



ZAVOD ZA
GRADBENIŠTVO
SLOVENIJE

SLOVENIAN
NATIONAL BUILDING
AND CIVIL ENGINEERING
INSTITUTE



Member of
www.eota.eu

Dimičeva 12,
1000 Ljubljana, Slovenija

Tel.: +386 (0)1 280 44 72, +386 (0)1-280 45 37

Fax: +386 (0)1 280 44 84

e-mail: info.ta@zag.si

<http://www.zag.si>

European Technical Assessment

ETA-17/0638
of 6. 4. 2020

English version prepared by ZAG

General Part

**Technical Assessment Body issuing the
European Technical Assessment**

ZAG Ljubljana

Trade name of the construction product

TX1 / TX1 A4

**Product family to which the construction
product belongs**

**33: Torque controlled expansion
anchor of sizes M8, M10, M12
and M16 for use in cracked and
non-cracked concrete**

Manufacturer

**AS SYSTEM d.o.o.
Obrtniška ulica 14
3240 Šmarje pri Jelšah
Slovenia
www.as-system.si**

Manufacturing plant

**AS SYSTEM d.o.o.
Obrtniška ulica 14
3240 Šmarje pri Jelšah
Slovenia**

**This European Technical Assessment
contains**

12 pages including 10 annexes, which form
an integral part of the document

This version replaces

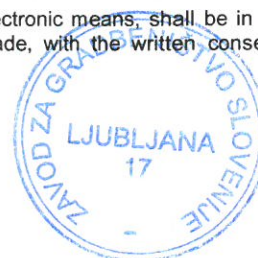
ETA-17/0638 issued on 02.10.2017

**This European Technical Assessment is
issued in accordance with Regulation (EU)
No 305/2011, on the basis of**

EAD 330232-00-0601, edition October 2016

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential Annex(es) referred to above). However, partial reproduction may be made, with the written consent of the issuing Technical Assessment Body. Any partial reproduction has to be identified as such.



Specific Parts

1 Technical description of the product

The TX1 and TX1 A4 in the range of M8, M10, M12 and M16 is an anchor made of galvanised steel (TX1) and stainless steel (TX1 A4), which is placed into a drilled hole and anchored by torque-controlled expansion.

An illustration and description of the anchor are given in Annexes A1 and A2.

2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

The performances given in Chapter 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for this assessment

3.1 Mechanical resistance and stability (BWR 1)

The basic work requirements for mechanical resistance and stability are listed in Annexes C1 and C2.

3.2 Safety in case of fire (BWR 2)

The basic work requirements for safety in case of fire are listed in Annexes C3 and C4.

3.8 General aspects relating to fitness for use

Durability and serviceability are only ensured if specifications of intended use according to Annex B1 are kept.

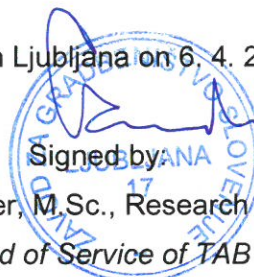
4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the decision 96/582/EC of the European Commission¹ the system of assessment and verification of constancy of performance (see Annex V to regulation (EU) No 305/2011) 1 apply.

5 Technical details necessary for the implementation of the AVCP system

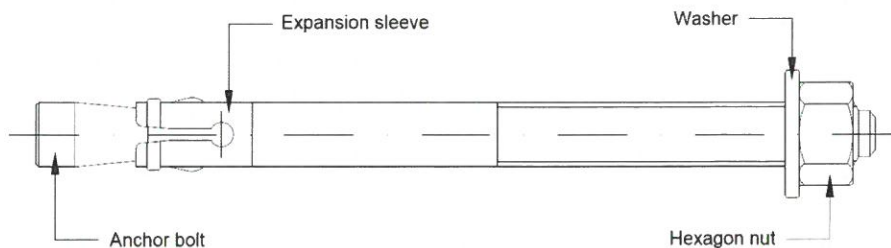
Technical details necessary for the implementation of the AVCP system are laid down in chapter 3 of EAD 330232-00-0601.

