... eine starke Verbindung

DECLARAÇÃO DE DESEMPENHO

DoP N.o: **MKT-2.1-400_pt**

✧ **Código de identificação único do produto-tipo:** **Sistema de injecção VME**

✧ **Utilização(ões) prevista(s):** Sistema de injeção para ancoragem em concreto não fissurado,veja o Anexo/Annex B

✧ **Fabricante:** MKT Metall-Kunststoff-Technik GmbH & Co.KG
Auf dem Immel 2
67685 Weilerbach

✧ **Sistema(s) de avaliação e verificação da regularidade do desempenho (AVCP):** 1

✧ **Documento de Avaliação Europeu** **ETAG 001-5**
Avaliação Técnica Europeia : **ETA-13/0773, 01.03.2017**
Organismo de Avaliação Técnica: DIBt, Berlin
Organismo(s) notificado (s): NB 2873 – Technische Universität Darmstadt

✧ **Desempenho(s) declarado(s):**

Características essenciais	Desempenho
Resistência mecânica e estabilidade (BWR 1)	
Valores característicos	Anexo/Annex C1 – C4
Deslocamento	Anexo/Annex C5 – C6
Segurança contra incêndio (BWR 2)	
Comportamento do fogo	Classe A1
Resistência ao fogo	NPD (No Performance Determined) Desempenho Não Determinado

O desempenho do produto identificado acima está em conformidade com o conjunto de desempenhos declarados. A presente declaração de desempenho é emitida, em conformidade com o Regulamento (UE) n.o 305/2011, sob a exclusiva responsabilidade do fabricante identificado acima.

Assinado por e em nome do fabricante por:

Stefan Weustenhagen
(Diretor-gerente)
Weilerbach, 01.01.2021

p.p.
Dipl.-Ing. Detlef Bigalke
(Director de Desenvolvimento de Produto)

O original desta declaração de desempenho foi escrito em alemão. Em caso de desvios na tradução, a versão alemã é válida.

Specifications of intended use

Anchorages subject to:
- Static and quasi static loads: M10 to M24, rebar Ø10 to Ø25

Base materials:
- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000
- Strength classes C20/25 to C50/60 according to EN 206-1:2000
- Uncracked concrete: M10 to M24, rebar Ø10 to Ø25

Temperature Range:
- I: - 40 °C to +40 °C (max long term temperature +24 °C and max short term temperature +40 °C)
- II: - 40 °C to +60 °C (max long term temperature +43 °C and max short term temperature +60 °C)
- III: - 40 °C to +72 °C (max long term temperature +43 °C and max short term temperature +72 °C)

Use conditions (Environmental conditions):
- Structures subject to dry internal conditions
  (zinc coated steel, stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist
  (stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist
  (high corrosion resistant steel).
  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. in desulphurization plants or road tunnels where de-icing materials are used).

Design:
- 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 (e.g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Anchorages under static or quasi-static actions are designed in accordance with:
  - EOTA Technical Report TR 029 "Design of bonded anchors", Edition September 2010 or
  - CEN/TS 1992-4:2009

Installation:
- Dry or wet concrete: M10 to M24, Rebar Ø10 to Ø25.
- Flooded holes (not sea water): M10 to M24, Rebar Ø10 to Ø25.
- Hole drilling by diamond drill mode.
- Overhead installation allowed.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Table B1: Installation parameters for threaded rod

Anchor size			M10	M12	M16	M20	M24
Nominal drill hole diameter	d_0 =	[mm]	12	14	18	24	28
Embedment depth and bore hole depth	$h_{ef,min}$ =	[mm]	60	70	80	90	96
	$h_{ef,max}$ =	[mm]	200	240	320	400	480
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	12	14	18	22	26
Diameter of steel brush	$d_b \geq$	[mm]	14	16	20	26	30
Installation torque	T_{inst}	[Nm]	20	40	80	120	160
Thickness of fixture	$t_{fix,min}$ >	[mm]	0				
	$t_{fix,max}$ <	[mm]	1500				
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2d_0$		
Minimum spacing	s_{min}	[mm]	50	60	80	100	120
Minimum edge distance	c_{min}	[mm]	50	60	80	100	120

