Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-05/0162 of 6 December 2021

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR
Product family to which the construction product belongs	Mechanical fastener for use in concrete
Manufacturer	MÜPRO Services GmbH Borsigstraße 14 65205 Wiesbaden DEUTSCHLAND
Manufacturing plant	MÜPRO Werk 1, Deutschland
This European Technical Assessment contains	15 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330232-01-0601, Edition 05/2021
This version replaces	ETA-05/0162 issued on 3 June 2021

Deutsches Institut für Bautechnik
Kolonnenstraße 30 B | 10829 Berlin | GERMANY | Phone: +49 30 78730-0 | Fax: +49 30 78730-320 | Email: dibt@dibt.de | www.dibt.de

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Specific Part

1 Technical description of the product

The MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR is a fastener made of zinc coated steel or stainless steel which is placed into a drilled hole and anchored by application of the installation torque.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

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

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 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 and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi static action) Method A	See Annex B4, C1 and C2
Characteristic resistance to shear load (static and quasi static action)	See Annex C3
Displacements	See Annex C4
Characteristic resistance and displacements for seismic performance categories C1 and C2	No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

3.3 Aspects of durability linked with the Basic Works Requirements

Essential characteristic	Performance
Durability	See Annex B1

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

In accordance with the European Assessment Document EAD 330232-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 6 December 2021 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

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MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

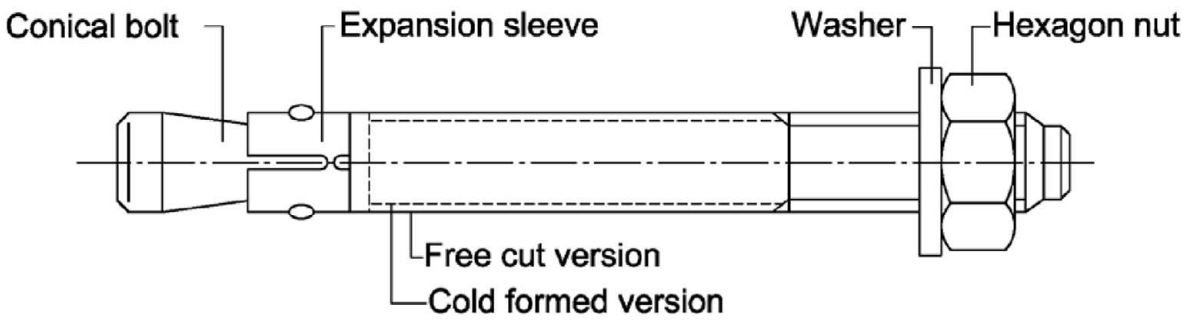


Table A1: Dimensions

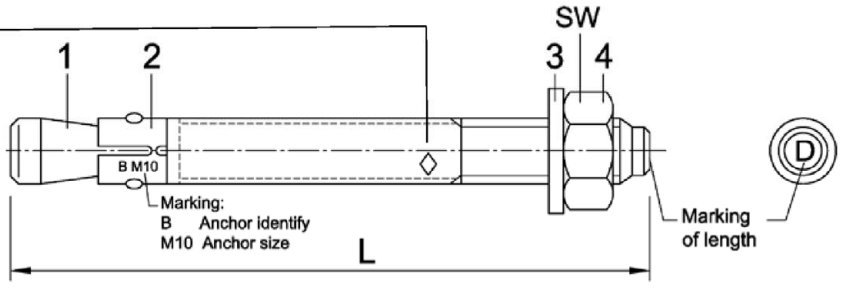
Fastener size	Fastener length L			Wrench size [SW]
	Embedment depth $h_{ef,1}$	Embedment depth $h_{ef,2}$	Embedment depth $h_{ef,3}$	
M6	$t_{fix\ hef,1}$ + 47,4	$t_{fix,hef,2}$ + 57,4	$t_{fix,hef,3}$ + 77,4	10
M8	$t_{fix\ hef,1}$ + 57,4	$t_{fix,hef,2}$ + 66,4	$t_{fix,hef,3}$ + 92,4	13
M10	$t_{fix\ hef,1}$ + 68,0	$t_{fix,hef,2}$ + 74,0	$t_{fix,hef,3}$ + 106,0	17
M12	$t_{fix\ hef,1}$ + 82,3	$t_{fix,hef,2}$ + 97,3	$t_{fix,hef,3}$ + 132,3	19
M16	$t_{fix\ hef,1}$ + 103,0 ($t_{fix\ hef,1}$ + 101,8)[1)]	$t_{fix,hef,2}$ + 121,0 ($t_{fix,hef,2}$ + 117,8)[1)]	$t_{fix,hef,3}$ + 159,0 ($t_{fix,hef,3}$ + 157,8)[1)]	24
M20	$t_{fix\ hef,1}$ + 120,7	$t_{fix,hef,2}$ + 142,7	$t_{fix,hef,3}$ + 157,7	30

