

### C4 EVO COATING

Multilayer coating with a surface treatment of epoxy resin and aluminium flakes. No rust after 1440 hours of salt spray exposure test, as per ISO 9227. It can be used for service class 3 outdoor applications and under class C4 atmospheric corrosion conditions tested by the Research Institutes of Sweden - RISE.

### 3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements.

Costs and time for project implementation are reduced.

### AUTOCLAVE-TREATED TIMBER

The C4 EVO coating has been certified according to US acceptance criterion AC257 for outdoor use with ACQ-treated timber.

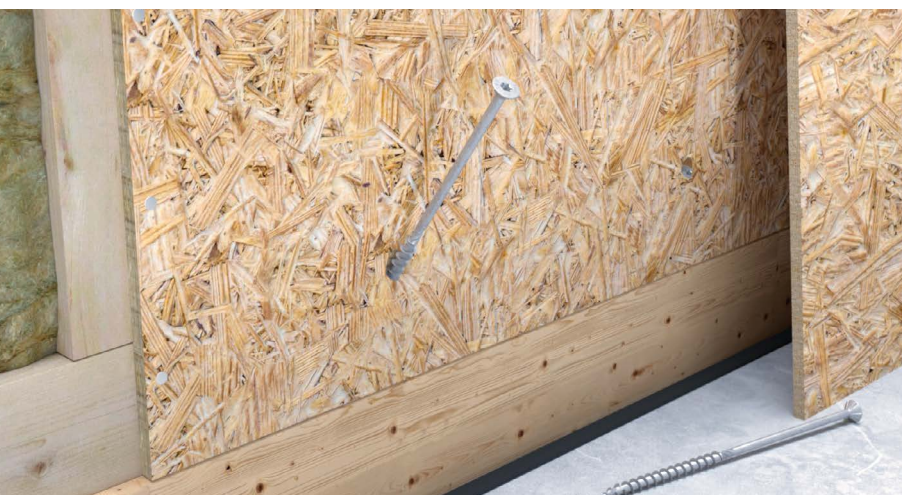
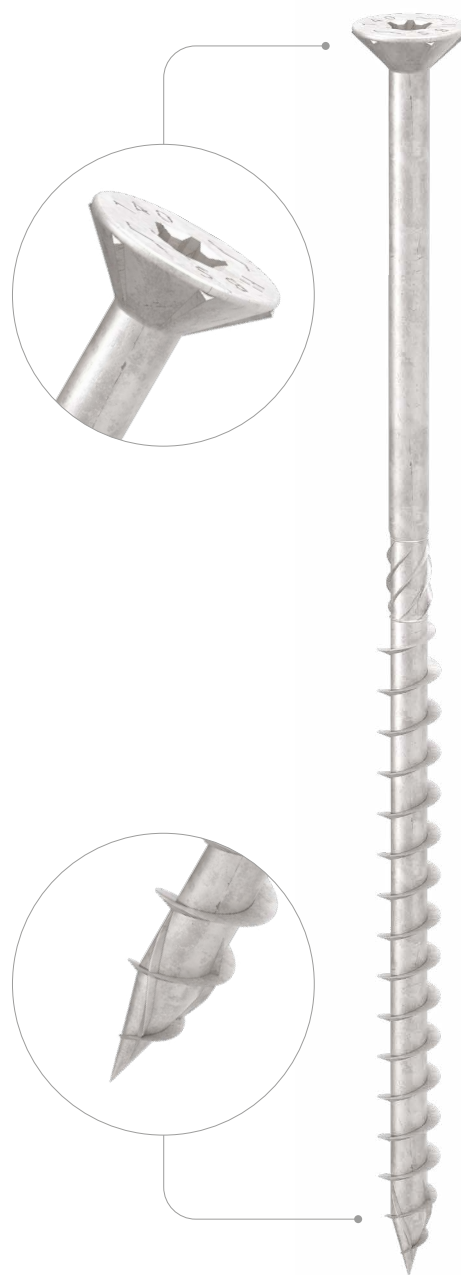
### T3 TIMBER CORROSIVITY

Coating suitable for use in applications on wood with an acidity level (pH) greater than 4, such as spruce, larch and pine (see page 314).