Table B2: Installation parameters for rebar

Rebar size			Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25
Nominal drill hole diameter	d_0 =	[mm]	14	16	18	20	24	32
Embedment depth and bore hole depth	$h_{ef,min}$ =	[mm]	60	70	75	80	90	100
	$h_{ef,max}$ =	[mm]	200	240	280	320	400	500
Diameter of steel brush	$d_b \geq$	[mm]	16	18	20	22	26	34
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30mm ≥ 100 mm	$h_{ef} + 2d_0$				
Minimum spacing	s_{min}	[mm]	50	60	70	80	100	125
Minimum edge distance	c_{min}	[mm]	50	60	70	80	100	125

Injection System VME for concrete

Intended use
Installation parameters

Annex B2

Steel brush

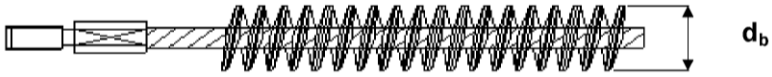
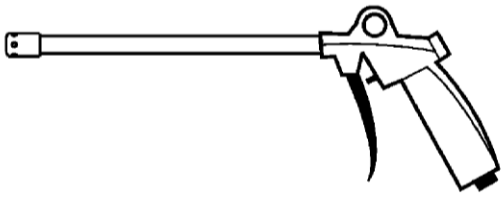
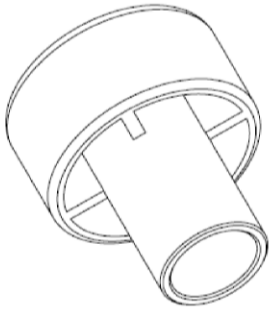


Table B3: Parameter cleaning and setting tools

Threaded rod	Rebar	d_0 Drill bit - Ø	d_b Brush - Ø	$d_{b,min}$ min. Brush - Ø	Retaining washer
[mm]	[mm]	[mm]	[mm]	[mm]	[-]
M10		12	14	12,5	No retaining washer required
M12	10	14	16	14,5	
	12	16	18	16,5	
M16	14	18	20	18,5	
	16	20	22	20,5	
M20	20	24	26	24,5	VM-IA 24
M24		28	30	28,5	VM-IA 28
	25	32	34	32,5	VM-IA 32

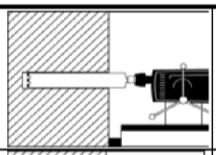
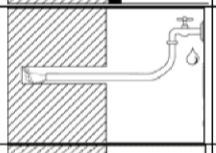
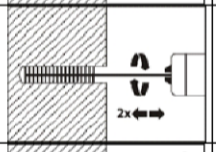
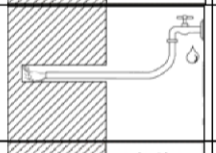
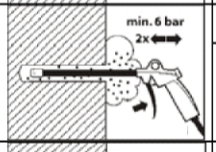
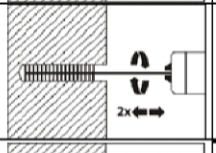
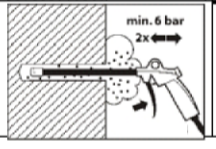
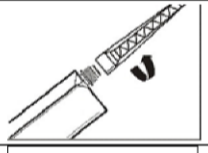
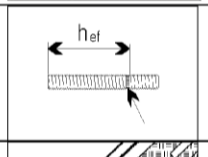
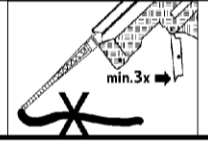