Issued in Ljubljana on 6. 4. 2020

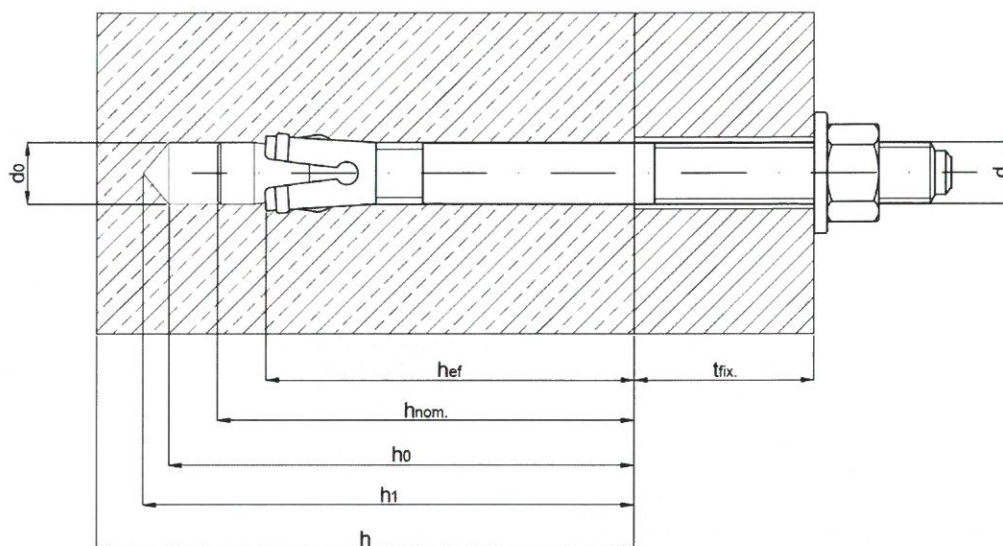


Signed by
Franc Capuder, M.Sc., Research Engineer
Head of Service of TAB

¹ Official Journal of the European Communities L 254 of 8.10.1996



Marking on the sleeve: Product name: (TX1 or TX1 A4)
 Diameter of an anchor: (e.g. M12)



- h_{ef} effective anchorage depth
- h_{nom} anchor embedment depth
- h_0 depth of cylindrical drill hole at shoulder
- h_1 hole depth
- h thickness of concrete member
- d_0 drill hole diameter
- d anchor bolt/thread diameter
- t_{fix} thickness of the fixture



TX1 / TX1 A4	Annex A1
Product description Product and intended use	

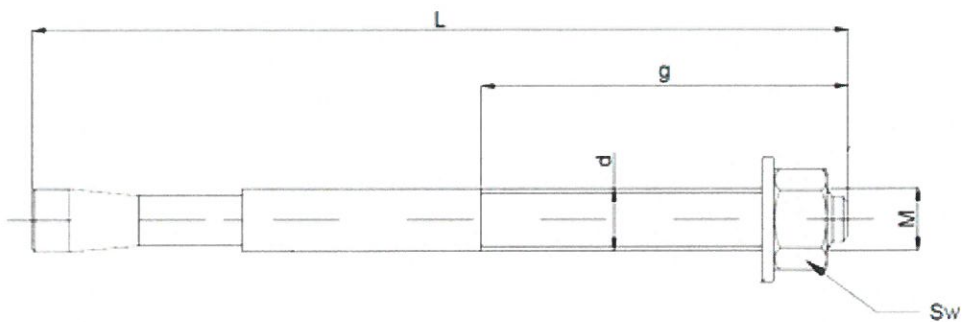


Table A1: Dimensions

		M8	M10	M12	M16
Bolt	L_{min} [mm]	50	60	70	90
	L_{max} [mm]	300	400	400	700
	d [mm]	8	10	12	16
	g_{min} [mm]	10	30	20	40
	g_{max} [mm]	70	100	100	100
Hexagonal nut	S_w [mm]	13	17	19	24



