RTR

STRUCTURAL REINFORCEMENT SYSTEM

UKTA-0836 22/6195

ETA-11/0030

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 N/mm²) 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

DIAMETER [mm]	16 (16 – 20) 20
LENGTH [mm]	2200
SERVICE CLASS	SC1 SC2
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn ELECTRO PLATED electrogalvanized carbon steel

FIELDS OF USE

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

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	pcs
16	**RTR162200**	2200	10
20	**RTR202200**	2200	5

RELATED PRODUCTS

D 38 RLE
4-SPEED DRILL DRIVER

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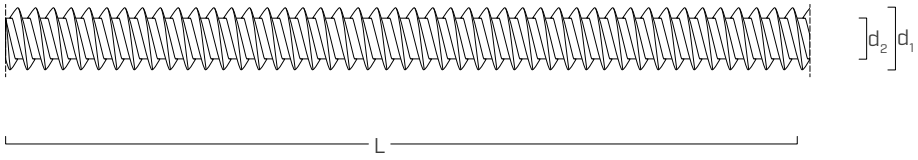
GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d_1	[mm]	**16**	**20**
Thread diameter	d_2	[mm]	12,00	15,00
Pre-drilling hole diameter(1)	$d_{V,S}$	[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/mm²]	640	640

(1) Pre-drilling valid for softwood.

CHARACTERISTIC MECHANICAL PARAMETERS

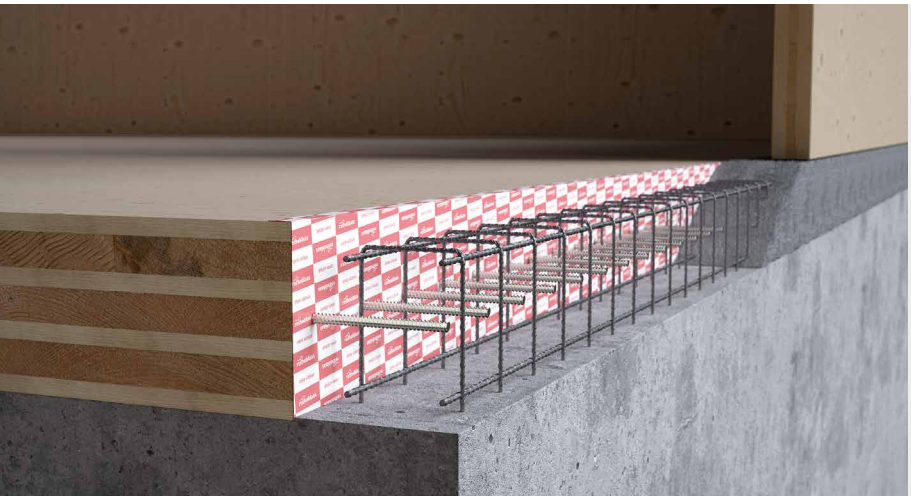
			softwood *(softwood)*
Withdrawal resistance parameter	$f_{ax,k}$	[N/mm²]	9,0
Associated density	ρ_a	[kg/m³]	350
Calculation density	ρ_k	*[kg/m³]*	*≤ 440*

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/mm²]	9,0	-

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



TC FUSION

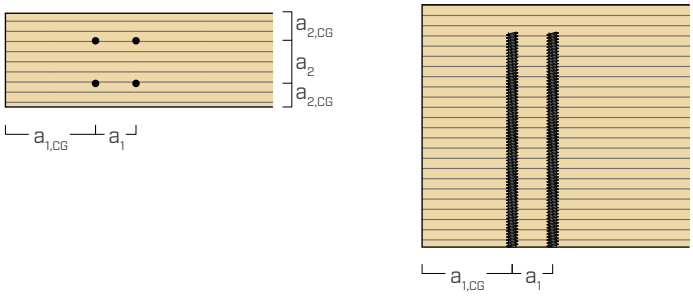
The ETA-22/0806 approval of the TC FUSION system allows the RTR threaded rods to be used together with the reinforcements in the concrete so that the panel floor slabs and the bracing core can be bonded together with a small integration of the casting.

MINIMUM DISTANCES FOR AXIAL STRESSES

rods inserted **WITH pre-drilled hole**

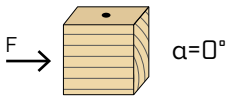
d_1	[mm]		16	20
a_1	[mm]	**5·d**	80	100
a_2	[mm]	**5·d**	80	100
$a_{1,CG}$	[mm]	**10·d**	160	200
$a_{2,CG}$	[mm]	**4·d**	64	80

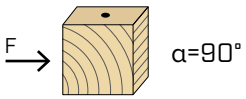
d = d_1 = nominal rod diameter



MINIMUM DISTANCES FOR SHEAR LOADS

rods inserted **WITH pre-drilled hole**

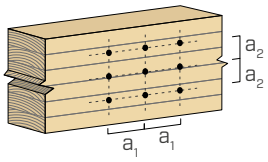




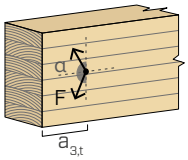
d_1	[mm]		16	20
a_1	[mm]	**5·d**	80	100
a_2	[mm]	**3·d**	48	60
$a_{3,t}$	[mm]	**12·d**	192	240
$a_{3,c}$	[mm]	**7·d**	112	140
$a_{4,t}$	[mm]	**3·d**	48	60
$a_{4,c}$	[mm]	**3·d**	48	60

d_1	[mm]		16	20
a_1	[mm]	**4·d**	64	80
a_2	[mm]	**4·d**	64	80
$a_{3,t}$	[mm]	**7·d**	112	140
$a_{3,c}$	[mm]	**7·d**	112	140
$a_{4,t}$	[mm]	**7·d**	112	140
$a_{4,c}$	[mm]	**3·d**	48	60