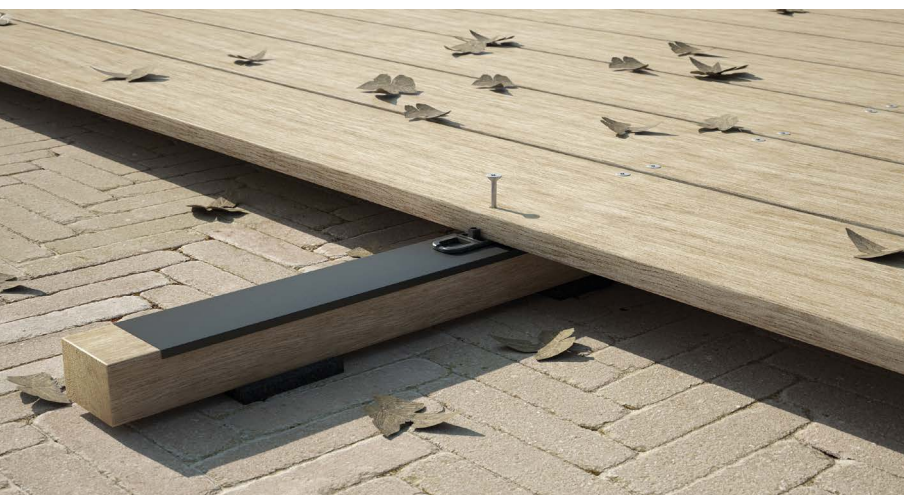
BIT INCLUDED

|                         |                                                            |     |     |      |
|-------------------------|------------------------------------------------------------|-----|-----|------|
| DIAMETER [mm]           | 3                                                          | 4   | 8   | 12   |
| LENGTH [mm]             | 12                                                         | 40  | 320 | 1000 |
| SERVICE CLASS           | SC1                                                        | SC2 | SC3 |      |
| ATMOSPHERIC CORROSIVITY | C1                                                         | C2  | C3  | C4   |
| WOOD CORROSIVITY        | T1                                                         | T2  | T3  |      |
| MATERIAL                | <div>C4 EVO COATING</div> carbon steel with C4 EVO coating |     |     |      |



### FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber



### SERVICE CLASS 3

Certified for use in service class 3 outdoor applications and under class C4 atmospheric corrosion conditions. Ideal for fastening timber framed panels and trusses (Rafter, Truss).

### PERGOLAS AND DECKS

The smaller sizes are ideal for securing boards and battens of decks set up outdoors.

## CODES AND DIMENSIONS

| d <sub>1</sub><br>[mm] | CODE       | L<br>[mm] | b<br>[mm] | A<br>[mm] | pcs |
|------------------------|------------|-----------|-----------|-----------|-----|
| 4<br>TX 20             | HBSEVO440  | 40        | 24        | 16        | 500 |
|                        | HBSEVO450  | 50        | 30        | 20        | 500 |
|                        | HBSEVO460  | 60        | 35        | 25        | 500 |
| 4,5<br>TX 20           | HBSEVO4545 | 45        | 30        | 15        | 400 |
|                        | HBSEVO4550 | 50        | 30        | 20        | 200 |
|                        | HBSEVO4560 | 60        | 35        | 25        | 200 |
|                        | HBSEVO4570 | 70        | 40        | 30        | 200 |
|                        | HBSEVO4580 | 80        | 40        | 40        | 200 |
| 5<br>TX 25             | HBSEVO550  | 50        | 24        | 26        | 200 |
|                        | HBSEVO560  | 60        | 30        | 30        | 200 |
|                        | HBSEVO570  | 70        | 35        | 35        | 100 |
|                        | HBSEVO580  | 80        | 40        | 40        | 100 |
|                        | HBSEVO590  | 90        | 45        | 45        | 100 |
| 6<br>TX 30             | HBSEVO5100 | 100       | 50        | 50        | 100 |
|                        | HBSEVO660  | 60        | 30        | 30        | 100 |
|                        | HBSEVO670  | 70        | 40        | 30        | 100 |
|                        | HBSEVO680  | 80        | 40        | 40        | 100 |
|                        | HBSEVO6100 | 100       | 50        | 50        | 100 |
|                        | HBSEVO6120 | 120       | 60        | 60        | 100 |
|                        | HBSEVO6140 | 140       | 75        | 65        | 100 |
|                        | HBSEVO6160 | 160       | 75        | 85        | 100 |
|                        | HBSEVO6180 | 180       | 75        | 105       | 100 |
|                        | HBSEVO6200 | 200       | 75        | 125       | 100 |