TX1 / TX1 A4

Intended use

Dimensions of an anchor

Annex A2

Table A2: **Materials**

Part	Designation	Material	
		TX1	TX1 A4
1	Bolt	Galvanised steel, thickness of galvanisation $\geq 5\mu\text{m}$	Stainless steel
2	Expansion sleeve	Galvanised steel, thickness of galvanisation $\geq 5\mu\text{m}$	Carbon steel with Zn-Ni coating
3	Washer	Galvanised steel acc. to DIN 125 / EN ISO 7089, DIN 9021 / EN ISO 7093 or DIN 440 / EN ISO 7094	Stainless steel acc. to DIN 125 / EN ISO 7089, DIN 9021 / EN ISO 7093 or DIN 440 / EN ISO 7094
4	Hexagon nut	Galvanised steel acc. to DIN 934	Stainless steel acc. to DIN 934



TX1 / TX1 A4

Product description
Materials

Annex A3

Specifications of intended use

Anchorage subjected to:

- Static and quasi static load.
- Fire exposure.

Base materials:

- Cracked and non-cracked concrete.
- Reinforced and unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according to EN 206:2013+A1:2016.

Use conditions (Environmental conditions):

- The TX1 anchors may be used in concrete subject to dry internal conditions.
- The TX1 A4 anchors may be used in concrete subject to dry internal conditions and also in concrete subject to external atmospheric exposure (including industrial and marine environment), or exposure in permanently damp internal conditions, if no particular aggressive conditions exist.

Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. desulphurization plants or road tunnels where de-icing materials are used).

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Anchorages under static and quasi-static actions are designed in accordance with EOTA TR 055, Edition December 2016 or EN 1992-4:2018.
- For application with resistance under fire exposure the anchorages are designed in accordance with the method given in EOTA TR 020, Edition May 2004.
- Verifiable calculation notes and drawings are prepared taking into account of the load to be anchored. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.).

Installation:

- Anchor installation carried out by appropriately qualified personnel and under supervision of the person responsible for technical matters of the site.
- Use of the anchor only supplied by the manufacturer without exchanging the components of an anchor.
- Anchor installation in accordance with the manufacturer's specification and drawings and using the appropriate tools.
- Checks before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range given and is not lower than that of the concrete to which the characteristic loads apply for.
- Check of concrete being well compacted, e.g. without significant voids.
- Cleaning of the hole of drilling dust.
- Anchor installation ensuring the specified embedment depth.
- Keeping of the edge distance and spacing to the specified values without minus tolerances.
- Positioning of the drill holes without damaging the reinforcement.
- In case of aborted hole, drilling of new hole at a minimum distance of twice the depth of the aborted hole, or smaller distance provided the aborted drill hole is filled with high strength non-shrinkage mortar. No shear or oblique tension loads are allowed in the direction of a not filled aborted hole.
- Application of the torque moment given in Annex B2 using a calibrated torque wrench.

