CSTB
le futur en construction

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European Technical Assessment

ETA-16/0574 dated 01/08/2016

English translation prepared by CSTB - Original version in French language

General Part

Nom commercial *Trade name*	**Throughbolt TX**
Famille de produit *Product family*	**Cheville métallique à expansion par vissage à couple contrôlé, de fixation dans le béton fissuré et non fissuré diamètres M8, M10, M12 et M16** ***Torque-controlled expansion anchor for use in cracked and uncracked concrete: sizes M8, M10, M12 and M16***
Titulaire *Manufacturer*	Trutek Fasteners Polska Sp. z o.o. Al. Krakowska 55, Sekocin Nowy 05-090 Raszyn Poland
Usine de fabrication *Manufacturing plants*	Trutek Production Plant 1
Cette evaluation contient: *This Assessment contains*	16 pages incluant 12 annexes qui font partie intégrante de cette évaluation 16 *pages including 12 annexes which form an integral part of this assessment*
Base de l'ETE *Basis of ETA*	ETAG 001, Version Avril 2013, utilisée en tant que EAD *ETAG 001, Edition April 2013 used as EAD*

Specific Part

1 Technical description of the product

The Throughbolt TX anchor is an anchor made of zinc electroplated steel which is placed into a drilled hole and anchored by torque-controlled expansion.

The anchor is placed into a drilled hole and anchored by torque-controlled expansion.

The illustration and the description of the product are given in Annexes A.

2 Specification of the intended use

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annexes 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 producer, 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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	**Performance**
Characteristic tension resistance acc. ETAG001, Annex C	See Annex C1
Characteristic shear resistance acc. ETAG001, Annex C	See Annex C2
Characteristic tension resistance acc. CEN/TS 1992-4	See Annex C5
Characteristic shear resistance acc. CEN/TS 1992-4	See Annex C6
Displacements	See Annex C9

3.2 Safety in case of fire (BWR 2)

Essential characteristic	**Performance**
Reaction to fire	Anchorages satisfy requirements for Class A1
Characteristic tension resistance under fire acc. ETAG001, Annex C	See Annex C3
Characteristic shear resistance under fire acc. ETAG001, Annex C	See Annex C4
Characteristic tension resistance under fire acc. CEN/TS 1992-4	See Annex C7
Characteristic shear resistance under fire acc. CEN/TS 1992-4	See Annex C8

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances contained in this European technical approval, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3.4 Safety in use (BWR 4)

For Basic requirement Safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability.

3.5 Protection against noise (BWR 5)

Not relevant.

3.6 Energy economy and heat retention (BWR 6)

Not relevant.

3.7 Sustainable use of natural resources ((BWR 7)

For the sustainable use of natural resources no performance was determined for this product.

3.8 General aspects relating to fitness for use

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

4 Assessment and verification of constancy of performance (AVCP)

According to the Decision 96/582/EC of the European Commission[1], as amended, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table apply.

Product	Intended use	Level or class	System
Metal anchors for use in concrete	For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the works) or heavy units	—	1

5 Technical details necessary for the implementation of the AVCP system

Technical details necessary for the implementation of the Assessment and verification of constancy of performance (AVCP) system are laid down in the control plan deposited at Centre Scientifique et Technique du Bâtiment.

The manufacturer shall, on the basis of a contract, involve a notified body approved in the field of anchors for issuing the certificate of conformity CE based on the control plan.

The original French version is signed by

Charles Baloche
Technical Director

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1 Official Journal of the European Communities L 254 of 08.10.1996