| d <sub>1</sub><br>[mm] | CODE       | L<br>[mm] | b<br>[mm] | A<br>[mm] | pcs |
|------------------------|------------|-----------|-----------|-----------|-----|
| 8<br>TX 40             | HBSEVO8100 | 100       | 52        | 48        | 100 |
|                        | HBSEVO8120 | 120       | 60        | 60        | 100 |
|                        | HBSEVO8140 | 140       | 60        | 80        | 100 |
|                        | HBSEVO8160 | 160       | 80        | 80        | 100 |
|                        | HBSEVO8180 | 180       | 80        | 100       | 100 |
|                        | HBSEVO8200 | 200       | 80        | 120       | 100 |
|                        | HBSEVO8220 | 220       | 80        | 140       | 100 |
|                        | HBSEVO8240 | 240       | 80        | 160       | 100 |
|                        | HBSEVO8260 | 260       | 80        | 180       | 100 |
|                        | HBSEVO8280 | 280       | 80        | 200       | 100 |
|                        | HBSEVO8300 | 300       | 100       | 200       | 100 |
|                        | HBSEVO8320 | 320       | 100       | 220       | 100 |

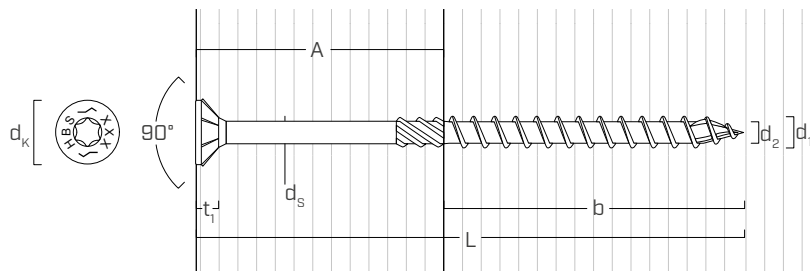
## RELATED PRODUCTS



**HUS EVO**  
TURNED WASHER

see page 68

## GEOMETRY AND MECHANICAL CHARACTERISTICS



### GEOMETRY

| Nominal diameter                          | d <sub>1</sub><br>[mm] | 4    | 4,5  | 5     | 6     | 8     |
|-------------------------------------------|------------------------|------|------|-------|-------|-------|
| Head diameter                             | d <sub>k</sub> [mm]    | 8,00 | 9,00 | 10,00 | 12,00 | 14,50 |
| Thread diameter                           | d <sub>2</sub> [mm]    | 2,55 | 2,80 | 3,40  | 3,95  | 5,40  |
| Shank diameter                            | d <sub>s</sub> [mm]    | 2,75 | 3,15 | 3,65  | 4,30  | 5,80  |
| Head thickness                            | t <sub>1</sub> [mm]    | 2,80 | 2,80 | 3,10  | 4,50  | 4,50  |
| Pre-drilling hole diameter <sup>(1)</sup> | d <sub>V,S</sub> [mm]  | 2,5  | 2,5  | 3,0   | 4,0   | 5,0   |
| Pre-drilling hole diameter <sup>(2)</sup> | d <sub>V,H</sub> [mm]  | -    | -    | 3,5   | 4,0   | 6,0   |

<sup>(1)</sup> Pre-drilling valid for softwood.

<sup>(2)</sup> Pre-drilling valid for hardwood and beech LVL.

### CHARACTERISTIC MECHANICAL PARAMETERS

| Nominal diameter | d <sub>1</sub><br>[mm]   | 4   | 4,5 | 5   | 6    | 8    |
|------------------|--------------------------|-----|-----|-----|------|------|
| Tensile strength | f <sub>tens,k</sub> [kN] | 5,0 | 6,4 | 7,9 | 11,3 | 20,1 |
| Yield moment     | M <sub>y,k</sub> [Nm]    | 3,0 | 4,1 | 5,4 | 9,5  | 20,1 |

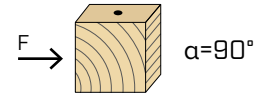
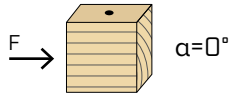
|                                 |                                          | softwood<br>(softwood) | LVL softwood<br>(LVL softwood) | pre-drilled beech LVL<br>(beech LVL predrilled) |
|---------------------------------|------------------------------------------|------------------------|--------------------------------|-------------------------------------------------|
| Withdrawal resistance parameter | f <sub>ax,k</sub> [N/mm <sup>2</sup> ]   | 11,7                   | 15,0                           | 29,0                                            |
| Head-pull-through parameter     | f <sub>head,k</sub> [N/mm <sup>2</sup> ] | 10,5                   | 20,0                           | -                                               |
| Associated density              | ρ <sub>a</sub> [kg/m <sup>3</sup> ]      | 350                    | 500                            | 730                                             |
| Calculation density             | ρ <sub>k</sub> [kg/m <sup>3</sup> ]      | ≤ 440                  | 410 ÷ 550                      | 590 ÷ 750                                       |

For applications with different materials please see ETA-11/0030.



