# VGS

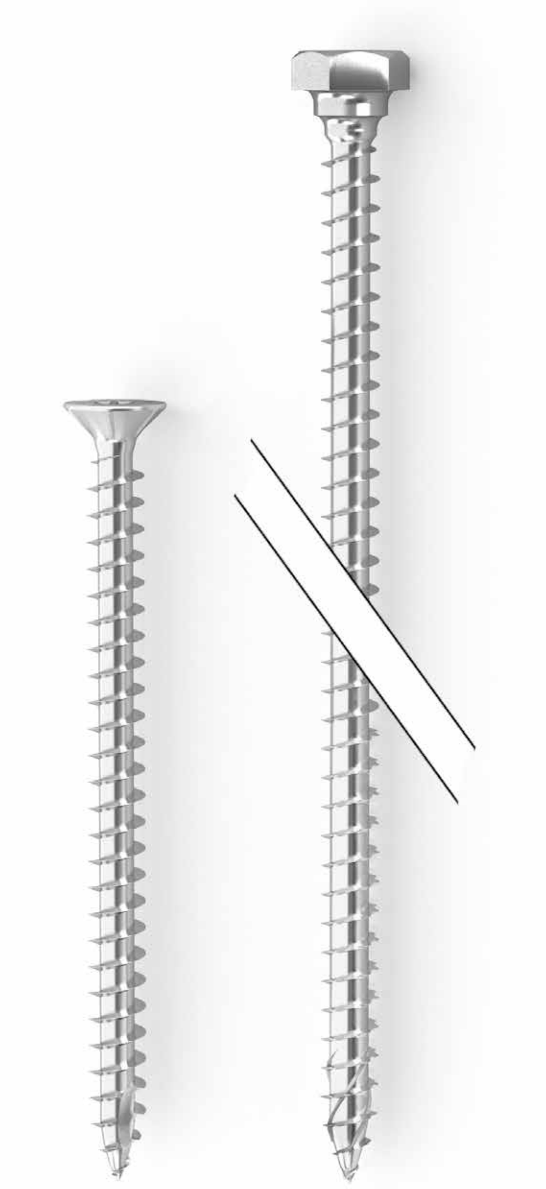
BIT INCLUDED
MY PROJECT SOFTWARE
ETA-11/0030

## FULLY THREADED SCREW WITH COUNTERSUNK OR HEXAGONAL HEAD

### TENSION
Deep thread and high resistance steel ($f_{y,k}$ = 1000 N/mm² | *145,038 psi*) for excellent tensile performance. Approved for structural applications subject to stresses in any direction vs. the grain (α = 0° - 90°).

### COUNTERSUNK OR HEXAGONAL HEAD
Countersunk head up to L = 600 mm, ideal for use on plates or for concealed reinforcements. Hexagonal head L > 600 mm to facilitate gripping with screwdriver.

### CHROMIUM (VI) FREE
Total absence of hexavalent chromium. Compliance with the strictest regulations governing chemical substances (SVHC).
REACH information available.



## CHARACTERISTICS

| | | |
|---|---|---|
| **FOCUS** | 45° connections, lifting and reinforcements | |
| **HEAD** | countersunk with ribs for L ≤ 600 mm<br>hexagonal for L > 600 mm | *≤ 23 5/8 inch*<br>*> 23 5/8 inch* |
| **DIAMETER** | 9 \| 11 mm | *0.36 \| 0.44 inch* |
| **LENGTH** | from 100 mm to 800 mm | *3 15/16 to 31 1/2 inch* |

## MATERIAL
Carbon steel with bright zinc plated.

## FIELDS OF USE
- wood based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT, LVL
- high density woods

Service classes 1 and 2.

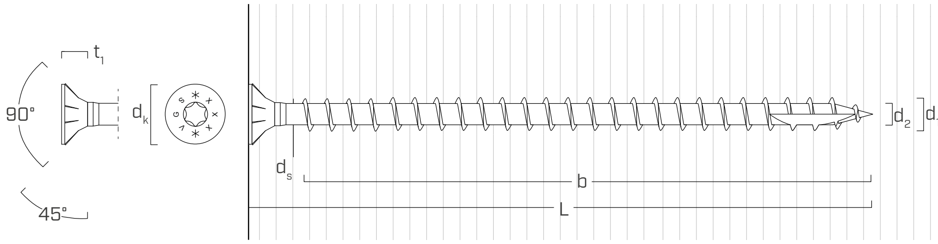
## TENSILE STRENGTH

Ideal for joints requiring high tensile or sliding strength. Can be used on steel plates in combination with the VGU washer.

## TITAN V

Values also tested, certified and calculated for fastening standard Rothoblaas plates.

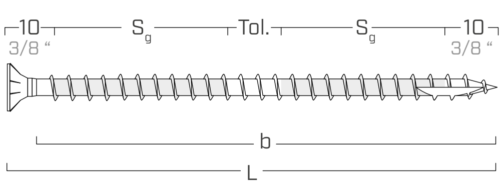
## GEOMETRY AND MECHANICAL CHARACTERISTICS




| | | | | |
|---|---|---|---|---|
| | | [mm] | **9** | **11** |
| **Nominal diameter** | $d_1$ | *[in]* | ***0.36*** | ***0.44*** |
| | | *[in]*(1) | *3/8* | *7/16* |
| Head diameter | $d_K$ | [mm] | 16.0 | 19.3 |
| | | *[in]* | *0.630* | *0.760* |
| Tip diameter | $d_2$ | [mm] | 5.90 | 6.60 |
| | | *[in]* | *0.232* | *0.260* |
| Shank diameter | $d_S$ | [mm] | 6.50 | 7.70 |
| | | *[in]* | 0.256 | 0.303 |
| Pre-drilling diameter | $d_V$ | [mm] | 5.00 | 6.00 |
| | | *[in]* | *0.197* | *0.236* |
| Characteristic yield moment | $M_{y,k}$ | [Nm] | 9.5 | 20.1 |
| | | *[lbf.in]* | *84.1* | *177.9* |
| Characteristic withdrawal-resistance parameter(2) | $f_{ax,k}$ | [N/mm$^2$] | 11.7 | 11.7 |
| | | *[psi]* | *1,697* | *1,697* |
| Associated density | $\rho_a$ | [kg/m$^3$] | 350 | 350 |
| Characteristic tensile strength | $f_{tens,k}$ | [kN] | 25.4 | 38.0 |
| | | *[lbf]* | *5,710* | *8,543* |
| Associated density | $\rho_a$ | [kg/m$^3$] | 350 | 350 |
| Characteristic yield strength | $f_{y,k}$ | [N/mm$^2$] | 1000 | 1000 |
| | | *[psi]* | *145,038* | *145,038* |

(1) The value in fractional inches is rounded to the closest fraction for simplicity of use. For the precise value of the nominal diameter $d_1$, see the value in decimal inches.
(2) Valid for softwood - maximum density 440 kg/m$^3$.
For applications on different timber types (e.g. LVL) or with a high density please check on the ETA-11/0030.

## EFFECTIVE THREAD USED IN CALCULATION




**b** = L - 10 mm
L - *3/8 inch*
represents the entire length of the threaded part

$\mathbf{S_g}$ = (L - 10 mm - 10 mm - Tol.)/ 2
(L - *3/8 inch* - *3/8 inch* - Tol.)/ 2
represents the partial length of the threaded part net of a laying tolerance (Tol.) of 10 mm (*3/8 inch*)

The extraction, shear and sliding values were calculated placing the centre of gravity of the connector in correspondence with the shear plane and considering an effective thread of $S_g$.