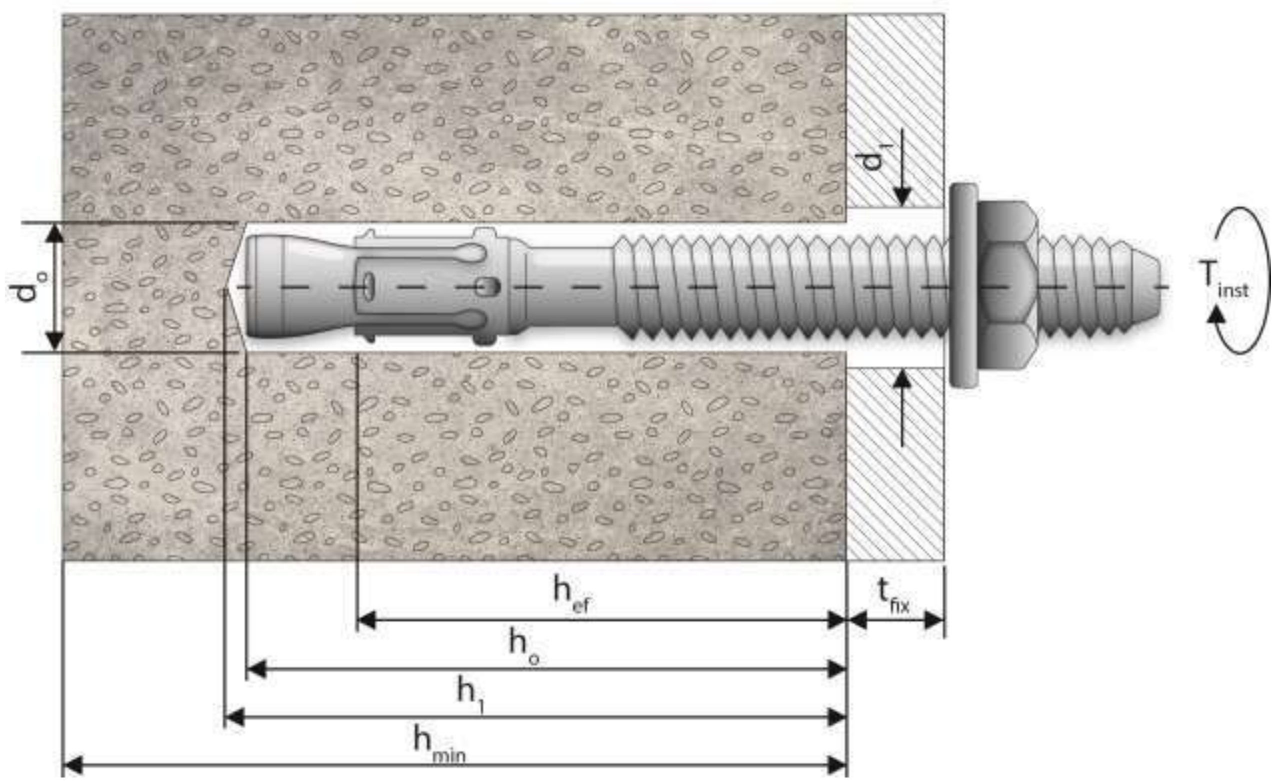
Hex head version:

Marking on the bolt: TX MX / L 

followed by MX/L where

MX = thread diameter
L = total lengh

Intended use:



Intended use:

Use in cracked or uncracked concrete in dry internal conditions

Throughbolt TX	Annex A1
Product descripion Installation conditions	

Different parts of the anchor:

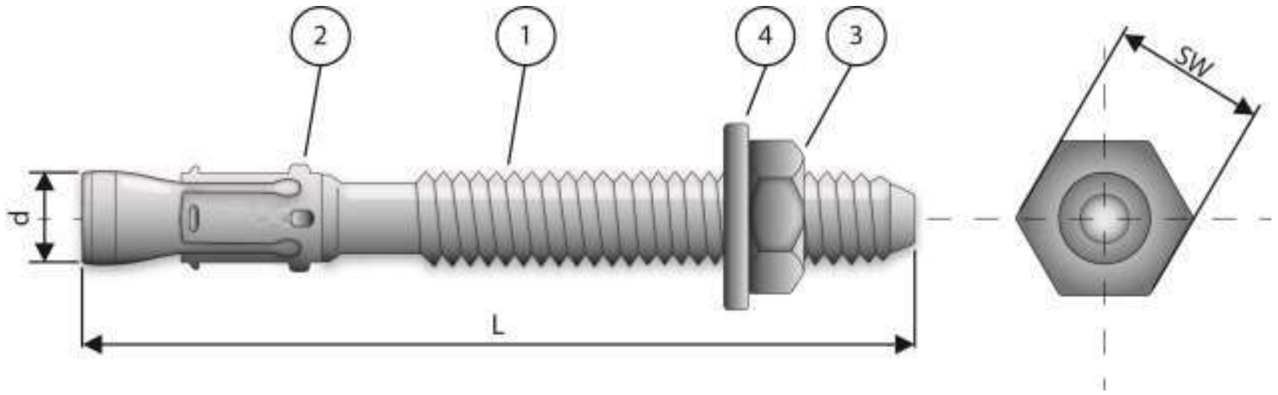


Table 1: Materials

Part	Designation	Material	Protection
1	Thread bolt	Coldform steel, grade C-1035	Zinc plated 5 µm
2	Expansion clip	Stainless steel	-
3	Washer	DIN 125 or EN ISO 7089 DIN 9021 or DIN 440 or D IN EN ISO 7093	Zinc plated
4	Hexagonal nut	Property class 8 acc. To DIN 267-4	Zinc plated

Specifications of intended use

Anchorages subject to:
- Static, quasi-static and fire.