## MINIMUM DISTANCES FOR SHEAR LOADS

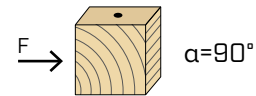
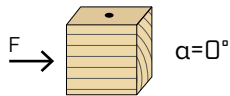
 screws inserted **WITHOUT** pre-drilled hole  $\rho_k \leq 420 \text{ kg/m}^3$



| $d_1$ [mm]     |      | 4  | 4,5 |      | 5  | 6  | 8   |
|----------------|------|----|-----|------|----|----|-----|
| $a_1$ [mm]     | 10·d | 40 | 45  | 10·d | 50 | 60 | 80  |
| $a_2$ [mm]     | 5·d  | 20 | 23  | 5·d  | 25 | 30 | 40  |
| $a_{3,t}$ [mm] | 15·d | 60 | 68  | 15·d | 75 | 90 | 120 |
| $a_{3,c}$ [mm] | 10·d | 40 | 45  | 10·d | 50 | 60 | 80  |
| $a_{4,t}$ [mm] | 5·d  | 20 | 23  | 5·d  | 25 | 30 | 40  |
| $a_{4,c}$ [mm] | 5·d  | 20 | 23  | 5·d  | 25 | 30 | 40  |

| $d_1$ [mm]     |      | 4  | 4,5 |      | 5  | 6  | 8  |
|----------------|------|----|-----|------|----|----|----|
| $a_1$ [mm]     | 5·d  | 20 | 23  | 5·d  | 25 | 30 | 40 |
| $a_2$ [mm]     | 5·d  | 20 | 23  | 5·d  | 25 | 30 | 40 |
| $a_{3,t}$ [mm] | 10·d | 40 | 45  | 10·d | 50 | 60 | 80 |
| $a_{3,c}$ [mm] | 10·d | 40 | 45  | 10·d | 50 | 60 | 80 |
| $a_{4,t}$ [mm] | 7·d  | 28 | 32  | 10·d | 50 | 60 | 80 |
| $a_{4,c}$ [mm] | 5·d  | 20 | 23  | 5·d  | 25 | 30 | 40 |

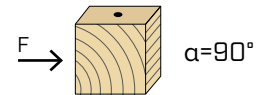
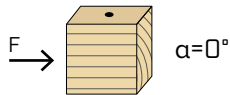
 screws inserted **WITHOUT** pre-drilled hole  $420 \text{ kg/m}^3 < \rho_k \leq 500 \text{ kg/m}^3$



| $d_1$ [mm]     |      | 4  | 4,5 |      | 5   | 6   | 8   |
|----------------|------|----|-----|------|-----|-----|-----|
| $a_1$ [mm]     | 15·d | 60 | 68  | 15·d | 75  | 90  | 120 |
| $a_2$ [mm]     | 7·d  | 28 | 32  | 7·d  | 35  | 42  | 56  |
| $a_{3,t}$ [mm] | 20·d | 80 | 90  | 20·d | 100 | 120 | 160 |
| $a_{3,c}$ [mm] | 15·d | 60 | 68  | 15·d | 75  | 90  | 120 |
| $a_{4,t}$ [mm] | 7·d  | 28 | 32  | 7·d  | 35  | 42  | 56  |
| $a_{4,c}$ [mm] | 7·d  | 28 | 32  | 7·d  | 35  | 42  | 56  |

| $d_1$ [mm]     |      | 4  | 4,5 |      | 5  | 6  | 8   |
|----------------|------|----|-----|------|----|----|-----|
| $a_1$ [mm]     | 7·d  | 28 | 32  | 7·d  | 35 | 42 | 56  |
| $a_2$ [mm]     | 7·d  | 28 | 32  | 7·d  | 35 | 42 | 56  |
| $a_{3,t}$ [mm] | 15·d | 60 | 68  | 15·d | 75 | 90 | 120 |
| $a_{3,c}$ [mm] | 15·d | 60 | 68  | 15·d | 75 | 90 | 120 |
| $a_{4,t}$ [mm] | 9·d  | 36 | 41  | 12·d | 60 | 72 | 96  |
| $a_{4,c}$ [mm] | 7·d  | 28 | 32  | 7·d  | 35 | 42 | 56  |

