

## STRUCTURAL REINFORCEMENT SYSTEM

### CERTIFICATION FOR TIMBER AND CONCRETE

Structural connector approved for timber applications according to ETA-11/0030 and for timber-concrete applications according to ETA-22/0806.

### RAPID DRY SYSTEM

Available in diameters 16 and 20 mm, it is used to reinforce and connect large elements. The timber thread allows application without the need for resins or adhesives.

### STRUCTURAL REINFORCEMENT

The high-performance tensile steel ( $f_{y,k} = 640 \text{ N/mm}^2$ ) and the large dimensions available make RTR ideal for structural reinforcement applications.

### LARGE SPANS

The system, developed for applications on large span elements, allows fast and secure reinforcement and connections on any beam size due to the considerable length of the bars.

Ideal for factory installations.

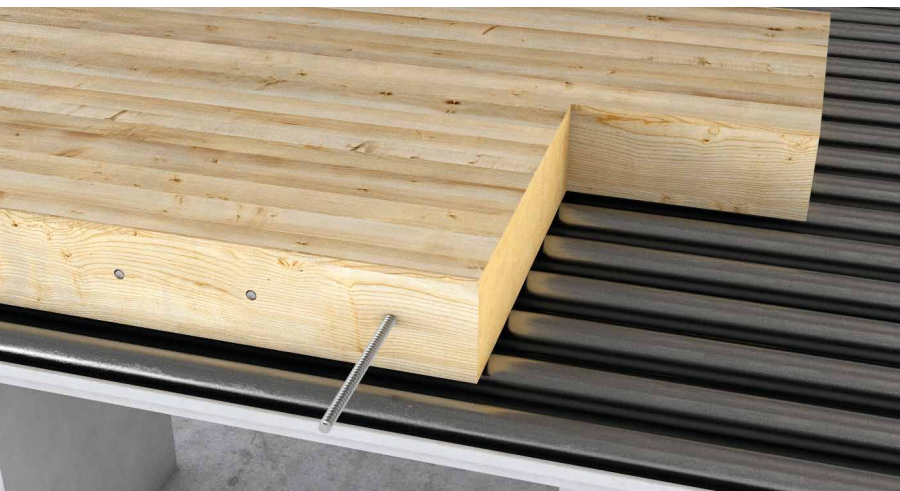


VIDEO



BIT INCLUDED

|                         |                                   |
|-------------------------|-----------------------------------|
| DIAMETER [mm]           | 16 16 20 20                       |
| LENGTH [mm]             | 2200                              |
| SERVICE CLASS           | SC1 SC2                           |
| ATMOSPHERIC CORROSIVITY | C1 C2                             |
| WOOD CORROSIVITY        | T1 T2                             |
| MATERIAL                | Zn electrogalvanized carbon steel |



### FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT, LVL

## CODES AND DIMENSIONS

| $d_1$<br>[mm] | CODE      | L<br>[mm] | pcs |
|---------------|-----------|-----------|-----|
| 16            | RTR162200 | 2200      | 10  |
| 20            | RTR202200 | 2200      | 5   |

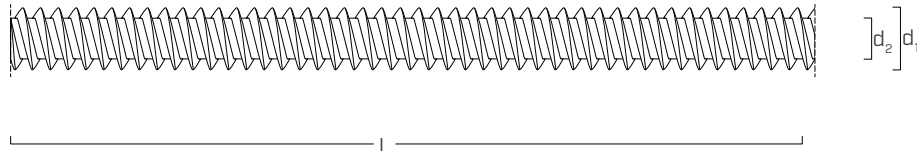
## RELATED PRODUCTS



**D 38 RLE**  
4-SPEED DRILL DRIVER

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## GEOMETRY AND MECHANICAL CHARACTERISTICS



| Nominal diameter                          | $d_1$        | [mm]                 | 16    | 20    |
|-------------------------------------------|--------------|----------------------|-------|-------|
| Thread diameter                           | $d_2$        | [mm]                 | 12,00 | 15,00 |
| Pre-drilling hole diameter <sup>(1)</sup> | $d_{v,s}$    | [mm]                 | 13,0  | 16,0  |
| Characteristic tensile strength           | $f_{tens,k}$ | [kN]                 | 100,0 | 145,0 |
| Characteristic yield moment               | $M_{y,k}$    | [Nm]                 | 200,0 | 350,0 |
| Characteristic yield strength             | $f_{y,k}$    | [N/mm <sup>2</sup> ] | 640   | 640   |