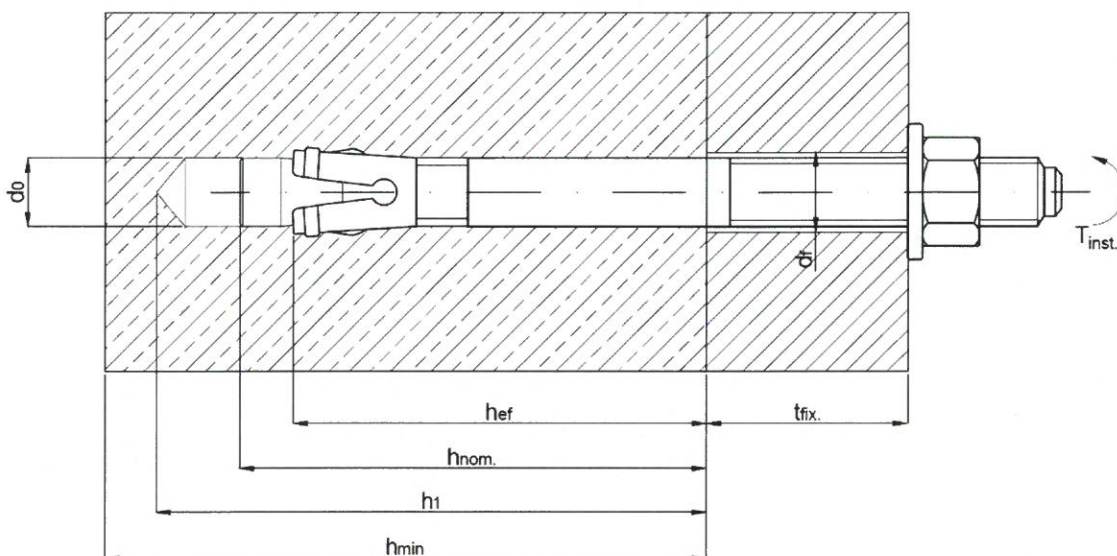
TX1 / TX1 A4

Intended use
Specification

Annex B1

Table B1: Installation data

			M8	M10	M12	M16
Nominal drill hole diameter	d_0	[mm]	8	10	12	16
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,45	12,50	16,5
Diameter of clearance hole of the fixture	d_f	[mm]	9	12	14	18
Depth of drill hole	$h_1 \geq$	[mm]	65	70	90	120
Embedment depth	h_{nom}	[mm]	55	60	80	100
Minimum thickness of the concrete member	h_{min}	[mm]	100	120	140	160
Effective embedment	h_{ef}	[mm]	41	45	62	88
Torque moment	T_{inst}	[Nm]	15	25	65	110
Thickness of the fixture - minimum	$t_{fix,min}$	[mm]	0	0	0	0
Thickness of the fixture - maximum	$t_{fix,max}$	[mm]	245	340	320	600



Non cracked concrete only			M8	M10	M12	M16
Effective anchorage depth	h_{ef}	[mm]	41	45	62	88
Minimum spacing	s_{min}	[mm]	45	60	70	60
Minimum edge distance	c_{min}	[mm]	45	70	85	70

TX1 / TX1 A4

Intended use
Installation data



Annex B2

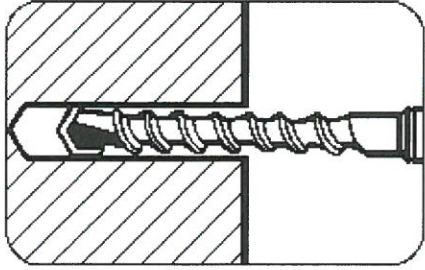
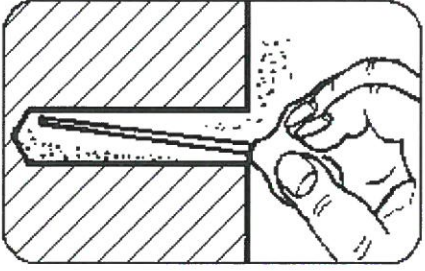
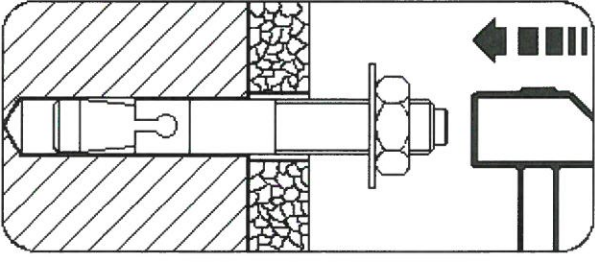
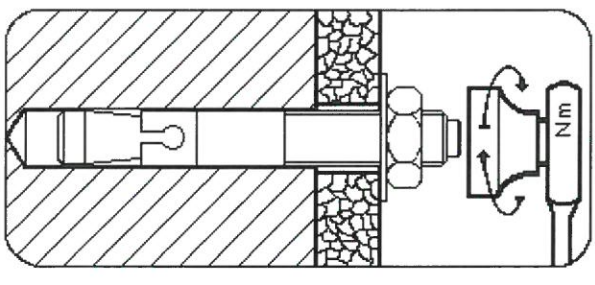
	<p>Drill a hole with until prescribed depth (h_1).</p>
	<p>Clean hole with air pump.</p>
	<p>Set the anchor with hammer ensuring of minimum embedment depth (h_{nom}).</p>
	<p>Apply prescribed installation torque (T_{inst}).</p>
<p>TX1 / TX1 A4</p>	
<p>Intended use Installation instructions</p>	<p>Annex B3</p>