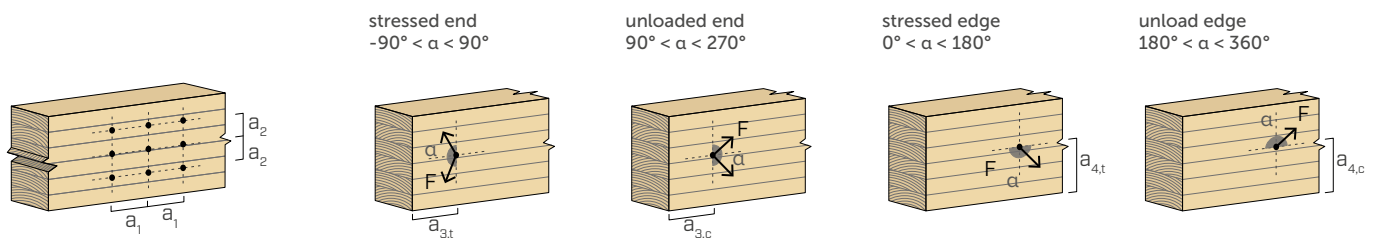
 screws inserted **WITH** pre-drilled hole



| $d_1$ [mm]     |      | 4  | 4,5 |      | 5  | 6  | 8  |
|----------------|------|----|-----|------|----|----|----|
| $a_1$ [mm]     | 5·d  | 20 | 23  | 5·d  | 25 | 30 | 40 |
| $a_2$ [mm]     | 3·d  | 12 | 14  | 3·d  | 15 | 18 | 24 |
| $a_{3,t}$ [mm] | 12·d | 48 | 54  | 12·d | 60 | 72 | 96 |
| $a_{3,c}$ [mm] | 7·d  | 28 | 32  | 7·d  | 35 | 42 | 56 |
| $a_{4,t}$ [mm] | 3·d  | 12 | 14  | 3·d  | 15 | 18 | 24 |
| $a_{4,c}$ [mm] | 3·d  | 12 | 14  | 3·d  | 15 | 18 | 24 |

| $d_1$ [mm]     |     | 4  | 4,5 |     | 5  | 6  | 8  |
|----------------|-----|----|-----|-----|----|----|----|
| $a_1$ [mm]     | 4·d | 16 | 18  | 4·d | 20 | 24 | 32 |
| $a_2$ [mm]     | 4·d | 16 | 18  | 4·d | 20 | 24 | 32 |
| $a_{3,t}$ [mm] | 7·d | 28 | 32  | 7·d | 35 | 42 | 56 |
| $a_{3,c}$ [mm] | 7·d | 28 | 32  | 7·d | 35 | 42 | 56 |
| $a_{4,t}$ [mm] | 5·d | 20 | 23  | 7·d | 35 | 42 | 56 |
| $a_{4,c}$ [mm] | 3·d | 12 | 14  | 3·d | 15 | 18 | 24 |

$\alpha$  = load-to-grain angle  
 $d = d_1$  = nominal screw diameter



### NOTES

- The minimum distances comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- The minimum spacing for all steel-to-timber connections ( $a_1$ ,  $a_2$ ) can be multiplied by a coefficient of 0,7.
- The minimum spacing for all panel-to-timber connections ( $a_1$ ,  $a_2$ ) can be multiplied by a coefficient of 0,85.
- In the case of joints with elements in Douglas fir (*Pseudotsuga menziesii*), the minimum spacing and distances parallel to the grain must be multiplied by a coefficient of 1.5.
- The spacing  $a_1$  in the table for screws with 3 THORNS tip and  $d_1 \geq 5 \text{ mm}$  inserted without pre-drilling hole in timber elements with density  $\rho_k \leq 420 \text{ kg/m}^3$  with minimum height and width equal to 10·d and load-to-grain angle  $\alpha = 0^\circ$  equal to 10·d. Alternatively, adopt 12·d in accordance with EN 1995:2014.