Base materials:
- Cracked concrete and non-cracked concrete
- Reinforced or unreinforced normal weight concrete of strength classes C 20/25 at least to C50/60 at most according to EN 206: 2000-12.

Use conditions (Environmental conditions):
- Structures subject to dry internal conditions.

Design:
- The anchorages are designed in accordance with the ETAG001 Annex C “Design Method for Anchorages” or CEN/TS 1992-4-4 " Design of fastenings for use in concrete” under the responsibility of an engineer experienced in anchorages and concrete work.
- For application with resistance under fire exposure the anchorages are designed in accordance with method given in TR020 “Evaluation of Anchorage in Concrete concerning Resistance to Fire”.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings.

Installation:
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor.
- Anchor installation in accordance with the manufacturer’s specifications and drawings and using the appropriate tools.
- Effective anchorage depth, edge distances and spacing not less than the specified values without minus tolerances.
- Hole drilling by hammer drill.
- Cleaning of the hole of drilling dust.
- Application of specified torque moment using a calibrated torque wrench.
- 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 mortar and no shear or oblique tension loads in the direction of aborted hole.

Table 2: Anchor dimensions

				M8	M10	M12	M16
Length of the anchor	Min.	L	[mm]	60	85	90	115
	Max.		[mm]	240	220	220	220
Fixture thickness	Min.	t_{fix}	[mm]	1	1	1	1
	Max.		[mm]	185	140	130	100
Length expansion sleeve		l_{clip}	[mm]	14	18	22	26
Width torque wrench		SW	[mm]	13	17	19	24

Table 3: Installation data

			M8	M10	M12	M16
Drill hole diameter	d_{cut}	[mm]	≤ 8,45	≤ 10,45	≤ 12,5	≤ 16,5
Drill hole depth	h_1	[mm]	55	75	75	100
Embedment depth	h_{ef}	[mm]	40	60	60	80
Installation torque	T_{inst}	[Nm]	30	50	70	130
Diameter through hole fixture	d_f	[mm]	9	12	14	18
Min. member thickness	h_{min}	[mm]	100	120	120	160
Minimum edge distance	c_{min}	[mm]	65	60	80	85
Minimum spacing	s_{min}	[mm]	65	150	80	85

Table 4: Characteristic values for tension loads in case of static and quasi static loading for design method A acc. ETAG001, Annex C

				M8	M10	M12	M16
Steel failure							
Char. resistance		$N_{Rk,s}$	[kN]	22,2	31,6	43,4	75,4
Partial safety factor		γ_{Ms} [1)]	[-]	1,88	1,88	1,88	1,88
Pullout failure $N_{Rk,p} = \Psi_c \times N^0_{Rk,p}$							
Char. resistance in concrete C20/25	cracked	$N^0_{Rk,p}$	[kN]	3	9	12	12
	non-cracked	$N^0_{Rk,p}$	[kN]	6	12	12	35
Partial safety factor for cracked or non-cracked concrete		γ_{Mp} [1)]	[-]	1,8 [3)]	1,8 [3)]	2,1 [2)]	2,1 [2)]
Increasing factor for N_{RK}	concrete C30/37	Ψ_c	[-]	1,22	1,22	1,22	1,22
	concrete C40/50		[-]	1,41	1,41	1,41	1,41
	concrete C50/60		[-]	1,55	1,55	1,55	1,55
Concrete cone failure and splitting failure							
Effective embedment depth		h_{ef}	[mm]	40	60	60	80
Partial safety factor for craked or non-cracked concrete		$\gamma_{Mc}=\gamma_{Msp}$ [1)]	[-]	1,8 [3)]	1,8 [3)]	2,1 [2)]	2,1 [2)]
Increasing factor for N_{RK}	concrete C30/37	Ψ_c	[-]	1,22	1,22	1,22	1,22
	concrete C40/50		[-]	1,41	1,41	1,41	1,41
	concrete C50/60		[-]	1,55	1,55	1,55	1,55
Char. spacing	concrete cone failure	$s_{cr,N}$	[mm]	120	180	180	240
	splitting failure	$s_{cr,sp}$	[mm]	200	300	360	400
Char. edge distance	concrete cone failure	$c_{cr,N}$	[mm]	60	90	90	120
	splitting failure	$c_{cr,sp}$	[mm]	100	150	180	200