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

### CHARACTERISTIC MECHANICAL PARAMETERS

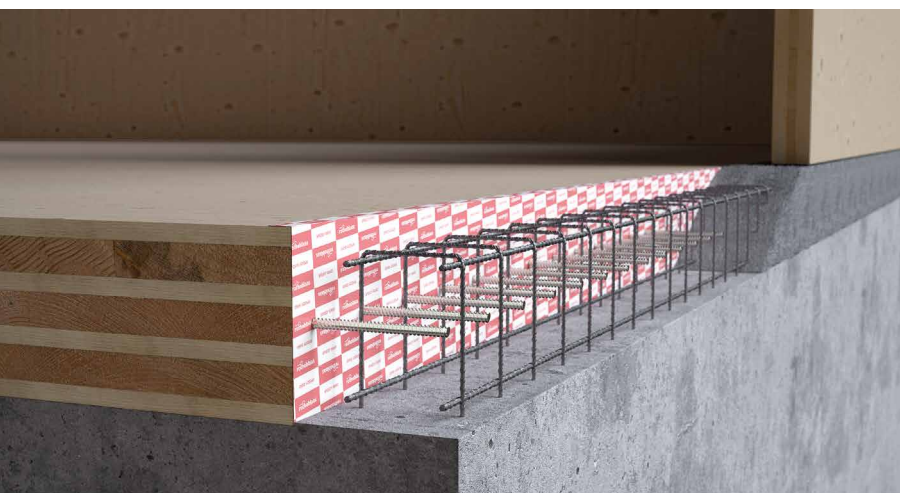
|                                 |            |                      | softwood<br>(softwood) |
|---------------------------------|------------|----------------------|------------------------|
| Withdrawal resistance parameter | $f_{ax,k}$ | [N/mm <sup>2</sup> ] | 9,0                    |
| Associated density              | $\rho_a$   | [kg/m <sup>3</sup> ] | 350                    |
| Calculation density             | $\rho_k$   | [kg/m <sup>3</sup> ] | $\leq 440$             |

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

### TC FUSION SYSTEM FOR TIMBER-CONCRETE APPLICATION

| Nominal diameter                                   | $d_1$     | [mm]                 | 16  | 20 |
|----------------------------------------------------|-----------|----------------------|-----|----|
| Tangential strength of adhesion in concrete C25/30 | $f_{b,k}$ | [N/mm <sup>2</sup> ] | 9,0 | -  |

For applications with different materials please see ETA-22/0806



### TC FUSION

The ETA-22/0806 approval of the TC FUSION system allows the RTR threaded rods to be used together with the reinforcements in the concrete so that the panel floor slabs and the bracing core can be bonded together with a small integration of the casting.

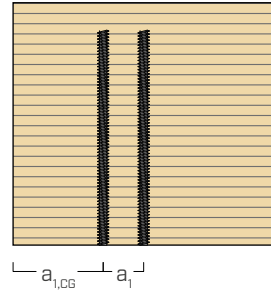
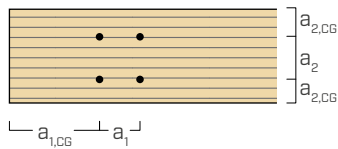
## MINIMUM DISTANCES FOR AXIAL STRESSES



rods inserted **WITH** pre-drilled hole

| $d_1$      | [mm] | 16   | 20  |
|------------|------|------|-----|
| $a_1$      | [mm] | 5·d  | 80  |
| $a_2$      | [mm] | 5·d  | 80  |
| $a_{1,CG}$ | [mm] | 10·d | 160 |
| $a_{2,CG}$ | [mm] | 4·d  | 64  |

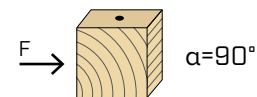
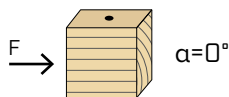
$d = d_1 =$  nominal rod diameter