Table C1: Characteristic resistances under tension loads in case of static and quasi-static loading for design according EOTA TR 055 or EN 1992-4

Essential characteristics			Performance				
			M8	M10	M12	M16	
Installation parameters							
d_o	Nominal diameter of drill bit	[mm]	8	10	12	16	
h_{nom}	Anchorage depth	[mm]	55	60	80	100	
h_{ef}	Effective anchorage depth	[mm]	41	45	62	88	
h_{min}	Minimum thickness of concrete member	[mm]	100	120	140	160	
T_{inst}	Torque moment	[Nm]	15	25	65	110	
s_{min}	Minimum spacing	[mm]	45	60	70	60	
c_{min}	Minimum edge distance	[mm]	45	70	85	70	
Tension steel failure mode							
$N_{Rk,s}$	Characteristic tension steel failure	TX1	[kN]	15	22	45	68
		TX1 A4	[kN]	15	25	47	79
$\gamma_{MsN}^{2)}$	Partial safety factor	TX1	[-]	1,4			
		TX1 A4	[-]	1,4			
Pull-out failure mode							
$N_{Rk,p}$	Characteristic pull-out failure in non-cracked concrete	[kN]	/ ¹⁾	11	18	25	
$N_{Rk,p}$	Characteristic pull-out failure in cracked concrete	[kN]	4	6	8	18	
$\gamma_2^{2)}$	Partial safety factor	[-]	1,0				
$\gamma_{Mp}^{3)}$		[-]	1,5				
$s_{cr,N}$	Characteristic spacing	[mm]	3 x h_{ef}				
$c_{cr,N}$	Characteristic edge distance	[mm]	1,5 x h_{ef}				
ψ_c C30/37	Increasing factor for $N_{Rk,p}$	[-]	1,00	1,08	1,22	1,21	
ψ_c C40/50		[-]	1,00	1,14	1,41	1,39	
ψ_c C50/60		[-]	1,00	1,20	1,58	1,55	
Concrete cone failure mode							
k_{cr}	Factor for cracked concrete EN 1992-4-4 §. 7.2.1.4	[-]	7,7				
k_{ucr}	Factor for un-cracked concrete EN 1992-4-4 §. 7.2.1.4	[-]	11,0				
$\gamma_{Mc}^{2)}$	Partial safety factor	[-]	1,5				
Splitting failure mode							
$s_{cr,sp}$	Characteristic spacing	[mm]	3 x h_{ef}				
$c_{cr,sp}$	Characteristic edge distance	[mm]	1,5 x h_{ef}				
$\gamma_{Mc}^{2)}$	Partial safety factor	[-]	1,5				
Displacement under tension load							
Non-cracked concrete C20/25							
N	Service tension load	[kN]	6,2	5,2	8,6	11,9	
δ_{N0}	Short term displacement	[mm]	0,12	0,06	0,05	0,17	
$\delta_{N\infty}$	Long term displacement	[mm]	1,56	1,59	1,73	1,65	
Cracked concrete C20/25							
N	Service tension load	[kN]	1,9	2,9	3,8	8,6	
δ_{N0}	Short term displacement	[mm]	0,83	0,80	0,49	1,40	
$\delta_{N\infty}$	Long term displacement	[mm]	1,56	1,59	1,73	1,65	

¹⁾ The pull-out is not decisive

²⁾ In absence of other national regulations

³⁾ The installation safety factor $\gamma_{Mp} = 1,0$ is included

TX1 / TX1 A4

Design acc. EOTA TR 055 or EN 1992-4

Characteristic resistance under Tension loads – BWR 1



Annex C1

Table C2: **Characteristic resistances under shear loads in case of static and quasi-static loading for design according EOTA TR 055 or CEN/TS 1992-4**