Rec. compressed air tool (min 6 bar)
All drill bit diameters (d_0)



Retaining washer for overhead or horizontal installation
Drill bit diameter (d_0): 24 mm to 32 mm

Installation instructions

1		Drill with diamond drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1 or Table B2).
2a		Rinsing with water until clear water comes out.
2b		Check brush diameter acc. Table B3 and attach the brush to a drilling machine or a battery screwdriver. Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B3) a minimum of two times. If the bore hole ground is not reached with the brush, a brush extension shall be used.
2c		Rinsing again with water until clear water comes out.
2d		**Attention! Standing water in the bore hole must be removed before cleaning.** Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) acc. to Annex B3, a minimum of two times. If the bore hole ground is not reached an extension shall be used.
2e		Check brush diameter acc. Table B3 and attach the brush to a drilling machine or a battery screwdriver. Brush the hole with an appropriate sized wire brush > $d_{b,min}$ a minimum of two times. If the bore hole ground is not reached with the brush, a brush extension shall be used.
2f		Finally blow the hole clean again with compressed air acc. to Annex B3 (min. 6 bar) a minimum of two times. If the bore hole ground is not reached an extension shall be used.
After cleaning, the bore hole hast to be protected against re-contamination in an appropriate way, until dispensing the adhesive in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the adhesive. In-flowing water must not contaminate the bore hole again.		
3		Attach a supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. For every working interruption longer than the recommended working time (Table B4) as well as for new cartridges, a new static-mixer shall be used.
4		Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.
5		Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the adhesive shows a consistent colour.

Injection System VME for concrete

Intended use
Installation instruction

Annex B4

Installation instructions (continuation)

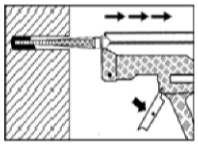
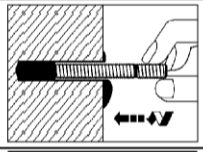
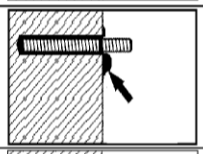
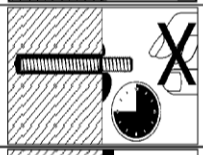
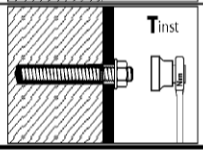
6		Starting from the bottom or back of the cleaned anchor hole fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets. For embedment larger than 190 mm an extension nozzle shall be used. For overhead and horizontal installation a retaining washer and extension nozzle (Annex B3) shall be used. Observe the working times given in Table B4.
7		Push the threaded rod or reinforcing bar into the hole while turning slightly to ensure positve distribution of the adhesive until the embedment depth is reached. The anchor should be free of dirt, grease, oil or other foreign material.
8		Be sure that the anchor is fully seated at the bottom of the hole and that excess adhesive is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed. For overhead installation fix embedded part (e.g. wedges).
9		Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B4).
10		After full curing, the add-on part can be installed with the maximum torque (Table B1) by using a calibrated torque wrench.

Table B4: Working and curing time

Bore hole temperature	Maximum working time	Minimum curing time	
		dry concrete	wet concrete
≥ + 5 °C	120 min	50 h	100 h
≥ + 10 °C	90 min	30 h	60 h
≥ + 20 °C	30 min	10 h	20 h
≥ + 30 °C	20 min	6 h	12 h
≥ + 40 °C	12 min	4 h	8 h

Table C1: Characteristic values for **threaded rods** under **tension loads** in uncracked concrete