## MINIMUM DISTANCES FOR SHEAR LOADS



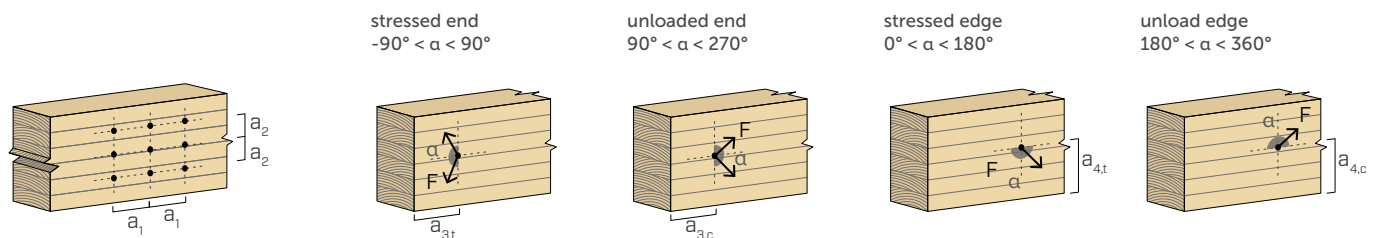
rods inserted **WITH** pre-drilled hole



| $d_1$     | [mm] | 16   | 20  |
|-----------|------|------|-----|
| $a_1$     | [mm] | 5·d  | 80  |
| $a_2$     | [mm] | 3·d  | 48  |
| $a_{3,t}$ | [mm] | 12·d | 192 |
| $a_{3,c}$ | [mm] | 7·d  | 112 |
| $a_{4,t}$ | [mm] | 3·d  | 48  |
| $a_{4,c}$ | [mm] | 3·d  | 48  |

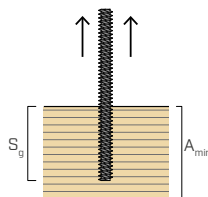
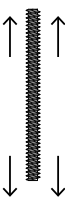
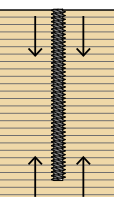
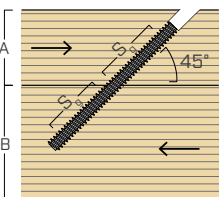
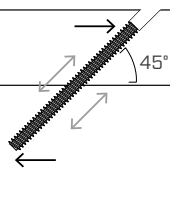
| $d_1$     | [mm] | 16  | 20  |
|-----------|------|-----|-----|
| $a_1$     | [mm] | 4·d | 64  |
| $a_2$     | [mm] | 4·d | 64  |
| $a_{3,t}$ | [mm] | 7·d | 112 |
| $a_{3,c}$ | [mm] | 7·d | 112 |
| $a_{4,t}$ | [mm] | 7·d | 112 |
| $a_{4,c}$ | [mm] | 3·d | 48  |

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

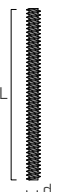
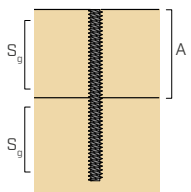
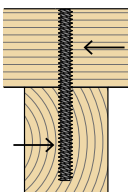


### NOTES

- Minimum distances according to ETA-11/0030.
- The minimum distances for shear-stressed bars are in accordance with EN 1995:2014.
- The minimum distances for axially stressed connectors are independent of the insertion angle of the connector and the angle of the force with respect to the grain.