Essential characteristics			Performance				
			M8	M10	M12	M16	
Shear steel failure mode							
$V_{Rk,s}$	Characteristic shear steel failure	TX1	[kN]	9,6	15,4	21,3	37,0
		TX1 A4	[kN]	18,7	28,1	52,0	70,6
$M^{0}_{Rk,s}$	Bending moment characteristic failure	TX1	[Nm]	25	51	92	200
		TX1 A4	[Nm]	26	52	95	233
$\gamma_{Msv}^{1)}$	Partial safety factor	TX1	[-]	1,5			
		TX1 A4	[-]	1,5			
Shear concrete pry-out and edge failure							
k_8	Factor for equations in EN 1992-4 § 7.2.2.4		[-]	1,0		2,0	
l_{ef}	Effective anchorage depth		[mm]	41	45	62	88
d_{nom}	Diameter of anchor		[mm]	8	10	12	16
Displacement under shear load							
V	Service shear load		[kN]	4,6	7,3	10,1	17,6
δ_{v0}	Short term displacement		[mm]	0,85	1,43	1,12	1,35
$\delta_{v\infty}$	Long term displacement		[mm]	1,28	2,15	1,67	2,03

¹⁾ In absence of other national regulations



TX1 / TX1 A4

Design acc. to EOTA TR 055 or EN 1992-4
Characteristic resistance under Shear loads – BWR 1

Annex C2

Table C3: **Characteristic resistance under tension loads in case of fire exposure for design acc. to EOTA TR 020 or EN 1992-4**

Essential characteristics			Performance			
			M8	M10	M12	M16
Tension steel failure mode						
TX1						
$N_{Rk,s,fi,30}$	Duration = 30 minutes	[kN]	0,22	0,48	1,33	2,26
$N_{Rk,s,fi,60}$	Duration = 60 minutes	[kN]	0,20	0,42	1,00	1,70
$N_{Rk,s,fi,90}$	Duration = 90 minutes	[kN]	0,15	0,32	0,86	1,47
$N_{Rk,s,fi,120}$	Duration = 120 minutes	[kN]	0,11	0,26	0,66	1,13
TX1 A4						
$N_{Rk,s,fi,30}$	Duration = 30 minutes	[kN]	0,44	0,81	2,00	3,39
$N_{Rk,s,fi,60}$	Duration = 60 minutes	[kN]	0,35	0,65	1,33	2,26
$N_{Rk,s,fi,90}$	Duration = 90 minutes	[kN]	0,26	0,52	1,07	1,81
$N_{Rk,s,fi,120}$	Duration = 120 minutes	[kN]	0,22	0,31	0,93	1,58
Pull-out failure mode						
$N_{Rk,p,fi,30}$	Duration = 30 minutes	[kN]	1,00	1,50	2,00	4,5
$N_{Rk,p,fi,60}$	Duration = 60 minutes	[kN]	1,00	1,50	2,00	4,5
$N_{Rk,p,fi,90}$	Duration = 90 minutes	[kN]	1,00	1,50	2,00	4,5
$N_{Rk,p,fi,120}$	Duration = 120 minutes	[kN]	0,80	1,20	1,60	3,6
Concrete cone failure mode¹⁾						
$N_{Rk,c,fi,30}$	Duration = 30 minutes	[kN]	1,85	2,34	5,21	12,51
$N_{Rk,c,fi,60}$	Duration = 60 minutes	[kN]	1,85	2,34	5,21	12,51
$N_{Rk,c,fi,90}$	Duration = 90 minutes	[kN]	1,85	2,34	5,21	12,51
$N_{Rk,c,fi,120}$	Duration = 120 minutes	[kN]	1,48	1,87	4,17	10,01
$s_{cr,N}$	Characteristic spacing	[mm]	4 x h_{ef}			
$c_{cr,N}$	Characteristic edge distance	[mm]	2 x h_{ef}			
s_{min}	Minimum spacing	[mm]	45	60	70	60
c_{min}	Minimum edge distance	[mm]	$c_{min} = 2 h_{ef}$, if fire attack from more than one side, the edge distance of the anchor has to be ≥ 300 mm and $\geq 2 h_{ef}$			

¹⁾ As a rule, splitting failure can be neglected when cracked concrete and reinforcement is assumed

Under fire exposure usually cracked concrete is assumed. The design equations are given in EOTA TR 020 § 2.2.1.