Anchor size threaded rod				**M 10**	**M 12**	**M 16**	**M 20**	**M24**
Steel failure								
Characteristic tension resistance, Steel, property class 4.6		$N_{Rk,s}$	[kN]	23	34	63	98	141
Characteristic tension resistance, Steel, property class 5.8		$N_{Rk,s}$	[kN]	29	42	78	122	176
Characteristic tension resistance, Steel, property class 8.8		$N_{Rk,s}$	[kN]	46	67	125	196	282
Characteristic tension resistance, Stainless steel A4 and HCR, property class 70		$N_{Rk,s}$	[kN]	41	59	110	171	247
Combined pull-out and concrete cone failure								
Characteristic bond resistance in non-cracked concrete C20/25								
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	11	10	10	9,5	9,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	9,0	10	9,5	9,5	8,5
Temperature range II: 60°C/43°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,0	6,5	6,0	6,0	5,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,0	6,0	5,5
Temperature range III: 72°C/43°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	6,0	6,0	5,5	5,0	5,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,0	6,0	5,0	5,0	5,0
Increasing factor for concrete		ψ_c	C30/37	[-]	1,04			
			C40/50	[-]	1,08			
			C50/60	[-]	1,10			
Factor according to CEN/TS 1992-4-5 Section 6.2.2.3		k_8		[-]	10,1			
Concrete cone failure								
Factor according to CEN/TS 1992-4-5 Section 6.2.3.1		k_{ucr}		[-]	10,1			
Edge distance		$c_{cr,N}$		[mm]	$1{,}5\ h_{ef}$			
Spacing		$s_{cr,N}$		[mm]	$3{,}0\ h_{ef}$			
Splitting failure								
Edge distance		$c_{cr,sp}$		[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$			
Spacing		$s_{cr,sp}$		[mm]	$2\ c_{cr,sp}$			
Installation safety factor		$\gamma_2 = \gamma_{inst}$		[-]	1,0	1,2		

Injection System VME for concrete

Performances
Characteristic values of resistance for threaded rods under tension loads in uncracked concrete

Annex C1

Table C2: Characteristic values for **threaded rods** under **shear loads** in uncracked concrete

Anchor size threaded rod			**M 10**	**M 12**	**M 16**	**M 20**	**M24**
Steel failure without lever arm							
Characteristic shear resistance, Steel, property class 4.6	$V_{Rk,s}$	[kN]	12	17	31	49	71
Characteristic shear resistance, Steel, property class 5.8	$V_{Rk,s}$	[kN]	15	21	39	61	88
Characteristic shear resistance, Steel, property class 8.8	$V_{Rk,s}$	[kN]	23	34	63	98	141
Characteristic shear resistance, Stainless steel A4 and HCR, property class 70	$V_{Rk,s}$	[kN]	20	30	55	86	124
Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1	k_2	[-]	0,8				
Steel failure with lever arm							
Characteristic bending moment, Steel, property class 4.6	$M^0_{Rk,s}$	[Nm]	30	52	133	260	449
Characteristic bending moment, Steel, property class 5.8	$M^0_{Rk,s}$	[Nm]	37	65	166	324	560
Characteristic bending moment, Steel, property class 8.8	$M^0_{Rk,s}$	[Nm]	60	105	266	519	896
Characteristic bending moment, Stainless steel A4 and HCR, property class 70	$M^0_{Rk,s}$	[Nm]	52	92	232	454	784
Concrete pry-out failure							
Factor k acc. to TR029 und k_3 acc. to CEN/TS 1992-4-5 Section 6.3.3	$k_{(3)}$	[-]	2,0				
Concrete edge failure							
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef}; 8\ d_{nom})$				
Outside diameter of anchor	d_{nom}	[mm]	10	12	16	20	24
Installation safety factor[-]	$\gamma_2 = \gamma_{inst}$	[-]	1,0				

Table C3: Characteristic values for **rebar** under **tension loads** in uncracked concrete