| TENSION / COMPRESSION                                                             |                                                                                   |                   |                       |                                                                                   |                                                                                   | SLIDING                                                                            |             |                   |                   |                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------|-----------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------|-------------------|-------------------|-------------------------------------------------------------------------------------|
| geometry                                                                          | thread withdrawal<br>$\varepsilon=90^\circ$                                       |                   |                       | steel tension                                                                     | instability<br>$\varepsilon=90^\circ$                                             | timber-to-timber                                                                   |             |                   |                   | steel tension                                                                       |
|  |  |                   |                       |  |  |  |             |                   |                   |  |
| $d_1$<br>[mm]                                                                     | $S_g$<br>[mm]                                                                     | $A_{min}$<br>[mm] | $R_{ax,90,k}$<br>[kN] | $R_{tens,k}$<br>[kN]                                                              | $R_{ki,90,k}$<br>[kN]                                                             | $S_g$<br>[mm]                                                                      | $A$<br>[mm] | $B_{min}$<br>[mm] | $R_{V,k}$<br>[kN] | $R_{tens,45,k}$<br>[kN]                                                             |
| 16                                                                                | 200                                                                               | 210               | 31,08                 | 100                                                                               | 55,16                                                                             | 100                                                                                | 80          | 90                | 10,99             | 70,71                                                                               |
|                                                                                   | 300                                                                               | 310               | 46,62                 |                                                                                   |                                                                                   | 150                                                                                | 115         | 125               | 16,48             |                                                                                     |
|                                                                                   | 400                                                                               | 410               | 62,16                 |                                                                                   |                                                                                   | 200                                                                                | 150         | 160               | 21,98             |                                                                                     |
|                                                                                   | 500                                                                               | 510               | 77,70                 |                                                                                   |                                                                                   | 250                                                                                | 185         | 195               | 27,47             |                                                                                     |
|                                                                                   | 600                                                                               | 610               | 93,25                 |                                                                                   |                                                                                   | 300                                                                                | 220         | 230               | 32,97             |                                                                                     |
|                                                                                   | 700                                                                               | 710               | 108,79                |                                                                                   |                                                                                   | 350                                                                                | 255         | 265               | 38,46             |                                                                                     |
|                                                                                   | 800                                                                               | 810               | 124,33                |                                                                                   |                                                                                   | 400                                                                                | 290         | 300               | 43,96             |                                                                                     |
|                                                                                   | 900                                                                               | 910               | 139,87                |                                                                                   |                                                                                   | 450                                                                                | 325         | 335               | 49,45             |                                                                                     |
|                                                                                   | 1000                                                                              | 1010              | 155,41                |                                                                                   |                                                                                   | 500                                                                                | 360         | 370               | 54,95             |                                                                                     |
|                                                                                   | 1200                                                                              | 1210              | 186,49                |                                                                                   |                                                                                   | 600                                                                                | 430         | 440               | 65,93             |                                                                                     |
| 20                                                                                | 200                                                                               | 210               | 38,85                 | 145                                                                               | 87,46                                                                             | 100                                                                                | 80          | 90                | 13,74             | 102,53                                                                              |
|                                                                                   | 300                                                                               | 310               | 58,28                 |                                                                                   |                                                                                   | 150                                                                                | 115         | 125               | 20,60             |                                                                                     |
|                                                                                   | 400                                                                               | 410               | 77,70                 |                                                                                   |                                                                                   | 200                                                                                | 150         | 160               | 27,47             |                                                                                     |
|                                                                                   | 500                                                                               | 510               | 97,13                 |                                                                                   |                                                                                   | 250                                                                                | 185         | 195               | 34,34             |                                                                                     |
|                                                                                   | 600                                                                               | 610               | 116,56                |                                                                                   |                                                                                   | 300                                                                                | 220         | 230               | 41,21             |                                                                                     |
|                                                                                   | 700                                                                               | 710               | 135,98                |                                                                                   |                                                                                   | 350                                                                                | 255         | 265               | 48,08             |                                                                                     |
|                                                                                   | 800                                                                               | 810               | 155,41                |                                                                                   |                                                                                   | 400                                                                                | 290         | 300               | 54,95             |                                                                                     |
|                                                                                   | 1000                                                                              | 1010              | 194,26                |                                                                                   |                                                                                   | 500                                                                                | 360         | 370               | 68,68             |                                                                                     |
|                                                                                   | 1200                                                                              | 1210              | 233,11                |                                                                                   |                                                                                   | 600                                                                                | 430         | 440               | 82,42             |                                                                                     |
|                                                                                   | 1400                                                                              | 1410              | 271,97                |                                                                                   |                                                                                   | 700                                                                                | 500         | 510               | 96,15             |                                                                                     |

$\varepsilon$  = screw-to-grain angle

| geometry                                                                            | SHEAR                                                                               |                                                                                     |             |                      |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------|----------------------|
|                                                                                     | timber-to-timber<br>$\varepsilon=90^\circ$                                          |                                                                                     |             |                      |
|  |  |  |             |                      |
| $d_1$<br>[mm]                                                                       | $L$<br>[mm]                                                                         | $S_g$<br>[mm]                                                                       | $A$<br>[mm] | $R_{V,90,k}$<br>[kN] |
| 16                                                                                  | 100                                                                                 | 50                                                                                  | 50          | 10,73                |
|                                                                                     | 200                                                                                 | 100                                                                                 | 100         | 18,87                |
|                                                                                     | 300                                                                                 | 150                                                                                 | 150         | 20,81                |
|                                                                                     | 400                                                                                 | 200                                                                                 | 200         | 22,75                |
|                                                                                     | 500                                                                                 | 250                                                                                 | 250         | 24,69                |
|                                                                                     | 600                                                                                 | 300                                                                                 | 300         | 26,64                |
|                                                                                     | $\geq 800$                                                                          | $\geq 400$                                                                          | $\geq 400$  | 29,96                |
|                                                                                     |                                                                                     |                                                                                     |             |                      |
| 20                                                                                  | 100                                                                                 | 50                                                                                  | 50          | 12,89                |
|                                                                                     | 200                                                                                 | 100                                                                                 | 100         | 25,78                |
|                                                                                     | 300                                                                                 | 150                                                                                 | 150         | 28,91                |
|                                                                                     | 400                                                                                 | 200                                                                                 | 200         | 31,34                |
|                                                                                     | 500                                                                                 | 250                                                                                 | 250         | 33,77                |
|                                                                                     | 600                                                                                 | 300                                                                                 | 300         | 36,19                |
|                                                                                     | 800                                                                                 | 400                                                                                 | 400         | 41,05                |
|                                                                                     | $\geq 1000$                                                                         | $\geq 500$                                                                          | $\geq 500$  | 43,25                |