## CODES AND DIMENSIONS

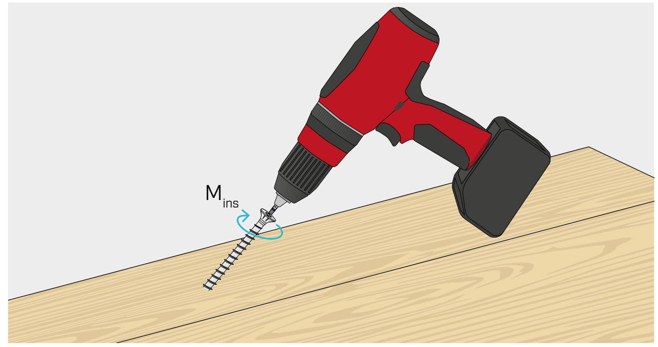
| d1 [mm] [in] | CODE | L [mm] | L [in] | b [mm] | b [in] | pcs |
|---|---|---|---|---|---|---|
| 9 0.36 TX 40 | **VGS9100** | 100 | *4* | 90 | *3 1/2* | 25 |
| | **VGS9120** | 120 | *4 3/4* | 110 | *4 3/8* | 25 |
| | **VGS9140** | 140 | *5 1/2* | 130 | *5 1/8* | 25 |
| | **VGS9160** | 160 | *6 1/4* | 150 | *6* | 25 |
| | **VGS9180** | 180 | *7 1/8* | 170 | *6 3/4* | 25 |
| | **VGS9200** | 200 | *8* | 190 | *7 1/2* | 25 |
| | **VGS9220** | 220 | *8 5/8* | 210 | *8 1/4* | 25 |
| | **VGS9240** | 240 | *9 1/2* | 230 | *9 1/16* | 25 |
| | **VGS9260** | 260 | *10 1/4* | 250 | *10* | 25 |
| | **VGS9280** | 280 | *11* | 270 | *10 5/8* | 25 |
| | **VGS9300** | 300 | *11 3/4* | 290 | *11 7/16* | 25 |
| | **VGS9320** | 320 | *12 5/8* | 310 | *12 3/16* | 25 |
| | **VGS9340** | 340 | *13 3/8* | 330 | *13* | 25 |
| | **VGS9360** | 360 | *14 1/4* | 350 | *13 3/4* | 25 |
| | **VGS9380** | 380 | *15* | 370 | *14 9/16* | 25 |
| | **VGS9400** | 400 | *15 3/4* | 390 | *15 3/8* | 25 |
| | **VGS9440** | 440 | *17 1/4* | 430 | *16 15/16* | 25 |
| | **VGS9480** | 480 | *19* | 470 | *18 1/2* | 25 |
| | **VGS9520** | 520 | *20 1/2* | 510 | *20 1/16* | 25 |

| d1 [mm] [in] | CODE | L [mm] | L [in] | b [mm] | b [in] | pcs |
|---|---|---|---|---|---|---|
| 11 0.44 TX 50 | **VGS11100** | 100 | *4* | 90 | *3 1/2* | 25 |
| | **VGS11125** | 125 | *4 15/16* | 115 | *4 1/2* | 25 |
| | **VGS11150** | 150 | *6* | 140 | *5 1/2* | 25 |
| | **VGS11175** | 175 | *6 7/8* | 165 | *6 1/2* | 25 |
| | **VGS11200** | 200 | *8* | 190 | *7 1/2* | 25 |
| | **VGS11225** | 225 | *8 7/8* | 215 | *8 7/16* | 25 |
| | **VGS11250** | 250 | *10* | 240 | *9 1/2* | 25 |
| | **VGS11275** | 275 | *10 7/8* | 265 | *10 7/16* | 25 |
| | **VGS11300** | 300 | *11 3/4* | 290 | *11 7/16* | 25 |
| | **VGS11325** | 325 | *12 3/4* | 315 | *12 3/8* | 25 |
| | **VGS11350** | 350 | *13 3/4* | 340 | *13 3/8* | 25 |
| | **VGS11375** | 375 | *14 3/4* | 365 | *14 3/8* | 25 |
| | **VGS11400** | 400 | *15 3/4* | 390 | *15 3/8* | 25 |
| | **VGS11450** | 450 | *17 3/4* | 440 | *17 1/4* | 25 |
| | **VGS11500** | 500 | *19 3/4* | 490 | *19 5/16* | 25 |
| | **VGS11550** | 550 | *21 5/8* | 540 | *21 1/4* | 25 |
| | **VGS11600** | 600 | *23 5/8* | 590 | *23 1/4* | 25 |
| | **VGS11700** | 700 | *27 1/2* | 690 | *27 3/16* | 25 |
| | **VGS11800** | 800 | *31 1/2* | 790 | *31 1/8* | 25 |

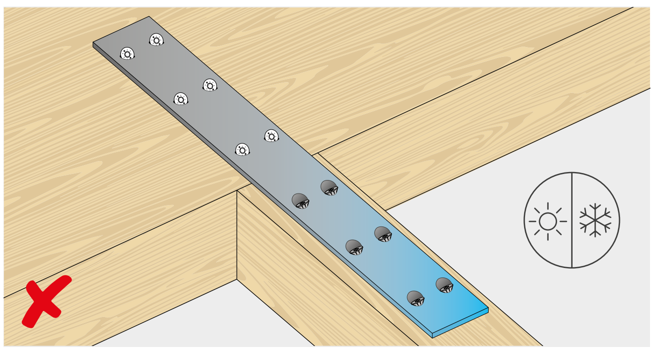
## TIMBER-TO-TIMBER APPLICATION

### RECOMMENDED INSERTION MOMENT: $M_{ins}$

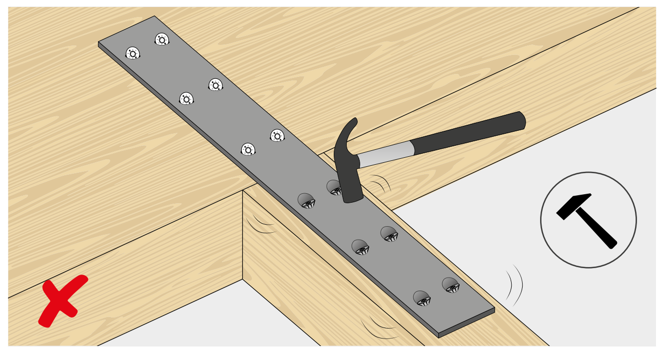
| | | | |
|---|---|---|---|
| VGS Ø9 | | $M_{ins}$ = 20 Nm | *177 lbf.in* |
| VGS Ø11 L < 400 mm | *15 3/4 inch* | $M_{ins}$ = 30 Nm | *265 lbf.in* |
| VGS Ø11 L ≥ 400 mm | *15 3/4 inch* | $M_{ins}$ = 40 Nm | *354 lbf.in* |




## STEEL-TO-TIMBER APPLICATION

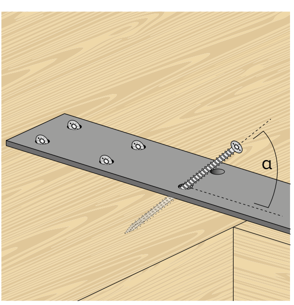


Avoid dimensional changes to the metal.

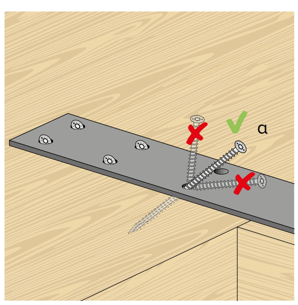


Avoid accidental stress during installation.

### A. SHAPED PLATE WITH COUNTERSUNK HOLES

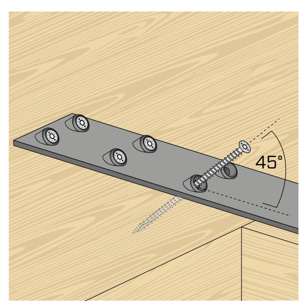



Respect the insertion angle (e.g. adopting a template).

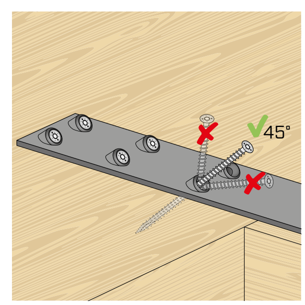



Avoid bending.

### B. VGU WASHER

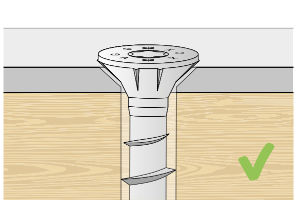



Respect the 45° insertion angle.

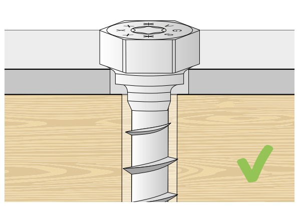



Avoid bending.

### A. SHAPED PLATE

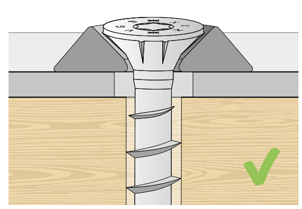


Countersunk hole.