[1)] In absence of other national regulations
[2)] The value contains an installation safety factor γ_2= 1.4
[3)] The value contains an installation safety factor γ_2= 1.2

Table 5: Characteristic values for shear loads in case of static and quasi static loading for design method A acc. ETAG001, Annex C

			M8	M10	M12	M16
Steel failure without lever arm						
Char. resistance	$V_{Rk,s}$	[kN]	8,1	17,6	24,7	45,9
Partial safety factor	γ_{Ms} [1)]	[-]	1,25	1,25	1,25	1,25
Steel failure with lever arm						
Char. bending resistance	$M^0_{Rk,s}$	[Nm]	22,8	45,5	76,6	194,8
Partial safety factor	γ_{Ms} [1)]	[-]	1,25	1,25	1,25	1,25
Concrete pry-out failure						
Factor in equation (5.6) of ETAG Annex C, § 5.2.3.3	k	[-]	1,0	2,0	2,0	2,0
Partial safety factor	γ_{Mc} [1)]	[-]	1,5	1,5	1,5	1,5
Concrete edge failure						
Effective length of anchor under shear loading	l_f	[mm]	40	60	60	80
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16
Partial safety factor	γ_{Mc} [1)]	[-]	1,5	1,5	1,5	1,5

[1)] In absence of other national regulations

Table 6: Characteristic tension resistance in cracked and non-cracked concrete under fire exposure for design method A acc. ETAG001, Annex C

			M8	M10	M12	M16
Steel failure						
Characteristic resistance	R30 $N_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60 $N_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90 $N_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120 $N_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Pullout failure (cracked and non-cracked concrete)						
Char. resistance in concrete ≥ C20/25	R30 $N_{Rk,p,fi}$	[kN]	0,8	2,3	3,0	4,0
	R60 $N_{Rk,p,fi}$	[kN]	0,8	2,3	3,0	4,0
	R90 $N_{Rk,p,fi}$	[kN]	0,8	2,3	3,0	4,0
	R120 $N_{Rk,p,fi}$	[kN]	0,6	1,8	2,4	3,2
Concrete cone and splitting failure[2] (cracked and non-cracked concrete)						
Char. resistance in concrete ≥ C20/25	R30 $N^0_{Rk,c,fi}$	[kN]	1,8	5,0	5,0	10,3
	R60 $N^0_{Rk,c,fi}$	[kN]	1,8	5,0	5,0	10,3
	R90 $N^0_{Rk,c,fi}$	[kN]	1,8	5,0	5,0	10,3
	R120 $N^0_{Rk,c,fi}$	[kN]	1,5	4,0	4,0	8,2
Characteristic spacing	$s_{cr,N,fi}$	[mm]	160	240	240	320
Characteristic edge distance	$c_{cr,N,fi}$	[mm]	80	120	120	160

[1] Design under fire exposure is performed according to the design method given in TR 020. Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020, Section 2.2.1.

[2] As a rule, splitting failure can be neglected when cracked concrete and reinforcement is assumed.

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 $\geq 2 \cdot h_{ef}$.

Table 7: Characteristic shear resistance in cracked and non-cracked concrete under fire exposure for design method A acc. ETAG001, Annex C

			M8	M10	M12	M16
Steel failure without lever arm						
Characteristic resistance	R30 $V_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60 $V_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90 $V_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120 $V_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Steel failure with lever arm						
Characteristic bending moment	R30 $M^0_{Rk,s,fi}$	[Nm]	0,4	1,1	2,6	6,7
	R60 $M^0_{Rk,s,fi}$	[Nm]	0,3	1,0	2,0	5,0
	R90 $M^0_{Rk,s,fi}$	[Nm]	0,3	0,7	1,7	4,3
	R120 $M^0_{Rk,s,fi}$	[Nm]	0,2	0,6	1,3	3,3
Concrete pry-out failure						
Factor in equation (5.6) of ETAG Annex C, § 5.2.3.3	k	[-]	1,0	2,0	2,0	2,0
Characteristic resistance	R30 $V_{Rk,cp,fi}$	[kN]	1,8	10,0	10,0	20,6
	R60 $V_{Rk, cp,fi}$	[kN]	1,8	10,0	10,0	20,6
	R90 $V_{Rk, cp,fi}$	[kN]	1,8	10,0	10,0	20,6
	R120 $V_{Rk, cp,fi}$	[kN]	1,5	8,0	8,0	16,5
Concrete edge failure						
Eff. length of anchor under shear loading	l_f	[mm]	40	60	60	80
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16

[1] Design under fire exposure is performed according to the design method given in TR 020. Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020, Section 2.2.2.