#### NOTES | TIMBER

- The characteristic thread withdrawal strengths were evaluated by considering an angle  $\varepsilon$  of  $90^\circ$  ( $R_{ax,90,k}$ ) between the grains of the timber element and the connector.
- The characteristic sliding strengths were evaluated by considering an angle  $\varepsilon$  of  $45^\circ$  between the grains of the timber element and the connector.
- The characteristic timber-to-timber shear strengths were evaluated considering an angle  $\varepsilon$  of  $90^\circ$  ( $R_{V,90,k}$ ) between the grains of the second element and the connector.
- For the calculation process a timber characteristic density  $\rho_k = 385 \text{ kg/m}^3$  has been considered.  
For different  $\rho_k$  values, the strength values in the table (withdrawal, compression, sliding and shear) can be converted via the  $k_{dens}$  coefficient.

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

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

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

$$R'_{V,90,k} = k_{dens,V} \cdot R_{V,90,k}$$

| $\rho_k$<br>[kg/m <sup>3</sup> ] | 350  | 380  | 385   | 405   | 425   | 430   | 440   |
|----------------------------------|------|------|-------|-------|-------|-------|-------|
| C-GL                             | C24  | C30  | GL24h | GL26h | GL28h | GL30h | GL32h |
| $k_{dens,ax}$                    | 0,92 | 0,98 | 1,00  | 1,04  | 1,08  | 1,09  | 1,11  |
| $k_{dens,ki}$                    | 0,97 | 0,99 | 1,00  | 1,00  | 1,01  | 1,02  | 1,02  |
| $k_{dens,V}$                     | 0,90 | 0,98 | 1,00  | 1,02  | 1,05  | 1,05  | 1,07  |

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

GENERAL PRINCIPLES on page 200.

TENSILE CONNECTION  
CLT - CONCRETE

| geometry               |                          | CLT                    |                             | concrete                 |                             |
|------------------------|--------------------------|------------------------|-----------------------------|--------------------------|-----------------------------|
|                        |                          |                        |                             |                          |                             |
| d <sub>1</sub><br>[mm] | L <sub>min</sub><br>[mm] | S <sub>g</sub><br>[mm] | R <sub>ax,0,k</sub><br>[kN] | l <sub>b,d</sub><br>[mm] | R <sub>ax,C,k</sub><br>[kN] |
| 16                     | 400                      | 240                    | 25,50                       | 150                      | 67,86                       |
|                        | 500                      | 340                    | 34,89                       | 150                      |                             |
|                        | 600                      | 440                    | 44,00                       | 150                      |                             |
|                        | 700                      | 540                    | 52,90                       | 150                      |                             |
|                        | 800                      | 640                    | 61,64                       | 150                      |                             |
|                        | 900                      | 740                    | 70,25                       | 150                      |                             |
|                        | 1000                     | 840                    | 78,74                       | 150                      |                             |
|                        | 1100                     | 940                    | 87,12                       | 150                      |                             |
|                        | 1200                     | 1040                   | 95,42                       | 150                      |                             |
|                        | 1300                     | 1140                   | 100,00                      | 150                      |                             |
|                        | 1400                     | 1240                   | 100,00                      | 150                      |                             |

NOTES | TC FUSION

- Characteristic values according to ETA-22/0806.
- The axial thread withdrawal resistance in the narrow face is valid for minimum CLT thickness  $t_{CLT,min} = 10 \cdot d_1$  and minimum screw pull-through depth  $t_{pen} = 10 \cdot d_1$ . Connectors with shorter lengths than those in the table do not comply with the minimum penetration depth requirements and are not reported.
- A concrete grade of C25/30 was considered in the calculation. For applications with different materials please see ETA-22/0806.
- The tensile design strength of the connector is the lower between the timber-side design strength ( $R_{ax,d}$ ) and the concrete-side design strength ( $R_{ax,C,d}$ ).