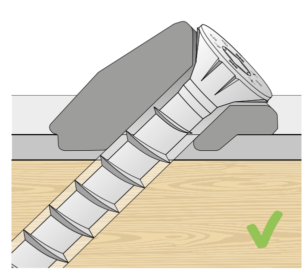


Cylindrical hole.

### B. WASHERS

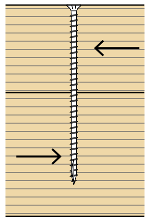


Flared washer.

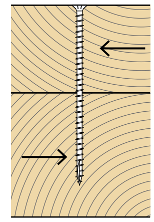


VGU washer.

# MINIMUM DISTANCES FOR SHEAR LOADS | WOOD ELEMENTS



Load-to-grain angle α = 0°

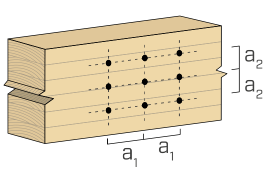


Load-to-grain angle α = 90°

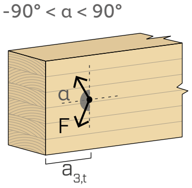
| | | SCREWS INSERTED WITH PREDRILL | | | | | |
|---|---|---|---|---|---|---|---|
| | | α = 0° | | | α = 90° | | |
| $d_1$ | **[mm]** | | **9** | **11** | | **9** | **11** |
| | ***[in]*** | | ***0.36*** | ***0.44*** | | ***0.36*** | ***0.44*** |
| $a_1$ | [mm] | **5·d (1)** | 45 | 55 | **4·d (1)** | 36 | 44 |
| | *[in]* | | *1.772* | *2.165* | | *1.417* | *1.732* |
| $a_2$ | [mm] | **3·d** | 27 | 33 | **4·d** | 36 | 44 |
| | *[in]* | | *1.063* | *1.299* | | *1.417* | *1.732* |
| $a_{3,t}$ | [mm] | **12·d (1)** | 108 | 132 | **7·d (1)** | 63 | 77 |
| | *[in]* | | *4.252* | *5.197* | | *2.480* | *3.031* |
| $a_{3,c}$ | [mm] | **7·d (1)** | 63 | 77 | **7·d (1)** | 63 | 77 |
| | *[in]* | | *2.480* | *3.031* | | *2.480* | *3.031* |
| $a_{4,t}$ | [mm] | **3·d** | 27 | 33 | **7·d** | 63 | 77 |
| | *[in]* | | *1.063* | *1.299* | | *2.480* | *3.031* |
| $a_{4,c}$ | [mm] | **3·d** | 27 | 33 | **3·d** | 27 | 33 |
| | *[in]* | | *1.063* | *1.299* | | *1.063* | *1.299* |

| | | SCREWS INSERTED WITHOUT PREDRILL | | | | | |
|---|---|---|---|---|---|---|---|
| | | α = 0° | | | α = 90° | | |
| $d_1$ | **[mm]** | | **9** | **11** | | **9** | **11** |
| | ***[in]*** | | ***0.36*** | ***0.44*** | | ***0.36*** | ***0.44*** |
| $a_1$ | [mm] | **12·d (1)** | 108 | 132 | **5·d (1)** | 45 | 55 |
| | *[in]* | | *4.252* | *5.197* | | *1.772* | *2.165* |
| $a_2$ | [mm] | **5·d** | 45 | 55 | **5·d** | 45 | 55 |
| | *[in]* | | *1.772* | *2.165* | | *1.772* | *2.165* |
| $a_{3,t}$ | [mm] | **15·d (1)** | 135 | 165 | **10·d (1)** | 90 | 110 |
| | *[in]* | | *5.315* | *6.496* | | *3.543* | *4.331* |
| $a_{3,c}$ | [mm] | **10·d (1)** | 90 | 110 | **10·d (1)** | 90 | 110 |
| | *[in]* | | *3.543* | *4.331* | | *3.543* | *4.331* |
| $a_{4,t}$ | [mm] | **5·d** | 45 | 55 | **10·d** | 90 | 110 |
| | *[in]* | | *1.772* | *2.165* | | *3.543* | *4.331* |
| $a_{4,c}$ | [mm] | **5·d** | 45 | 55 | **5·d** | 45 | 55 |
| | *[in]* | | *1.772* | *2.165* | | *1.772* | *2.165* |

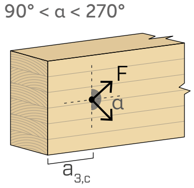
**d = nominal screw diameter**



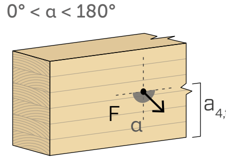

stressed end
-90° < α < 90°



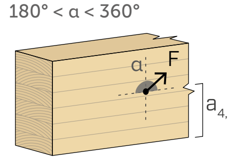

unloaded end
90° < α < 270°




stressed edge
0° < α < 180°




unload edge
180° < α < 360°

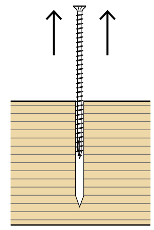



NOTES:

- The minimum distances are in accordance with the EN 1995:2014 standard, according to ETA-11/0030, considering a density of the wood elements $\rho_k \leq 420$ kg/m$^3$.
- For wood densities conversion (mean oven-dry relative density to 5th-percentile density 12% MC wt & vol ) see "Background document" available at Rothoblaas.
- In the case of OSB-wood joints, the minimum spacings ($a_1$, $a_2$) can be multiplied by a coefficient of 0.85.
- In the case of steel-wood joints, the minimum spacings ($a_1$, $a_2$) can be multiplied by a coefficient of 0.7.

(1) For Douglas fir members minimum spacing and distances parallel to the grain shall be increased by 50%.

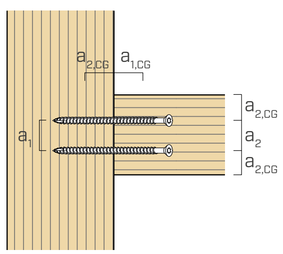
## MINIMUM DISTANCES FOR AXIAL LOADS | WOOD ELEMENTS



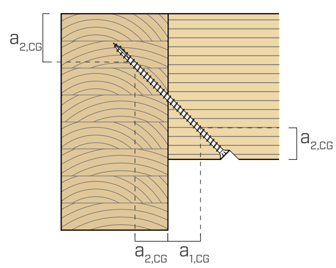
| | | | SCREWS INSERTED WITH AND WITHOUT PREDRILL | |
|---|---|---|---|---|
| **$d_1$** | **[mm]** | | **9** | **11** |
| | ***[in]*** | | ***0.36*** | ***0.44*** |
| **$a_1$** | [mm] | **5·d** | 45 | 55 |
| | *[in]* | | *1.772* | *2.165* |
| **$a_2$** | [mm] | **5·d** | 45 | 55 |
| | *[in]* | | *1.772* | *2.165* |
| **$a_{2,LIM}$**(2) | [mm] | **2.5·d** | 23 | 28 |
| | *[in]* | | *0.886* | *1.083* |
| **$a_{1,CG}$** | [mm] | **8·d** | 72 | 88 |
| | *[in]* | | *2.835* | *3.465* |
| **$a_{2,CG}$** | [mm] | **3·d** | 27 | 33 |
| | *[in]* | | *1.063* | *1.299* |
| **$a_{CROSS}$** | [mm] | **1.5·d** | 14 | 17 |
| | *[in]* | | *0.531* | *0.650* |

**d = nominal screw diameter**

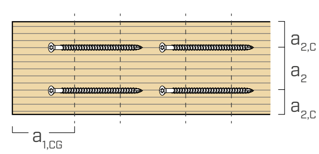
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



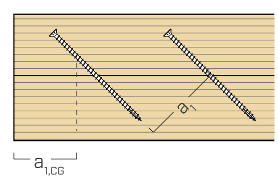

plan




front

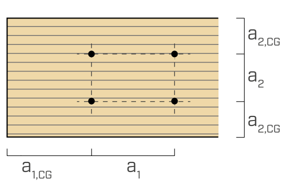



plan

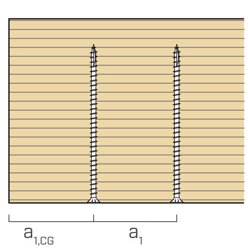



front

SCREWS INSERTED WITH α 90° ANGLE WITH RESPECT TO THE GRAIN

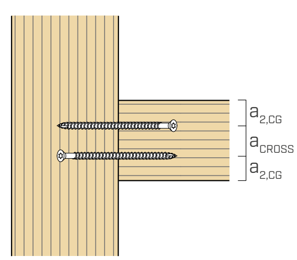



plan

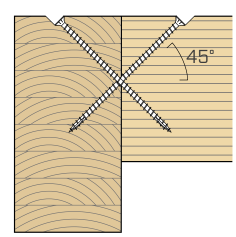



front

CROSS SCREWS INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN




plan



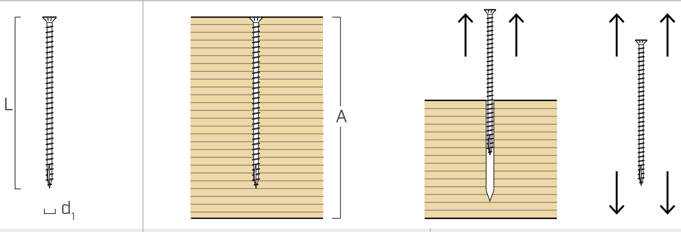

front

NOTES:

- The minimum distances for connectors stressed axially are independent of the insertion angle of the connector and the angle of the force with respect to the grain, in accordance with ETA-11/0030.