In the absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended.



TX1 / TX1 A4

Design according to EOTA TR 020

Characteristic tension resistance under fire exposure -
BWR 2

Annex C3

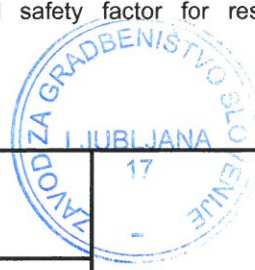
Table C4: Characteristic resistance under shear loads in case of fire exposure for design acc. to EOTA TR 020 or EN 1992-4

Essential characteristics			Performance			
			M8	M10	M12	M16
Shear steel failure without lever arm						
TX1						
$V_{Rk,s,fi,30}$	Duration = 30 minutes	[kN]	0,22	0,48	1,33	2,26
$V_{Rk,s,fi,60}$	Duration = 60 minutes	[kN]	0,20	0,42	1,00	1,70
$V_{Rk,s,fi,90}$	Duration = 90 minutes	[kN]	0,15	0,32	0,86	1,47
$V_{Rk,s,fi,120}$	Duration = 120 minutes	[kN]	0,11	0,26	0,66	1,13
TX1 A4						
$V_{Rk,s,fi,30}$	Duration = 30 minutes	[kN]	0,44	0,81	2,00	3,39
$V_{Rk,s,fi,60}$	Duration = 60 minutes	[kN]	0,35	0,65	1,33	2,26
$V_{Rk,s,fi,90}$	Duration = 90 minutes	[kN]	0,26	0,52	1,07	1,81
$V_{Rk,s,fi,120}$	Duration = 120 minutes	[kN]	0,22	0,31	0,93	1,58
Shear steel failure with lever arm						
TX1						
$M^0_{Rk,s,fi,30}$	Duration = 30 minutes	[Nm]	0,37	1,12	2,71	6,66
$M^0_{Rk,s,fi,60}$	Duration = 60 minutes	[Nm]	0,34	0,97	2,04	5,00
$M^0_{Rk,s,fi,90}$	Duration = 90 minutes	[Nm]	0,26	0,75	1,76	4,33
$M^0_{Rk,s,fi,120}$	Duration = 120 minutes	[Nm]	0,19	0,60	0,68	3,33
TX1 A4						
$M^0_{Rk,s,fi,30}$	Duration = 30 minutes	[Nm]	0,75	1,87	4,07	10,00
$M^0_{Rk,s,fi,60}$	Duration = 60 minutes	[Nm]	0,60	1,50	3,39	8,32
$M^0_{Rk,s,fi,90}$	Duration = 90 minutes	[Nm]	0,45	1,20	2,71	6,66
$M^0_{Rk,s,fi,120}$	Duration = 120 minutes	[Nm]	0,37	1,05	2,17	5,33
Shear concrete pry-out failure						
k_8		[-]	1,0		2,0	
$V_{Rk,cp,fi,30}$	Duration = 30 minutes	[kN]	1,85	2,34	10,42	25,02
$V_{Rk,cp,fi,60}$	Duration = 60 minutes	[kN]	1,85	2,34	10,42	25,02
$V_{Rk,cp,fi,90}$	Duration = 90 minutes	[kN]	1,85	2,34	10,42	25,02
$V_{Rk,cp,fi,120}$	Duration = 120 minutes	[kN]	1,48	1,87	8,34	20,02
Concrete edge failure						
The characteristic resistance $V^0_{Rk,c,fi}$ in concrete C 20/25 to C50/60 is determined by: $V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c} (\leq R90)$ and $V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c} (R120)$ with $V^0_{Rk,c}$, which is initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature						

Under fire exposure usually cracked concrete is assumed. The design equations are given in EOTA TR 020 § 2.2.1.

EOTA TR 020 covers design for fire exposure from one side. For fire attack from more than one side the edge distance must be increased to $c_{min} \geq 300$ mm and $\geq 2 \times h_{ef}$.

In the absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended



TX1 / TX1 A4

Design according to EOTA TR 020

Characteristic shear resistance under fire exposure - BWR 2

Annex C4