$$R_{ax,d} = \min \left\{ \begin{array}{l} \frac{R_{ax,0,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{ax,C,k}}{\gamma_{M,concrete}} \end{array} \right.$$

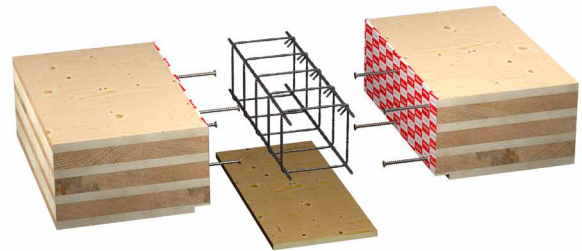
- The concrete element must have adequate reinforcement bars.
- The connectors must be arranged at a maximum distance of 300 mm.

## TC FUSION

### TIMBER-TO-CONCRETE JOINT SYSTEM

The innovation of VGS, VGZ and RTR all-thread connectors for timber-concrete applications.

Find it out on page 270.



## STRUCTURAL VALUES

### GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- The tensile design strength of the connector is the lower between the timber-side design strength ( $R_{ax,d}$ ) and the steel-side design strength ( $R_{tens,d}$ ).

$$R_{ax,d} = \min \left\{ \begin{array}{l} \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{tens,k}}{\gamma_{M2}} \end{array} \right.$$

- The compression design strength of the connector is the lower between the timber-side design strength ( $R_{ax,d}$ ) and the instability design strength ( $R_{ki,d}$ ).

$$R_{ax,d} = \min \left\{ \begin{array}{l} \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{ki,k}}{\gamma_{M1}} \end{array} \right.$$

- The design sliding strength of the joint is either the timber-side design strength ( $R_{V,d}$ ) and the design strength on the steel side projected ( $R_{tens,45,d}$ ), whichever is lower:

$$R_{V,d} = \min \left\{ \begin{array}{l} \frac{R_{V,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{tens,45,k}}{\gamma_{M2}} \end{array} \right.$$

- The design shear strength of the connector is obtained from the characteristic value as follows:

$$R_{V,d} = \frac{R_{V,k} \cdot k_{mod}}{\gamma_M}$$

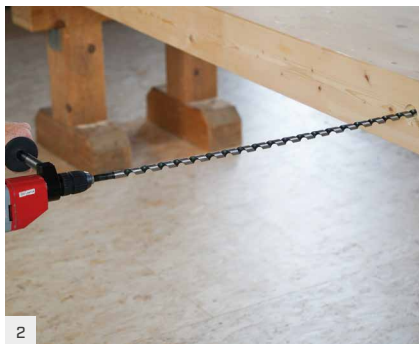
- The coefficients  $\gamma_M$  and  $k_{mod}$  should be taken according to the current regulations used for the calculation.
- For the mechanical resistance values and the geometry of the rods, reference was made to ETA-11/0030.
- Dimensioning and verification of the timber elements must be carried out separately.
- The rods must be positioned in accordance with the minimum distances.
- The characteristic thread withdrawal resistances were evaluated considering a penetration length of  $S_g$  as shown in the table. For intermediate values of  $S_g$  it is possible to linearly interpolate.



## ■ INSTALLATION SUGGESTIONS



For a better finish, it is recommended to drill a hole through BORMAX to accommodate the timber end cap.



Pre-drill the hole inside the timber element, ensuring that it is straight. The use of COLUMN ensures better accuracy.



Cut the RTR threaded rod to the desired length, ensuring that it is less than the depth of the pre-drilling.



Assemble the sleeve (ATCS007 or ATCS008) onto the adapter with safety clutch (DUVSKU). Alternatively, a simple adapter (ATCS2010) can be used.



Insert the sleeve into the threaded rod and the adapter into the screwdriver. We recommend the use of the handle (DUD38SH) for more control and stability when screwing.



Screw up to the length defined in the design. We recommend limiting the insertion moment value to 200 Nm (RTR 16) and 300 Nm (RTR 20).

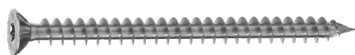


Unscrew the sleeve from the bar.



If provided, insert a TAP cap to conceal the threaded rod and ensure better aesthetic finish and fire strength.

## ■ RELATED PRODUCTS



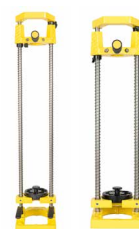
**VGS**  
page 164



**LEWIS**  
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**D 38 RLE**  
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**COLUMN**  
page 411