(2) The axial distance $a_2$ can be reduced down to 2,5 $d_1$ if for each connector a "joint surface" $a_1\ a_2 = 25\ d_1^2$ is maintained.

## STATIC VALUES | TRACTION




| geometry | | | | | | | | total thread withdrawal [2] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | characteristic values | | | | design values[1] (factored resistance) | | | | | |
| $d_1$ | $L$ | | $b$ | | $A_{MIN}$ | | | timber $R_{ax,k}$ | | steel $R_{tens,k}$ | | $R_{ax,d}$ Load Case 1 | | $R_{ax,d}$ Load Case 2&3 | | $R_{ax,d}$ Load Case 4&5 | |
| [mm] *[in]* | [mm] | *[in]* | [mm] | *[in]* | [mm] | *[in]* | | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* |
| 9 *0.36* | 100 | *4* | 90 | *3 1/2* | 110 | *4 3/8* | | 9.91 | *2,227* | 25.40 | *5,710* | 4.57 | *1,028* | 6.10 | *1,371* | 6.86 | *1,542* |
| | 120 | *4 3/4* | 110 | *4 3/8* | 130 | *5 1/8* | | 12.11 | *2,722* | | | 5.59 | *1,256* | 7.45 | *1,675* | 8.38 | *1,885* |
| | 140 | *5 1/2* | 130 | *5 1/8* | 150 | *6* | | 14.31 | *3,217* | | | 6.61 | *1,485* | 8.81 | *1,980* | 9.91 | *2,227* |
| | 160 | *6 1/4* | 150 | *6* | 170 | *6 3/4* | | 16.51 | *3,712* | | | 7.62 | *1,713* | 10.16 | *2,284* | 11.43 | *2,570* |
| | 180 | *7 1/8* | 170 | *6 3/4* | 190 | *7 1/2* | | 18.71 | *4,207* | | | 8.64 | *1,942* | 11.52 | *2,589* | 12.96 | *2,913* |
| | 200 | *8* | 190 | *7 1/2* | 210 | *8 1/4* | | 20.92 | *4,702* | | | 9.65 | *2,170* | 12.87 | *2,894* | 14.48 | *3,255* |
| | 220 | *8 5/8* | 210 | *8 1/4* | 230 | *9 1/16* | | 23.12 | *5,197* | | | 10.67 | *2,399* | 14.23 | *3,198* | 16.00 | *3,598* |
| | 240 | *9 1/2* | 230 | *9 1/16* | 250 | *10* | | 25.32 | *5,692* | | | 11.69 | *2,627* | 15.58 | *3,503* | 17.53 | *3,941* |
| | 260 | *10 1/4* | 250 | *10* | 270 | *10 5/8* | | 27.52 | *6,187* | | | 12.70 | *2,856* | 16.94 | *3,807* | 19.05 | *4,283* |
| | 280 | *11* | 270 | *10 5/8* | 290 | *11 7/16* | | 29.72 | *6,682* | | | 13.72 | *3,084* | 18.29 | *4,112* | 20.32 | *4,568* |
| | 300 | *11 3/4* | 290 | *11 7/16* | 310 | *12 3/16* | | 31.93 | *7,177* | | | 14.73 | *3,312* | 19.65 | *4,417* | 20.32 | *4,568* |
| | 320 | *12 5/8* | 310 | *12 3/16* | 330 | *13* | | 34.13 | *7,672* | | | 15.75 | *3,541* | 20.32 | *4,568* | 20.32 | *4,568* |
| | 340 | *13 3/8* | 330 | *13* | 350 | *13 3/4* | | 36.33 | *8,167* | | | 16.77 | *3,769* | 20.32 | *4,568* | 20.32 | *4,568* |
| | 360 | *14 1/4* | 350 | *13 3/4* | 370 | *14 9/16* | | 38.53 | *8,662* | | | 17.78 | *3,998* | 20.32 | *4,568* | 20.32 | *4,568* |
| | 380 | *15* | 370 | *14 9/16* | 390 | *15 3/8* | | 40.73 | *9,157* | | | 18.80 | *4,226* | 20.32 | *4,568* | 20.32 | *4,568* |
| | 400 | *15 3/4* | 390 | *15 3/8* | 410 | *16 1/8* | | 42.93 | *9,652* | | | 19.82 | *4,455* | 20.32 | *4,568* | 20.32 | *4,568* |
| | 440 | *17 1/4* | 430 | *16 15/16* | 450 | *17 3/4* | | 47.34 | *10,642* | | | 20.32 | *4,568* | 20.32 | *4,568* | 20.32 | *4,568* |
| | 480 | *19* | 470 | *18 1/2* | 490 | *19 5/16* | | 51.74 | *11,632* | | | 20.32 | *4,568* | 20.32 | *4,568* | 20.32 | *4,568* |
| | 520 | *20 1/2* | 510 | *20 1/16* | 530 | *20 7/8* | | 56.14 | *12,622* | | | 20.32 | *4,568* | 20.32 | *4,568* | 20.32 | *4,568* |
| 11 *0.44* | 100 | *4* | 90 | *3 1/2* | 110 | *4 3/8* | | 12.11 | *2,722* | 38.00 | *8,543* | 5.59 | *1,256* | 7.45 | *1,675* | 8.38 | *1,885* |
| | 125 | *4 15/16* | 115 | *4 1/2* | 135 | *5 5/16* | | 15.47 | *3,479* | | | 7.14 | *1,605* | 9.52 | *2,141* | 10.71 | *2,408* |
| | 150 | *6* | 140 | *5 1/2* | 160 | *6 1/4* | | 18.84 | *4,235* | | | 8.69 | *1,954* | 11.59 | *2,606* | 13.04 | *2,932* |
| | 175 | *6 7/8* | 165 | *6 1/2* | 185 | *7 1/4* | | 22.20 | *4,991* | | | 10.25 | *2,304* | 13.66 | *3,071* | 15.37 | *3,455* |
| | 200 | *8* | 190 | *7 1/2* | 210 | *8 1/4* | | 25.56 | *5,747* | | | 11.80 | *2,653* | 15.73 | *3,537* | 17.70 | *3,979* |
| | 225 | *8 7/8* | 215 | *8 7/16* | 235 | *9 1/4* | | 28.93 | *6,503* | | | 13.35 | *3,002* | 17.80 | *4,002* | 20.03 | *4,502* |
| | 250 | *10* | 240 | *9 1/2* | 260 | *10 1/4* | | 32.29 | *7,260* | | | 14.90 | *3,351* | 19.87 | *4,467* | 22.36 | *5,026* |
| | 275 | *10 7/8* | 265 | *10 7/16* | 285 | *11 1/4* | | 35.66 | *8,016* | | | 16.46 | *3,700* | 21.94 | *4,933* | 24.68 | *5,549* |
| | 300 | *11 3/4* | 290 | *11 7/16* | 310 | *12 3/16* | | 39.02 | *8,772* | | | 18.01 | *4,049* | 24.01 | *5,398* | 27.01 | *6,073* |
| | 325 | *12 3/4* | 315 | *12 3/8* | 335 | *13 3/16* | | 42.38 | *9,528* | | | 19.56 | *4,398* | 26.08 | *5,863* | 29.34 | *6,596* |
| | 350 | *13 3/4* | 340 | *13 3/8* | 360 | *14 1/4* | | 45.75 | *10,284* | | | 21.11 | *4,747* | 28.15 | *6,329* | 30.40 | *6,834* |
| | 375 | *14 3/4* | 365 | *14 3/8* | 385 | *15 3/16* | | 49.11 | *11,041* | | | 22.67 | *5,096* | 30.22 | *6,794* | 30.40 | *6,834* |
| | 400 | *15 3/4* | 390 | *15 3/8* | 410 | *16 1/8* | | 52.47 | *11,797* | | | 24.22 | *5,445* | 30.40 | *6,834* | 30.40 | *6,834* |
| | 450 | *17 3/4* | 440 | *17 1/4* | 460 | *18 1/8* | | 59.20 | *13,309* | | | 27.32 | *6,143* | 30.40 | *6,834* | 30.40 | *6,834* |
| | 500 | *19 3/4* | 490 | *19 5/16* | 510 | *20 1/16* | | 65.93 | *14,822* | | | 30.40 | *6,834* | 30.40 | *6,834* | 30.40 | *6,834* |
| | 550 | *21 5/8* | 540 | *21 1/4* | 560 | *22* | | 72.66 | *16,334* | | | 30.40 | *6,834* | 30.40 | *6,834* | 30.40 | *6,834* |
| | 600 | *23 5/8* | 590 | *23 1/4* | 610 | *24* | | 79.38 | *17,846* | | | 30.40 | *6,834* | 30.40 | *6,834* | 30.40 | *6,834* |
| | 700 | *27 1/2* | 690 | *27 3/16* | 710 | *27 15/16* | | 92.84 | *20,871* | | | 30.40 | *6,834* | 30.40 | *6,834* | 30.40 | *6,834* |
| | 800 | *31 1/2* | 790 | *31 1/8* | 810 | *31 7/8* | | 106.29 | *23,896* | | | 30.40 | *6,834* | 30.40 | *6,834* | 30.40 | *6,834* |