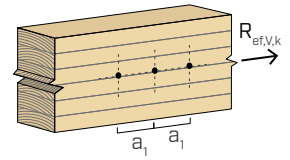
|               |           |           |           | SHEAR                                      |                                           |                   |                               |                                                |                                               | TENSION               |                      |                      |
|---------------|-----------|-----------|-----------|--------------------------------------------|-------------------------------------------|-------------------|-------------------------------|------------------------------------------------|-----------------------------------------------|-----------------------|----------------------|----------------------|
| geometry      |           |           |           | timber-to-timber<br>$\varepsilon=90^\circ$ | timber-to-timber<br>$\varepsilon=0^\circ$ | panel-to-timber   | steel-to-timber<br>thin plate | thread<br>withdrawal<br>$\varepsilon=90^\circ$ | thread<br>withdrawal<br>$\varepsilon=0^\circ$ | head<br>pull-through  |                      |                      |
|               |           |           |           |                                            |                                           |                   |                               |                                                |                                               |                       |                      |                      |
| $d_1$<br>[mm] | L<br>[mm] | b<br>[mm] | A<br>[mm] | $R_{V,90,k}$<br>[kN]                       | $R_{V,0,k}$<br>[kN]                       | $S_{PAN}$<br>[mm] | $R_{V,k}$<br>[kN]             | $S_{PLATE}$<br>[mm]                            | $R_{V,k}$<br>[kN]                             | $R_{ax,90,k}$<br>[kN] | $R_{ax,0,k}$<br>[kN] | $R_{head,k}$<br>[kN] |
| 4             | 40        | 24        | 16        | 0,83                                       | 0,51                                      | 12                | 0,84                          | 2                                              | 1,12                                          | 1,21                  | 0,36                 | 0,73                 |
|               | 50        | 30        | 20        | 0,91                                       | 0,62                                      |                   | 0,84                          |                                                | 1,19                                          | 1,52                  | 0,45                 | 0,73                 |
|               | 60        | 35        | 25        | 0,99                                       | 0,69                                      |                   | 0,84                          |                                                | 1,26                                          | 1,77                  | 0,53                 | 0,73                 |
| 4,5           | 45        | 30        | 15        | 0,96                                       | 0,61                                      | 12                | 0,97                          | 2,25                                           | 1,42                                          | 1,70                  | 0,51                 | 0,92                 |
|               | 50        | 30        | 20        | 1,06                                       | 0,69                                      |                   | 0,97                          |                                                | 1,42                                          | 1,70                  | 0,51                 | 0,92                 |
|               | 60        | 35        | 25        | 1,18                                       | 0,79                                      |                   | 0,97                          |                                                | 1,49                                          | 1,99                  | 0,60                 | 0,92                 |
|               | 70        | 40        | 30        | 1,22                                       | 0,86                                      |                   | 0,97                          |                                                | 1,56                                          | 2,27                  | 0,68                 | 0,92                 |
|               | 80        | 40        | 40        | 1,22                                       | 0,86                                      |                   | 1,06                          |                                                | 1,56                                          | 2,27                  | 0,68                 | 0,92                 |
| 5             | 50        | 24        | 26        | 1,29                                       | 0,73                                      | 15                | 1,20                          | 2,5                                            | 1,56                                          | 1,52                  | 0,45                 | 1,13                 |
|               | 60        | 30        | 30        | 1,46                                       | 0,81                                      |                   | 1,20                          |                                                | 1,65                                          | 1,89                  | 0,57                 | 1,13                 |
|               | 70        | 35        | 35        | 1,46                                       | 0,88                                      |                   | 1,20                          |                                                | 1,73                                          | 2,21                  | 0,66                 | 1,13                 |
|               | 80        | 40        | 40        | 1,46                                       | 0,96                                      |                   | 1,20                          |                                                | 1,81                                          | 2,53                  | 0,76                 | 1,13                 |
|               | 90        | 45        | 45        | 1,46                                       | 1,05                                      |                   | 1,20                          |                                                | 1,89                                          | 2,84                  | 0,85                 | 1,13                 |
|               | 100       | 50        | 50        | 1,46                                       | 1,13                                      |                   | 1,20                          |                                                | 1,97                                          | 3,16                  | 0,95                 | 1,13                 |
| 6             | 60        | 30        | 30        | 1,78                                       | 1,04                                      | 18                | 1,65                          | 3                                              | 2,24                                          | 2,27                  | 0,68                 | 1,63                 |