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 $\geq 2 \cdot h_{ef}$.

Table 8: Characteristic values for tension loads in case of static and quasi static loading for design design method A acc. CEN/TS 1992-4

				M8	M10	M12	M16
Steel failure							
Char. resistance		$N_{Rk,s}$	[kN]	22,2	31,6	43,4	75,4
Partial safety factor		γ_{Ms} 1)	[-]	1,88	1,88	1,88	1,88
Pullout failure $N_{Rk,p} = \Psi_c \times N^0_{Rk,p}$							
Char. resistance in concrete C20/25	cracked	$N^0_{Rk,p}$	[kN]	3	9	12	12
	non-cracked	$N^0_{Rk,p}$	[kN]	6	12	12	35
Partial safety factor for cracked or non-cracked concrete		γ_{Mp} 1)	[-]	1,8 3)	1,8 3)	2,1 2)	2,1 2)
Increasing factor for $N_{RK,p}$	concrete C30/37	Ψ_c	[-]	1,22	1,22	1,22	1,22
	concrete C40/50		[-]	1,41	1,41	1,41	1,41
	concrete C50/60		[-]	1,55	1,55	1,55	1,55
Concrete cone failure and splitting failure							
Effective embedment depth		h_{ef}	[mm]	40	60	60	80
Factor for cracked concrete		k_{cr}	[-]	7,2	7,2	7,2	7,2
Factor for non cracked concrete		k_{ucr}	[-]	10,1	10,1	10,1	10,1
Partial safety factor		$\gamma_{Mc}=\gamma_{Msp}$ 1)	[-]	1,8 3)	1,8 3)	2,1 2)	2,1 2)
Char. spacing	concrete cone failure	$s_{cr,N}$	[mm]	120	180	180	240
	splitting failure	$s_{cr,sp}$	[mm]	200	300	360	400
Char. edge distance	concrete cone failure	$c_{cr,N}$	[mm]	60	90	90	120
	splitting failure	$c_{cr,sp}$	[mm]	100	150	180	200

1) In absence of other national regulations
2) The value contains an installation safety factor $\gamma_2 = 1.4$
3) The value contains an installation safety factor $\gamma_2 = 1.2$

Table 9: Characteristic values for shear loads in case of static and quasi static loading for design design method A acc. CEN/TS 1992-4

			M8	**M10**	**M12**	**M16**
Steel failure without lever arm						
Char. resistance	$V_{Rk,s}$	[kN]	8,1	17,6	24,7	45,9
Factor considering ductility	k_2	[-]	0,8	0,8	0,8	0,8
Partial safety factor	γ_{Ms} [1)]	[-]	1,25	1,25	1,25	1,25
Steel failure with lever arm						
Char. bending moment	$M^0_{Rk,s}$	[Nm]	22,8	45,5	76,6	194,8
Partial safety factor	γ_{Ms} [1)]	[-]	1,25	1,25	1,25	1,25
Concrete pry-out failure						
Factor in equation (16) of CEN/TS 1992-4-4, § 6.2.2.3	k_3	[-]	1,0	2,0	2,0	2,0
Partial safety factor	γ_{Mc} [1)]	[-]	1,5	1,5	1,5	1,5
Concrete edge failure						
Effective length of anchor under shear loading	l_f	[mm]	40	60	60	80
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16
Partial safety factor	γ_{Mc} [1)]	[-]	1,5	1,5	1,5	1,5

[1)] In absence of other national regulations

Table 10: Characteristic tension resistance in cracked and non-cracked concrete under fire exposure for design method A acc. CEN/TS 1992-4