NOTES:

(1) The tensile design strength of the connector is the lower between the wood-side design strength ($R_{ax,d}$) and the steel-side design strength ($R_{tens,d}$).

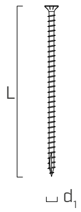
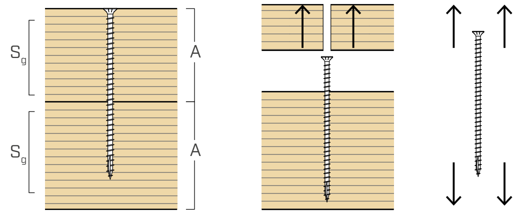
$$R_{ax,d} = \min \begin{cases} R_{ax,k} \cdot DMF \\ \dfrac{R_{tens,k}}{\gamma_{M2}} \end{cases}$$

$\gamma_{M2}$: partial factor for resistance of cross-sections in tension to fracture according to EN 1993-1-1. Please see notes "Background document" available at Rothoblaas.

(2) The axial resistance of the thread to extraction was calculated considering a 90° angle between the fibres and the connector and for a effective thread length of b or $S_g$. For intermediate $S_g$ values it is possible to interpolate linearly.

(3) The axial resistance of the thread to extraction was calculated considering a 45° angle between the fibres and the connector and for an effective thread length of $S_g$.

## STATIC VALUES | TRACTION

| geometry | partial thread withdrawal (2) |
|---|---|
| <br> | <br> |

| $d_1$ | L | | $S_g$ | | $A_{MIN}$ | | characteristic values timber $R_{ax,k}$ | | characteristic values steel $R_{tens,k}$ | | design values(1) (factored resistance) $R_{ax,d}$ Load Case 1 | | $R_{ax,d}$ Load Case 2&3 | | $R_{ax,d}$ Load Case 4&5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [mm] *[in]* | [mm] | *[in]* | [mm] | *[in]* | [mm] | *[in]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* |
| | 100 | *4* | 35 | *1 3/8* | 55 | *2 3/16* | 3.85 | *866* | | | 1.78 | *400* | 2.37 | *533* | 2.67 | *600* |
| | 120 | *4 3/4* | 45 | *1 3/4* | 65 | *2 9/16* | 4.95 | *1,114* | | | 2.29 | *514* | 3.05 | *685* | 3.43 | *771* |
| | 140 | *5 1/2* | 55 | *2 3/16* | 75 | *2 15/16* | 6.05 | *1,361* | | | 2.79 | *628* | 3.73 | *838* | 4.19 | *942* |
| | 160 | *6 1/4* | 65 | *2 9/16* | 85 | *3 3/8* | 7.16 | *1,609* | | | 3.30 | *742* | 4.40 | *990* | 4.95 | *1,114* |
| | 180 | *7 1/8* | 75 | *2 15/16* | 95 | *3 3/4* | 8.26 | *1,856* | | | 3.81 | *857* | 5.08 | *1,142* | 5.72 | *1,285* |
| | 200 | *8* | 85 | *3 3/8* | 105 | *4 1/8* | 9.36 | *2,104* | | | 4.32 | *971* | 5.76 | *1,295* | 6.48 | *1,456* |
| | 220 | *8 5/8* | 95 | *3 3/4* | 115 | *4 1/2* | 10.46 | *2,351* | | | 4.83 | *1,085* | 6.44 | *1,447* | 7.24 | *1,628* |
| | 240 | *9 1/2* | 105 | *4 1/8* | 125 | *4 15/16* | 11.56 | *2,599* | | | 5.33 | *1,199* | 7.11 | *1,599* | 8.00 | *1,799* |
| | 260 | *10 1/4* | 115 | *4 1/2* | 135 | *5 5/16* | 12.66 | *2,846* | | | 5.84 | *1,314* | 7.79 | *1,751* | 8.76 | *1,970* |
| **9** *0.36* | 280 | *11* | 125 | *4 15/16* | 145 | *5 11/16* | 13.76 | *3,094* | 25.40 | *5,710* | 6.35 | *1,428* | 8.47 | *1,904* | 9.53 | *2,142* |
| | 300 | *11 3/4* | 135 | *5 5/16* | 155 | *6 1/8* | 14.86 | *3,341* | | | 6.86 | *1,542* | 9.15 | *2,056* | 10.29 | *2,313* |
| | 320 | *12 5/8* | 145 | *5 11/16* | 165 | *6 1/2* | 15.96 | *3,589* | | | 7.37 | *1,656* | 9.82 | *2,208* | 11.05 | *2,484* |
| | 340 | *13 3/8* | 155 | *6 1/8* | 175 | *6 7/8* | 17.06 | *3,836* | | | 7.88 | *1,770* | 10.50 | *2,361* | 11.81 | *2,656* |
| | 360 | *14 1/4* | 165 | *6 1/2* | 185 | *7 1/4* | 18.16 | *4,084* | | | 8.38 | *1,885* | 11.18 | *2,513* | 12.58 | *2,827* |
| | 380 | *15* | 175 | *6 7/8* | 195 | *7 11/16* | 19.27 | *4,331* | | | 8.89 | *1,999* | 11.86 | *2,665* | 13.34 | *2,998* |
| | 400 | *15 3/4* | 185 | *7 1/4* | 205 | *8 1/16* | 20.37 | *4,578* | | | 9.40 | *2,113* | 12.53 | *2,818* | 14.10 | *3,170* |
| | 440 | *17 1/4* | 205 | *8 1/16* | 225 | *8 7/8* | 22.57 | *5,073* | | | 10.42 | *2,342* | 13.89 | *3,122* | 15.62 | *3,512* |
| | 480 | *19* | 225 | *8 7/8* | 245 | *9 5/8* | 24.77 | *5,568* | | | 11.43 | *2,570* | 15.24 | *3,427* | 17.15 | *3,855* |
| | 520 | *20 1/2* | 245 | *9 5/8* | 265 | *10 7/16* | 26.97 | *6,063* | | | 12.45 | *2,798* | 16.60 | *3,731* | 18.67 | *4,198* |
| | 100 | *4* | 35 | *1 3/8* | 55 | *2 3/16* | 4.71 | *1,059* | | | 2.17 | *489* | 2.90 | *651* | 3.26 | *733* |
| | 125 | *4 15/16* | 48 | *1 7/8* | 68 | *2 11/16* | 6.39 | *1,437* | | | 2.95 | *663* | 3.93 | *884* | 4.42 | *995* |
| | 150 | *6* | 60 | *2 3/8* | 80 | *3 1/8* | 8.07 | *1,815* | | | 3.73 | *838* | 4.97 | *1,117* | 5.59 | *1,256* |
| | 175 | *6 7/8* | 73 | *2 7/8* | 93 | *3 11/16* | 9.75 | *2,193* | | | 4.50 | *1,012* | 6.00 | *1,350* | 6.75 | *1,518* |
| | 200 | *8* | 85 | *3 3/8* | 105 | *4 1/8* | 11.44 | *2,571* | | | 5.28 | *1,187* | 7.04 | *1,582* | 7.92 | *1,780* |
| | 225 | *8 7/8* | 98 | *3 7/8* | 118 | *4 5/8* | 13.12 | *2,949* | | | 6.05 | *1,361* | 8.07 | *1,815* | 9.08 | *2,042* |
| | 250 | *10* | 110 | *4 3/8* | 130 | *5 1/8* | 14.80 | *3,327* | | | 6.83 | *1,536* | 9.11 | *2,048* | 10.25 | *2,304* |
| | 275 | *10 7/8* | 123 | *4 13/16* | 143 | *5 5/8* | 16.48 | *3,705* | | | 7.61 | *1,710* | 10.14 | *2,280* | 11.41 | *2,565* |
| | 300 | *11 3/4* | 135 | *5 5/16* | 155 | *6 1/8* | 18.16 | *4,084* | | | 8.38 | *1,885* | 11.18 | *2,513* | 12.58 | *2,827* |
| **11** *0.44* | 325 | *12 3/4* | 148 | *5 13/16* | 168 | *6 5/8* | 19.85 | *4,462* | 38.00 | *8,543* | 9.16 | *2,059* | 12.21 | *2,746* | 13.74 | *3,089* |
| | 350 | *13 3/4* | 160 | *6 1/4* | 180 | *7 1/8* | 21.53 | *4,840* | | | 9.94 | *2,234* | 13.25 | *2,978* | 14.90 | *3,351* |
| | 375 | *14 3/4* | 173 | *6 13/16* | 193 | *7 5/8* | 23.21 | *5,218* | | | 10.71 | *2,408* | 14.28 | *3,211* | 16.07 | *3,612* |
| | 400 | *15 3/4* | 185 | *7 1/4* | 205 | *8 1/16* | 24.89 | *5,596* | | | 11.49 | *2,583* | 15.32 | *3,444* | 17.23 | *3,874* |
| | 450 | *17 3/4* | 210 | *8 1/4* | 230 | *9 1/16* | 28.26 | *6,352* | | | 13.04 | *2,932* | 17.39 | *3,909* | 19.56 | *4,398* |
| | 500 | *19 3/4* | 235 | *9 1/4* | 255 | *10 1/16* | 31.62 | *7,108* | | | 14.59 | *3,281* | 19.46 | *4,374* | 21.89 | *4,921* |
| | 550 | *21 5/8* | 260 | *10 1/4* | 280 | *11* | 34.98 | *7,865* | | | 16.15 | *3,630* | 21.53 | *4,840* | 24.22 | *5,445* |
| | 600 | *23 5/8* | 285 | *11 1/4* | 305 | *12* | 38.35 | *8,621* | | | 17.70 | *3,979* | 23.60 | *5,305* | 26.55 | *5,968* |
| | 700 | *27 1/2* | 335 | *13 3/16* | 355 | *14* | 45.07 | *10,133* | | | 20.80 | *4,677* | 27.74 | *6,236* | 30.40 | *6,834* |
| | 800 | *31 1/2* | 385 | *15 3/16* | 405 | *15 15/16* | 51. 80 | *11,646* | | | 23.91 | *5,375* | 30.40 | *6,834* | 30.40 | *6,834* |