|               | 70        | 40        | 30        | 1,88                                       | 1,20                                      |                   | 1,65                          |                                                | 2,43                                          | 3,03                  | 0,91                 | 1,63                 |
|               | 80        | 40        | 40        | 2,08                                       | 1,20                                      |                   | 1,65                          |                                                | 2,43                                          | 3,03                  | 0,91                 | 1,63                 |
|               | 100       | 50        | 50        | 2,08                                       | 1,38                                      |                   | 1,65                          |                                                | 2,61                                          | 3,79                  | 1,14                 | 1,63                 |
|               | 120       | 60        | 60        | 2,08                                       | 1,58                                      |                   | 1,65                          |                                                | 2,80                                          | 4,55                  | 1,36                 | 1,63                 |
|               | 140       | 75        | 65        | 2,08                                       | 1,67                                      |                   | 1,65                          |                                                | 3,09                                          | 5,68                  | 1,70                 | 1,63                 |
|               | 160       | 75        | 85        | 2,08                                       | 1,67                                      |                   | 1,65                          |                                                | 3,09                                          | 5,68                  | 1,70                 | 1,63                 |
|               | 180       | 75        | 105       | 2,08                                       | 1,67                                      |                   | 1,65                          |                                                | 3,09                                          | 5,68                  | 1,70                 | 1,63                 |
|               | 200       | 75        | 125       | 2,08                                       | 1,67                                      |                   | 1,65                          |                                                | 3,09                                          | 5,68                  | 1,70                 | 1,63                 |
| 8             | 100       | 52        | 48        | 3,28                                       | 1,95                                      | 22                | 2,60                          | 4                                              | 4,00                                          | 5,25                  | 1,58                 | 2,38                 |
|               | 120       | 60        | 60        | 3,28                                       | 2,13                                      |                   | 2,60                          |                                                | 4,20                                          | 6,06                  | 1,82                 | 2,38                 |
|               | 140       | 60        | 80        | 3,28                                       | 2,13                                      |                   | 2,60                          |                                                | 4,20                                          | 6,06                  | 1,82                 | 2,38                 |
|               | 160       | 80        | 80        | 3,28                                       | 2,60                                      |                   | 2,60                          |                                                | 4,70                                          | 8,08                  | 2,42                 | 2,38                 |
|               | 180       | 80        | 100       | 3,28                                       | 2,60                                      |                   | 2,60                          |                                                | 4,70                                          | 8,08                  | 2,42                 | 2,38                 |
|               | 200       | 80        | 120       | 3,28                                       | 2,60                                      |                   | 2,60                          |                                                | 4,70                                          | 8,08                  | 2,42                 | 2,38                 |
|               | 220       | 80        | 140       | 3,28                                       | 2,60                                      |                   | 2,60                          |                                                | 4,70                                          | 8,08                  | 2,42                 | 2,38                 |
|               | 240       | 80        | 160       | 3,28                                       | 2,60                                      |                   | 2,60                          |                                                | 4,70                                          | 8,08                  | 2,42                 | 2,38                 |
|               | 260       | 80        | 180       | 3,28                                       | 2,60                                      |                   | 2,60                          |                                                | 4,70                                          | 8,08                  | 2,42                 | 2,38                 |
|               | 280       | 80        | 200       | 3,28                                       | 2,60                                      |                   | 2,60                          |                                                | 4,70                                          | 8,08                  | 2,42                 | 2,38                 |
|               | 300       | 100       | 200       | 3,28                                       | 2,62                                      |                   | 2,60                          |                                                | 5,21                                          | 10,10                 | 3,03                 | 2,38                 |
|               | 320       | 100       | 220       | 3,28                                       | 2,62                                      |                   | 2,60                          |                                                | 5,21                                          | 10,10                 | 3,03                 | 2,38                 |