Anchor size reinforcing bar				**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**
Steel failure									
Characteristic tension resistance		$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$					
Combined pull-out and concrete cone failure									
Characteristic bond resistance in non-cracked concrete C20/25									
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	11	10	10	10	9,5	9,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	9,0	10	10	9,5	9,5	8,5
Temperature range II: 60°C/43°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,0	6,5	6,5	6,0	6,0	5,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,0	6,0	5,5
Temperature range III: 72°C/43°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	6,0	6,0	6,0	5,5	5,0	5,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,0	6,0	5,5	5,5	5,0	5,0
Increasing factor for concrete	C30/37	ψ_c	[-]	1,04					
	C40/50		[-]	1,08					
	C50/60		[-]	1,10					
Factor according to CEN/TS 1992-4-5 Section 6.2.2.3		k_8	[-]	10,1					
Concrete cone failure									
Factor according to CEN/TS 1992-4-5 Section 6.2.3.1		k_{ucr}	[-]	10,1					
Edge distance		$c_{cr,N}$	[mm]	$1,5\ h_{ef}$					
Spacing		$s_{cr,N}$	[mm]	$3,0\ h_{ef}$					
Splitting failure									
Edge distance		$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$					
Spacing		$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$					
Installation safety factor		$\gamma_2 = \gamma_{inst}$	[-]	1,0	1,2				

Table C4: Characteristic values for **rebar** under **shear loads** in uncracked concrete

Anchor size reinforcing bar			**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**
Steel failure without lever arm								
Characteristic shear resistance	$V_{Rk,s}$	[kN]	$0{,}50 \cdot A_s \cdot f_{uk}$					
Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1	k_2	[-]	0,8					
Steel failure with lever arm								
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1{,}2 \cdot W_{el} \cdot f_{uk}$					
Concrete pry-out failure								
Factor k acc. to TR029 und k_3 acc. to CEN/TS 1992-4-5 Section 6.3.3	$k_{(3)}$	[-]	2,0					
Concrete edge failure								
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef};\ 8\ d_{nom})$					
Outside diameter of anchor	d_{nom}	[mm]	10	12	14	16	20	25
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0					

Injection System VME for concrete

Performances
Characteristic values of resistance for **rebar** under shear loads in uncracked concrete

Annex C4

Table C5: Displacements under tension loads [1] (threaded rod)

Anchor size threaded rod			M 10	M 12	M 16	M 20	M24
Temperature range 40°C/24°C for non-cracked concrete C20/25							
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,013	0,015	0,020	0,024	0,029
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,052	0,061	0,079	0,096	0,114
Temperature range 72°C/43°C and 60°C/43°C for non-cracked concrete C20/25							
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,015	0,018	0,023	0,028	0,033
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,060	0,070	0,091	0,111	0,131

[1] Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: action bond strength
$\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$;

Table C6: Displacement under shear load [1] (threaded rod)

Anchor size threaded rod			M10	M12	M16	M20	M24
Displacement	δ_{V0}-factor	[mm/(kN)]	0,06	0,05	0,04	0,04	0,03
Displacement	$\delta_{V\infty}$-factor	[mm/(kN)]	0,08	0,08	0,06	0,06	0,05

[1] Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: action shear load
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

Table C7: Displacements under tension loads [1] (rebar)

Anchor size reinforcing bar			Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25
Temperature range 40°C/24°C for non-cracked concrete C20/25								
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,013	0,015	0,018	0,020	0,024	0,030
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,052	0,061	0,070	0,079	0,096	0,118
Temperature range 72°C/43°C and 60°C/43°C for non-cracked concrete C20/25								
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,015	0,018	0,020	0,023	0,028	0,034
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,060	0,070	0,081	0,091	0,111	0,136

[1] Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: action bond strength
$\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$;

Table C8: Displacement under shear load [1] (rebar)

Anchor size reinforcing bar			Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25
Displacement	δ_{V0}-factor	[mm/(kN)]	0,05	0,05	0,04	0,04	0,04	0,03
Displacement	$\delta_{V\infty}$-factor	[mm/(kN)]	0,08	0,07	0,06	0,06	0,05	0,05

[1] Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: action shear load
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;