**NOTES:**

(1) The tensile design strength of the connector is the lower between the woodside design strength ($R_{ax,d}$) and the steel-side design strength ($R_{tens,d}$).

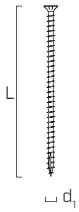
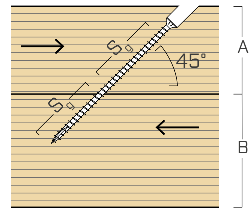
$$R_{ax,d} = \min \begin{cases} R_{ax,k} \cdot DMF \\ \dfrac{R_{tens,k}}{\gamma_{M2}} \end{cases}$$

$\gamma_{M2}$: partial factor for resistance of cross-sections in tension to fracture according to EN 1993-1-1. Please see "Background document" available at Rothoblaas.

(2) The axial resistance of the thread to extraction was calculated considering a 90° angle between the fibres and the connector and for a effective thread length of b or $S_g$. For intermediate $S_g$ values it is possible to interpolate linearly.

(3) The axial resistance of the thread to extraction was calculated considering a 45° angle between the fibres and the connector and for an effective thread length of $S_g$.

# STATIC VALUES | SLIDING TIMBER-TO-TIMBER

| geometry | | timber-to-timber(3) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | |  | | | | | | | | | | | | | | |
| | | | | | | | | characteristic values | | design values(1) (factored resistance) | | | | | | |
| $d_1$ | $L$ | | $S_g$ | | $A_{MIN}$ | | $B_{MIN}$ | | $R_{V,k}$ | | $R_{V,d}$ Load Case 1 | | $R_{V,d}$ Load Case 2&3 | | $R_{V,d}$ Load Case 4&5 | |
| [mm] *[in]* | [mm] | *[in]* | [mm] | *[in]* | [mm] | *[in]* | [mm] | *[in]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* |
| 9 *0.36* | 100 | *4* | 35 | *1 3/8* | 40 | *1 9/16* | 55 | *2 3/16* | 2.72 | *612* | 1.26 | *283* | 1.68 | *377* | 1.89 | *424* |
| | 120 | *4 3/4* | 45 | *1 3/4* | 50 | *1 15/16* | 60 | *2 3/8* | 3.50 | *787* | 1.62 | *363* | 2.16 | *485* | 2.43 | *545* |
| | 140 | *5 1/2* | 55 | *2 3/16* | 55 | *2 3/16* | 70 | *2 3/4* | 4.28 | *962* | 1.98 | *444* | 2.63 | *592* | 2.96 | *666* |
| | 160 | *6 1/4* | 65 | *2 9/16* | 60 | *2 3/8* | 75 | *2 15/16* | 5.06 | *1,137* | 2.34 | *525* | 3.11 | *700* | 3.50 | *787* |
| | 180 | *7 1/8* | 75 | *2 15/16* | 70 | *2 3/4* | 85 | *3 3/8* | 5.84 | *1,312* | 2.69 | *606* | 3.59 | *808* | 4.04 | *909* |
| | 200 | *8* | 85 | *3 3/8* | 75 | *2 15/16* | 90 | *3 1/2* | 6.62 | *1,487* | 3.05 | *687* | 4.07 | *915* | 4.58 | *1,030* |
| | 220 | *8 5/8* | 95 | *3 3/4* | 85 | *3 3/8* | 100 | *4* | 7.40 | *1,662* | 3.41 | *767* | 4.55 | *1,023* | 5.12 | *1,151* |
| | 240 | *9 1/2* | 105 | *4 1/8* | 90 | *3 1/2* | 105 | *4 1/8* | 8.17 | *1,837* | 3.77 | *848* | 5.03 | *1,131* | 5.66 | *1,272* |
| | 260 | *10 1/4* | 115 | *4 1/2* | 100 | *4* | 110 | *4 3/8* | 8.95 | *2,012* | 4.13 | *929* | 5.51 | *1,238* | 6.20 | *1,393* |
| | 280 | *11* | 125 | *4 15/16* | 105 | *4 1/8* | 120 | *4 3/4* | 9.73 | *2,187* | 4.49 | *1,010* | 5.99 | *1,346* | 6.74 | *1,514* |
| | 300 | *11 3/4* | 135 | *5 5/16* | 110 | *4 3/8* | 125 | *4 15/16* | 10.51 | *2,362* | 4.85 | *1,090* | 6.47 | *1,454* | 7.28 | *1,636* |
| | 320 | *12 5/8* | 145 | *5 11/16* | 120 | *4 3/4* | 135 | *5 5/16* | 11.29 | *2,537* | 5.21 | *1,171* | 6.95 | *1,562* | 7.81 | *1,757* |
| | 340 | *13 3/8* | 155 | *6 1/8* | 125 | *4 15/16* | 140 | *5 1/2* | 12.07 | *2,712* | 5.57 | *1,252* | 7.43 | *1,669* | 8.35 | *1,878* |
| | 360 | *14 1/4* | 165 | *6 1/2* | 135 | *5 5/16* | 145 | *5 11/16* | 12.84 | *2,887* | 5.93 | *1,333* | 7.90 | *1,777* | 8.89 | *1,999* |
| | 380 | *15* | 175 | *6 7/8* | 140 | *5 1/2* | 155 | *6 1/8* | 13.62 | *3,062* | 6.29 | *1,413* | 8.38 | *1,885* | 9.43 | *2,120* |
| | 400 | *15 3/4* | 185 | *7 1/4* | 145 | *5 11/16* | 160 | *6 1/4* | 14.40 | *3,237* | 6.65 | *1,494* | 8.86 | *1,992* | 9.97 | *2,241* |
| | 440 | *17 1/4* | 205 | *8 1/16* | 160 | *6 1/4* | 175 | *6 7/8* | 15.96 | *3,587* | 7.37 | *1,656* | 9.82 | *2,208* | 11.05 | *2,484* |
| | 480 | *19* | 225 | *8 7/8* | 175 | *6 7/8* | 190 | *7 1/2* | 17.51 | *3,937* | 8.08 | *1,817* | 10.78 | *2,423* | 12.13 | *2,726* |