$\varepsilon$  = screw-to-grain angle

## EFFECTIVE NUMBER FOR SHEAR LOADS

The load-bearing capacity of a connection made with several screws, all of the same type and size, may be lower than the sum of the load-bearing capacities of the individual connection system. For a row of  $n$  screws arranged parallel to the direction of the grain at a distance  $a_1$ , the characteristic effective load-bearing capacity is equal to:

$$R_{ef,V,k} = n_{ef} \cdot R_{V,k}$$



The  $n_{ef}$  value is given in the table below as a function of  $n$  and  $a_1$ .

| n |   | a <sub>1</sub> (*) |      |      |      |      |      |      |      |      |        |
|---|---|--------------------|------|------|------|------|------|------|------|------|--------|
|   |   | 4·d                | 5·d  | 6·d  | 7·d  | 8·d  | 9·d  | 10·d | 11·d | 12·d | ≥ 14·d |
| n | 2 | 1,41               | 1,48 | 1,55 | 1,62 | 1,68 | 1,74 | 1,80 | 1,85 | 1,90 | 2,00   |
|   | 3 | 1,73               | 1,86 | 2,01 | 2,16 | 2,28 | 2,41 | 2,54 | 2,65 | 2,76 | 3,00   |
|   | 4 | 2,00               | 2,19 | 2,41 | 2,64 | 2,83 | 3,03 | 3,25 | 3,42 | 3,61 | 4,00   |
|   | 5 | 2,24               | 2,49 | 2,77 | 3,09 | 3,34 | 3,62 | 3,93 | 4,17 | 4,43 | 5,00   |

(\*)For intermediate  $a_1$  values a linear interpolation is possible.

### GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- Design values can be obtained from characteristic values as follows:

$$R_d = \frac{R_k \cdot k_{mod}}{\gamma_M}$$

The coefficients  $\gamma_M$  and  $k_{mod}$  should be taken according to the current regulations used for the calculation.

- For the mechanical resistance values and the geometry of the screws, reference was made to ETA-11/0030.
- Sizing and verification of the timber elements, panels and metal plates must be done separately.
- The screws must be positioned in accordance with the minimum distances.
- The characteristic shear resistances are calculated for screws inserted without pre-drilling hole. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.
- Shear strengths were calculated considering the threaded part fully inserted in the second element.
- The characteristic panel-timber shear strengths are calculated considering an OSB3 or OSB4 panel, as per EN 300, or a particle board panel, as per EN 312, with thickness  $S_{PAN}$  and density  $\rho_k = 500 \text{ kg/m}^3$ .
- The thread withdrawal characteristic strength has been evaluated considering a fixing length equal to  $b$ .
- The head pull-through characteristic strength was calculated using timber elements.  
In the case of steel-to-timber connections, generally the steel tensile strength is binding with respect to head separation or pull-through.
- For different calculation configurations, the MyProject software is available ([www.rothoblaas.com](http://www.rothoblaas.com)).
- For minimum distances and structural values on CLT and LVL see HBS on page 30.
- The characteristic strengths of HBS EVO screws with HUS EVO can be found on page 52.

### NOTES

- The characteristic timber-to-timber shear strengths were evaluated considering both an  $\epsilon$  angle of  $90^\circ$  ( $R_{V,90,k}$ ) and  $0^\circ$  ( $R_{V,0,k}$ ) between the grains of the second element and the connector.
- The characteristic panel-timber and steel-timber shear strengths were evaluated by considering a  $\epsilon$  angle of  $90^\circ$  between the grains of the timber element and the connector.
- The shear strength characteristics on the plate are calculated considering the case of a thin plate ( $S_{PLATE} = 0.5 d_1$ ). For the case of a thick plate, refer to the structural values of the HBS screw on page 30.
- The characteristic thread withdrawal resistances were evaluated considering both an  $\epsilon$  angle of  $90^\circ$  ( $R_{ax,90,k}$ ) and of  $0^\circ$  ( $R_{ax,0,k}$ ) between the grains of the timber element and the connector.
- For the calculation process a timber characteristic density  $\rho_k = 385 \text{ kg/m}^3$  has been considered.

For different values of  $\rho_k$ , the strength values in the table (timber-to-timber shear, steel-to-timber shear and tensile) can be converted by means of the coefficient  $k_{dens}$ :

$$R'_{V,k} = k_{dens,v} \cdot R_{V,k}$$

$$R'_{ax,k} = k_{dens,ax} \cdot R_{ax,k}$$

$$R'_{head,k} = k_{dens,ax} \cdot R_{head,k}$$

| $\rho_k$<br>[kg/m <sup>3</sup> ] | 350  | 380  | <b>385</b> | 405   | 425   | 430   | 440   |
|----------------------------------|------|------|------------|-------|-------|-------|-------|
| C-GL                             | C24  | C30  | GL24h      | GL26h | GL28h | GL30h | GL32h |
| $k_{dens,v}$                     | 0,90 | 0,98 | 1,00       | 1,02  | 1,05  | 1,05  | 1,07  |
| $k_{dens,ax}$                    | 0,92 | 0,98 | 1,00       | 1,04  | 1,08  | 1,09  | 1,11  |

Strength values thus determined may differ, for higher safety standards, from those resulting from an exact calculation.



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