{t,1}$  must fulfil the following equation according to ADM2020:

$$\frac{F_{t,1}}{\left(\text{or } \frac{1}{\Omega}\right) \cdot t_w \cdot l \cdot F_{ty}} + \frac{3 \cdot F_{t,1} \cdot (t + t_w)}{\left(\text{or } \frac{1}{\Omega}\right) \cdot t_w^2 \cdot l \cdot F_{ty}} \leq 1.0$$

$t$  = timber width

$t_w$  = vertical plate width

$l$  = plate length

$F_{ty}$  = aluminum yield strength

### GENERAL PRINCIPLES

- The verification of the fastener-to-concrete connection must be carried out separately.
- The strength values are calculated individually. In case of combined loading the verification must be carried out separately.
- For the calculation process a timber with a specific gravity of 0.42 has been considered.
- For the Timber side : The values are calculated according to the NDS (2024). The tabulated reference design values are unfactored and should be multiplied by the adjustment factors to get the adjusted design values except for uplift that  $C_d = 1.6$  was considered for load duration factor.
- For the aluminium side: calculations are based on ADM2020 and test-validated analysis.

### INTELLECTUAL PROPERTY

- An ALU START model is protected by the Registered Community Design RCD 008254353-0002.