| | 520 | *20 1/2* | 245 | *9 5/8* | 190 | *7 1/2* | 205 | *8 1/16* | 17.96 | *4,038* | 8.29 | *1,864* | 11.05 | *2,485* | 12.43 | *2,795* |
| 11 *0.44* | 100 | *4* | 35 | *1 3/8* | 40 | *1 9/16* | 55 | *2 3/16* | 3.33 | *749* | 1.54 | *346* | 2.05 | *461* | 2.31 | *518* |
| | 125 | *4 15/16* | 48 | *1 7/8* | 50 | *1 15/16* | 65 | *2 9/16* | 4.52 | *1,016* | 2.09 | *469* | 2.78 | *625* | 3.13 | *703* |
| | 150 | *6* | 60 | *2 3/8* | 60 | *2 3/8* | 75 | *2 15/16* | 5.71 | *1,283* | 2.63 | *592* | 3.51 | *790* | 3.95 | *888* |
| | 175 | *6 7/8* | 73 | *2 7/8* | 70 | *2 3/4* | 80 | *3 1/8* | 6.90 | *1,551* | 3.18 | *716* | 4.24 | *954* | 4.78 | *1,074* |
| | 200 | *8* | 85 | *3 3/8* | 80 | *3 1/8* | 90 | *3 1/2* | 8.09 | *1,818* | 3.73 | *839* | 4.98 | *1,119* | 5.60 | *1,259* |
| | 225 | *8 7/8* | 98 | *3 7/8* | 85 | *3 3/8* | 100 | *4* | 9.28 | *2,085* | 4.28 | *962* | 5.71 | *1,283* | 6.42 | *1,444* |
| | 250 | *10* | 110 | *4 3/8* | 95 | *3 3/4* | 110 | *4 3/8* | 10.47 | *2,353* | 4.83 | *1,086* | 6.44 | *1,448* | 7.25 | *1,629* |
| | 275 | *10 7/8* | 123 | *4 13/16* | 105 | *4 1/8* | 115 | *4 1/2* | 11.65 | *2,620* | 5.38 | *1,209* | 7.17 | *1,612* | 8.07 | *1,814* |
| | 300 | *11 3/4* | 135 | *5 5/16* | 115 | *4 1/2* | 125 | *4 15/16* | 12.84 | *2,887* | 5.93 | *1,333* | 7.90 | *1,777* | 8.89 | *1,999* |
| | 325 | *12 3/4* | 148 | *5 13/16* | 120 | *4 3/4* | 135 | *5 5/16* | 14.03 | *3,155* | 6.48 | *1,456* | 8.64 | *1,941* | 9.72 | *2,184* |
| | 350 | *13 3/4* | 160 | *6 1/4* | 130 | *5 1/8* | 145 | *5 11/16* | 15.22 | *3,422* | 7.03 | *1,579* | 9.37 | *2,106* | 10.54 | *2,369* |
| | 375 | *14 3/4* | 173 | *6 13/16* | 140 | *5 1/2* | 155 | *6 1/8* | 16.41 | *3,690* | 7.57 | *1,703* | 10.10 | *2,270* | 11.36 | *2,554* |
| | 400 | *15 3/4* | 185 | *7 1/4* | 150 | *6* | 160 | *6 1/4* | 17.60 | *3,957* | 8.12 | *1,826* | 10.83 | *2,435* | 12.19 | *2,739* |
| | 450 | *17 3/4* | 210 | *8 1/4* | 165 | *6 1/2* | 180 | *7 1/8* | 19.98 | *4,492* | 9.22 | *2,073* | 12.30 | *2,764* | 13.83 | *3,110* |
| | 500 | *19 3/4* | 235 | *9 1/4* | 185 | *7 1/4* | 195 | *7 11/16* | 22.36 | *5,026* | 10.32 | *2,320* | 13.76 | *3,093* | 15.48 | *3,480* |
| | 550 | *21 5/8* | 260 | *10 1/4* | 200 | *8* | 215 | *8 7/16* | 24.74 | *5,561* | 11.42 | *2,567* | 15.22 | *3,422* | 17.13 | *3,850* |
| | 600 | *23 5/8* | 285 | *11 1/4* | 220 | *8 5/8* | 230 | *9 1/16* | 26.87 | *6,041* | 12.40 | *2,788* | 16.54 | *3,717* | 18.60 | *4,182* |
| | 700 | *27 1/2* | 335 | *13 3/16* | 255 | *10 1/16* | 265 | *10 7/16* | 26.87 | *6,041* | 12.40 | *2,788* | 16.54 | *3,717* | 18.60 | *4,182* |
| | 800 | *31 1/2* | 385 | *15 3/16* | 290 | *11 7/16* | 305 | *12* | 26.87 | *6,041* | 12.40 | *2,788* | 16.54 | *3,717* | 18.60 | *4,182* |



NOTES:

(1) The tensile design strength of the connector is the lower between the woodside design strength ($R_{ax,d}$) and the steel-side design strength ($R_{tens,d}$).

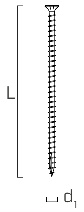
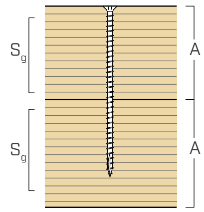
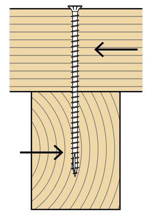
$$R_{ax,d} = min\begin{cases} R_{ax,k} \cdot DMF \\ \dfrac{R_{tens,k}}{\gamma_{M2}} \end{cases}$$

$\gamma_{M2}$: partial factor for resistance of cross-sections in tension to fracture according to EN 1993-1-1. Please see "Background document" available at Rothoblaas.

(2) The axial resistance of the thread to extraction was calculated considering a 90° angle between the fibres and the connector and for a effective thread length of b or $S_g$. For intermediate $S_g$ values it is possible to interpolate linearly.

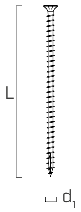
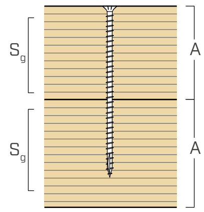
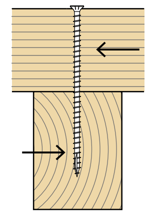
(3) The axial resistance of the thread to extraction was calculated considering a 45° angle between the fibres and the connector and for an effective thread length of $S_g$.