			M8	M10	M12	M16
Steel failure						
Characteristic resistance	R30 $N_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60 $N_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90 $N_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120 $N_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Pullout failure (cracked and non-cracked concrete)						
Char. resistance in concrete ≥ C20/25	R30 $N_{Rk,p,fi}$	[kN]	0,8	2,3	3,0	4,0
	R60 $N_{Rk,p,fi}$	[kN]	0,8	2,3	3,0	4,0
	R90 $N_{Rk,p,fi}$	[kN]	0,8	2,3	3,0	4,0
	R120 $N_{Rk,p,fi}$	[kN]	0,6	1,8	2,4	3,2
Concrete cone and splitting failure [2] (cracked and non-cracked concrete)						
Char. resistance in concrete ≥ C20/25	R30 $N^0_{Rk,c,fi}$	[kN]	1,8	5,0	5,0	10,3
	R60 $N^0_{Rk,c,fi}$	[kN]	1,8	5,0	5,0	10,3
	R90 $N^0_{Rk,c,fi}$	[kN]	1,8	5,0	5,0	10,3
	R120 $N^0_{Rk,c,fi}$	[kN]	1,5	4,0	4,0	8,2
Characteristic spacing	$s_{cr,N,fi}$	[mm]	160	240	240	320
Characteristic edge distance	$c_{cr,N,fi}$	[mm]	80	120	120	160

[1] Design under fire exposure is performed according to the design method given in TR 020. Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020, Section 2.2.1.

[2] As a rule, splitting failure can be neglected when cracked concrete and reinforcement is assumed.

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 $\geq 2 \cdot h_{ef}$.

Table 11: Characteristic shear resistance in cracked and non-cracked concrete under fire exposure for design method A acc. CEN/TS 1992-4

			M8	M10	M12	M16
Steel failure without lever arm						
Characteristic resistance	R30 $V_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60 $V_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90 $V_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120 $V_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Steel failure with lever arm						
Characteristic bending moment	R30 $M^0_{Rk,s,fi}$	[Nm]	0,4	1,1	2,6	6,7
	R60 $M^0_{Rk,s,fi}$	[Nm]	0,3	1,0	2,0	5,0
	R90 $M^0_{Rk,s,fi}$	[Nm]	0,3	0,7	1,7	4,3
	R120 $M^0_{Rk,s,fi}$	[Nm]	0,2	0,6	1,3	3,3
Concrete pry-out failure						
Factor in equation (16) of CEN/TS 1992-4-4, § 6.2.2.3	k_3	[-]	1,0	2,0	2,0	2,0
Characteristic resistance	R30 $V_{Rk,cp,fi}$	[kN]	1,8	10,0	10,0	20,6
	R60 $V_{Rk, cp,fi}$	[kN]	1,8	10,0	10,0	20,6
	R90 $V_{Rk, cp,fi}$	[kN]	1,8	10,0	10,0	20,6
	R120 $V_{Rk, cp,fi}$	[kN]	1,5	8,0	8,0	16,5
Concrete edge failure						
Eff. length of anchor under shear loading	l_f	[mm]	40	60	60	80
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16

[1] Design under fire exposure is performed according to the design method given in TR 020. Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020, Section 2.2.2.

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 $\geq 2 \cdot h_{ef}$.

Table 12: Displacements under tension loading

			M8	M10	M12	M16
Tension load in non-cracked concrete C20/25 [kN]			2,38	4,76	5,44	11,90
Displacement	δ_{N0}	[mm]	0,05	0,10	0,06	0,30
	$\delta_{N\infty}$	[mm]	0,65	1,17	1,53	0,65
Tension load in non-cracked concrete C50/60 [kN]			3,69	9,92	10,20	18,45
Displacement	δ_{N0}	[mm]	0,05	0,24	0,10	0,10
	$\delta_{N\infty}$	[mm]	0,65	1,17	1,53	0,65
Tension load in cracked concrete C20/25 [kN]			1,19	4,76	4,08	4,08
Displacement	δ_{N0}	[mm]	0,05	0,83	1,04	0,40
	$\delta_{N\infty}$	[mm]	1,15	1,17	1,53	1,14
Tension load in cracked concrete C50/60 [kN]			1,85	4,76	10,20	6,33
Displacement	δ_{N0}	[mm]	2,95	0,94	1,89	3,43
	$\delta_{N\infty}$	[mm]	2,95	1,17	1,53	3,43

Tableau 13: Displacements under shear loading

			M8	M10	M12	M16
Shear load in cracked and non-cracked concrete C20/25 to C50/60		**[kN]**	4,63	9,14	9,52	26,23
Displacement	δ_{V0}	[mm]	5,50	5,26	5,84	3,60
	$\delta_{V\infty}$	[mm]	8,25	7,89	8,76	5,40

Additional displacement due to anular gap between anchor and fixture is to be taken into account.