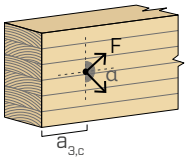
α = load-to-grain angle
d = d_1 = nominal rod diameter



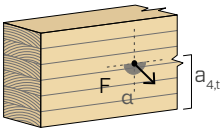
stressed end
-90° < α < 90°



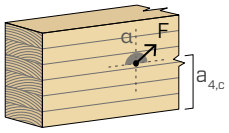
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°

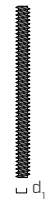
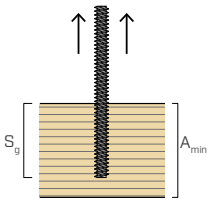
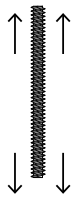
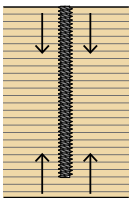
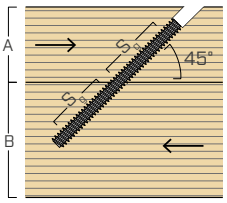
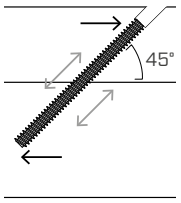


unload edge
180° < α < 360°

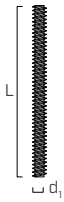
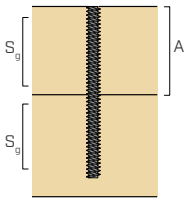
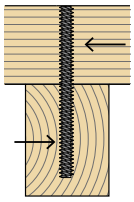


NOTES

- 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 ε=90°			steel tension	instability ε=90°	timber-to-timber			steel tension
									
d_1 [mm]	S_g [mm]	A_{min} [mm]	$R_{ax,90,k}$ [kN]	$R_{tens,k}$ [kN]	$R_{ki,90,k}$ [kN]	S_g [mm]	A [mm]	B_{min} [mm]	$R_{V,k}$ [kN]	$R_{tens,45,k}$ [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	

ε = screw-to-grain angle

	SHEAR			
geometry	timber-to-timber ε=90°			
				
d_1 [mm]	L [mm]	S_g [mm]	A [mm]	$R_{V,90,k}$ [mm]
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
	≥ 800	≥ 400	≥ 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
	≥ 1000	≥ 500	≥ 500	43,25

NOTES | TIMBER

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

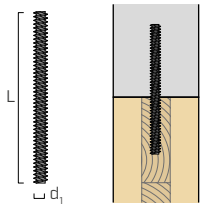
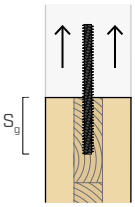
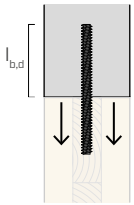
$$R'_{ax,k} = k_{dens,ax} \cdot R_{ax,k}$$
$$R'_{ki,k} = k_{dens,ki} \cdot R_{ki,k}$$
$$R'_{V,k} = k_{dens,ax} \cdot R_{V,k}$$
$$R'_{V,90,k} = k_{dens,V} \cdot R_{V,90,k}$$

ρ_k [kg/m^3]	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_1 [mm]	L_{min} [mm]	S_g [mm]	$R_{ax,0,k}$ [kN]	$l_{b,d}$ [mm]	$R_{ax,C,k}$ [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 ($R_{ax,C,d}$).

$$R_{ax,d} = min \begin{cases} \frac{R_{ax,0,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{ax,C,k}}{\gamma_{M,concrete}} \end{cases}$$

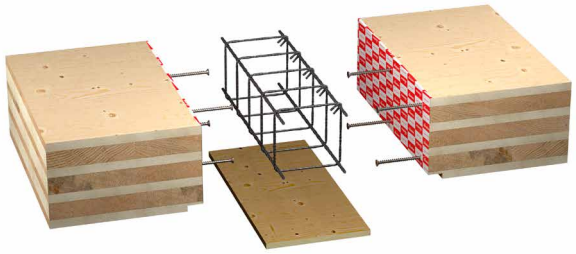
- The concrete element must have adequate reinforcement bars.
- The connectors must be arranged at a maximum distance of 300 mm.

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 ($R_{tens,d}$).

$$R_{ax,d} = min \begin{cases} \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{tens,k}}{\gamma_{M2}} \end{cases}$$

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

$$R_{ax,d} = min \begin{cases} \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{ki,k}}{\gamma_{M1}} \end{cases}$$

- 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:

$$R_{V,d} = min \begin{cases} \frac{R_{V,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{tens,45,k}}{\gamma_{M2}} \end{cases}$$

- 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 γ_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

1

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

2

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

3

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

4

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

5

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.

6

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).

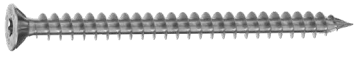
7

Unscrew the sleeve from the bar.

8

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

RELATED PRODUCTS



VGS
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LEWIS
page 414

D 38 RLE
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COLUMN
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