# STATIC VALUES | SHEAR TIMBER-TO-TIMBER

| geometry | timber-to-timber |
|---|---|
|  |   |

| $d_1$ | L | | $S_g$ | | $A_{MIN}$ | | characteristic values $R_{V,k}$ | | design values (factored resistance) $R_{V,d}$ Load Case 1 | | $R_{V,d}$ Load Case 2&3 | | $R_{V,d}$ Load Case 4&5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [mm] *[in]* | [mm] | *[in]* | [mm] | *[in]* | [mm] | *[in]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* |
| **9** *0.36* | 100 | *4* | 35 | *1 3/8* | 50 | *1 15/16* | 3.43 | *772* | 1.58 | *356* | 2.11 | *475* | 2.38 | *534* |
| | 120 | *4 3/4* | 45 | *1 3/4* | 60 | *2 3/8* | 4.06 | *912* | 1.87 | *421* | 2.50 | *562* | 2.81 | *632* |
| | 140 | *5 1/2* | 55 | *2 3/16* | 70 | *2 3/4* | 4.70 | *1,058* | 2.17 | *488* | 2.89 | *651* | 3.26 | *732* |
| | 160 | *6 1/4* | 65 | *2 9/16* | 80 | *3 1/8* | 4.98 | *1,119* | 2.30 | *517* | 3.06 | *689* | 3.45 | *775* |
| | 180 | *7 1/8* | 75 | *2 15/16* | 90 | *3 1/2* | 5.25 | *1,181* | 2.43 | *545* | 3.23 | *727* | 3.64 | *818* |
| | 200 | *8* | 85 | *3 3/8* | 100 | *4* | 5.53 | *1,243* | 2.55 | *574* | 3.40 | *765* | 3.83 | *861* |
| | 220 | *8 5/8* | 95 | *3 3/4* | 110 | *4 3/8* | 5.80 | *1,305* | 2.68 | *602* | 3.57 | *803* | 4.02 | *903* |
| | 240 | *9 1/2* | 105 | *4 1/8* | 120 | *4 3/4* | 6.08 | *1,367* | 2.81 | *631* | 3.74 | *841* | 4.21 | *946* |
| | 260 | *10 1/4* | 115 | *4 1/2* | 130 | *5 1/8* | 6.36 | *1,429* | 2.93 | *659* | 3.91 | *879* | 4.40 | *989* |
| | 280 | *11* | 125 | *4 15/16* | 140 | *5 1/2* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |
| | 300 | *11 3/4* | 135 | *5 5/16* | 150 | *6* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |
| | 320 | *12 5/8* | 145 | *5 11/16* | 160 | *6 1/4* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |
| | 340 | *13 3/8* | 155 | *6 1/8* | 170 | *6 3/4* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |
| | 360 | *14 1/4* | 165 | *6 1/2* | 180 | *7 1/8* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |
| | 380 | *15* | 175 | *6 7/8* | 190 | *7 1/2* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |
| | 400 | *15 3/4* | 185 | *7 1/4* | 200 | *8* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |
| | 440 | *17 1/4* | 205 | *8 1/16* | 220 | *8 5/8* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |
| | 480 | *19* | 225 | *8 7/8* | 240 | *9 1/2* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |
| | 520 | *20 1/2* | 245 | *9 5/8* | 260 | *10 1/4* | 6.38 | *1,434* | 2.94 | *662* | 3.93 | *883* | 4.42 | *993* |

## STATIC VALUES | SHEAR TIMBER-TO-TIMBER

| geometry | | timber-to-timber | |
|---|---|---|---|
|  |  | |  |





| $d_1$ | $L$ | | $S_g$ | | $A_{MIN}$ | | characteristic values $R_{V,k}$ | | design values (factored resistance) $R_{V,d}$ Load Case 1 | | $R_{V,d}$ Load Case 2&3 | | $R_{V,d}$ Load Case 4&5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [mm] *[in]* | [mm] | *[in]* | [mm] | *[in]* | [mm] | *[in]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* | [kN] | *[lbf]* |
| **11** *0.44* | 100 | *4* | 35 | *1 3/8* | 50 | *1 15/16* | 4.11 | *925* | 1.90 | *427* | 2.53 | *569* | 2.85 | *640* |
| | 125 | *4 15/16* | 48 | *1 7/8* | 63 | *2 1/2* | 5.23 | *1,177* | 2.42 | *543* | 3.22 | *724* | 3.62 | *815* |
| | 150 | *6* | 60 | *2 3/8* | 75 | *2 15/16* | 6.19 | *1,392* | 2.86 | *643* | 3.81 | *857* | 4.29 | *964* |
| | 175 | *6 7/8* | 73 | *2 7/8* | 88 | *3 7/16* | 6.88 | *1,547* | 3.18 | *714* | 4.23 | *952* | 4.76 | *1,071* |
| | 200 | *8* | 85 | *3 3/8* | 100 | *4* | 7.30 | *1,642* | 3.37 | *758* | 4.49 | *1,010* | 5.06 | *1,136* |
| | 225 | *8 7/8* | 98 | *3 7/8* | 113 | *4 1/2* | 7.72 | *1,736* | 3.56 | *801* | 4.75 | *1,068* | 5.35 | *1,202* |
| | 250 | *10* | 110 | *4 3/8* | 125 | *4 15/16* | 8.14 | *1,831* | 3.76 | *845* | 5.01 | *1,127* | 5.64 | *1,267* |
| | 275 | *10 7/8* | 123 | *4 13/16* | 138 | *5 7/16* | 8.56 | *1,925* | 3.95 | *889* | 5.27 | *1,185* | 5.93 | *1,333* |
| | 300 | *11 3/4* | 135 | *5 5/16* | 150 | *6* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 325 | *12 3/4* | 148 | *5 13/16* | 163 | *6 7/16* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 350 | *13 3/4* | 160 | *6 1/4* | 175 | *6 7/8* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 375 | *14 3/4* | 173 | *6 13/16* | 188 | *7 3/8* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 400 | *15 3/4* | 185 | *7 1/4* | 200 | *8* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 450 | *17 3/4* | 210 | *8 1/4* | 225 | *8 7/8* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 500 | *19 3/4* | 235 | *9 1/4* | 250 | *10* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 550 | *21 5/8* | 260 | *10 1/4* | 275 | *10 7/8* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 600 | *23 5/8* | 285 | *11 1/4* | 300 | *11 3/4* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 700 | *27 1/2* | 335 | *13 3/16* | 350 | *13 3/4* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |
| | 800 | *31 1/2* | 385 | *15 3/16* | 400 | *15 3/4* | 8.89 | *1,997* | 4.10 | *922* | 5.47 | *1,229* | 6.15 | *1,383* |

### GENERAL PRINCIPLES:

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- According to EN 1995:2014 for shear characteristic values the contribution from the rope effect ($F_{ax,Rk}$ / 4) is considered. This is resulting in higher shear resistances compared to shear resistances calculated in accordance with CSA O86-14.
- Design values for wood-side are obtained from the following characteristic values:

$$R_d = R_k \cdot \text{DMF}$$

DMF: design modification factor based on $k_{mod}$ as per Table 10 and for $\gamma_M$ as per Table 11 ( $\gamma_M$ = 1.3). See "Background document" available at Rothoblaas.

| Load case | Load Combination Principal Load | Companion Load | Design Modification Factor DMF |
|---|---|---|---|
| 1 | 1.4D | - | 0.46 |
| 2 | (1.25D or 0.9D) + 1.5L | 1.0S or 0.4W | 0.62 (1) |
| 3 | (1.25D or 0.9D) + 1.5S | 1.0L or 0.4W | 0.62 |
| 4 | (1.25D or 0.9D) + 1.4W | 0.5L or 0.5S | 0.69 |
| 5 | 1.0D + 1.0E | 0.5L or 0.25S | 0.69 |

(1) If Live Load L is associated with long term loads such as storage, equipment areas etc., use 0,54.

- For the mechanical resistance values and the geometry of the screws, reference was made to ETA-11/0030.
- In the calculations, the density of the wood elements was considered equal to $\rho_k$ = 370 kg/m$^3$ (S-P-F sawn lumber). For wood densities conversion (mean ovendry relative density to 5th-percentile density 12% MC wt & vol ) see "Background document" available at Rothoblaas.
  Characteristic resistances can also be considered as valid for higher densities, for the purposes of safety.
- Sizing and verification of the wooden elements and steel plates must be done separately.
- The shear characteristic resistances are calculated for screws inserted without pre-bored holes. In the case of screws inserted with pre-bored holes, greater resistance values can be obtained.
- The wood-wood extraction, shear and sliding values were calculated considering the centre of gravity of the connector placed in correspondence with the shear plane.
- The characteristic resistances were calculated using solid wood or glulam. In the case of joints with CLT elements, the resistance values may be different and should be calculated on the basis of the characteristics of the panel and the connection configuration.

Packaged quantities may vary.
Original text: Italian.
Reference unit of measurement: metric.