[1)] Fastener version Through Anchor A2 / A4 / HCR

Marking: e.g.: ◇ 15/21

◇ Identifying mark of manufacturing plant
15 maximum thickness of fixture for $h_{ef,2}$
21 maximum thickness of fixture for $h_{ef,1}$

additional marking:
A2 stainless steel
A4 stainless steel
HCR high corrosion resistant steel



Marking of length	A	B	C	D	E	F	G	H	I	J	K	L	M
Length of fastener min ≥	38,1	50,8	63,5	76,2	88,9	101,6	114,3	127,0	139,7	152,4	165,1	177,8	190,5
Length of fastener max <	50,8	63,5	76,2	88,9	101,6	114,3	127,0	139,7	152,4	165,1	177,8	190,5	203,2

Marking of length	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Length of fastener min ≥	203,2	215,9	228,6	241,3	254,0	279,4	304,8	330,2	355,6	381,0	406,4	431,8	457,2
Length of fastener max <	215,9	228,6	241,3	254,0	279,4	304,8	330,2	355,6	381,0	406,4	431,8	457,2	483,0

Dimensions in mm

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Product description
Marking and Dimensions

Annex A1

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Table A2: Materials

Part	Designation	Material
Through Anchor vz	electroplated	≥ 5 µm acc. to EN ISO 4042:2018
Through Anchor fvz	hot-dip galvanized	≥ 40 µm (in average 50 µm) acc. to EN ISO 10684:2011 or EN ISO 1461:2009
Through Anchor sh	sherardized	≥ 45 µm acc. to EN ISO 17668:2016
1	Conical bolt	Cold formed or machined steel
2	Expansion sleeve	Stainless steel according CRC II [1)], acc. to EN 10088:2014
3	Washer	Steel, zinc plated
4	Hexagon nut	Property class 8 acc. to EN ISO 898-2:2012
Through Anchor A2		
1	Conical bolt	Stainless steel according CRC II [1)], coated
2	Expansion sleeve	Stainless steel according CRC II [1)], acc. to EN 10088:2014
3	Washer	Stainless steel according CRC II [1)]
4	Hexagon nut	Stainless steel according CRC II [1)], property class 70, coated, EN ISO 3506-2:2020
Through Anchor A4		
1	Conical bolt	Stainless steel according CRC III [1)], coated
2	Expansion sleeve	Stainless steel according CRC II [1)] or CRC III [1)], acc. to EN 10088:2014
3	Washer	Stainless steel according CRC III [1)]
4	Hexagon nut	Stainless steel according CRC III [1)], property class 70, coated, EN ISO 3506-2:2020
Through Anchor HCR		
1	Conical bolt	Stainless steel according CRC V [1)], coated
2	Expansion sleeve	Stainless steel according CRC III [1)], acc. to EN 10088:2014
3	Washer	Stainless steel according CRC V [1)]
4	Hexagon nut	Stainless steel according CRC V [1)], property class 70, coated, EN ISO 3506-2:2020, EN 10088:2014

[1)] Corrosion resistance class according to EN 1993-1-4:2015, Annex A, Table A.3

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Product description
Materials

Annex A2

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Specifications of intended use

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR		M6	M8	M10	M12	M16	M20
Through Anchor vz	electroplated	✓	✓	✓	✓	✓	✓
Through Anchor fvz	hot-dip galvanized	-	✓	✓	✓	✓	✓
Through Anchor sh	sherardized	✓	✓	✓	✓	✓	✓
Through Anchor A2	stainless steel	✓	✓	✓	✓	✓	✓
Through Anchor A4	stainless steel	✓	✓	✓	✓	✓	✓
Through Anchor HCR	high corrosion resistant steel	✓	✓	✓	✓	✓	✓
all versions	static or quasi-static action	✓					
	uncracked concrete	✓					

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A1:2016
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials)
- For all other conditions:

Fastener version	Use according to EN 1993-1-4:2015 corresponding to the corrosion resistance class CRC according to Annex A, Table A.2
Through Anchor A2	CRC II
Through Anchor A4	CRC III
Through Anchor HCR	CRC V

Design:

- Fasteners are designed under the responsibility of an engineer experienced in anchorages and concrete work
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.)
- Fasteners are designed according to EN 1992-4:2018 and Technical Report TR 055, Edition February 2018

Installation:

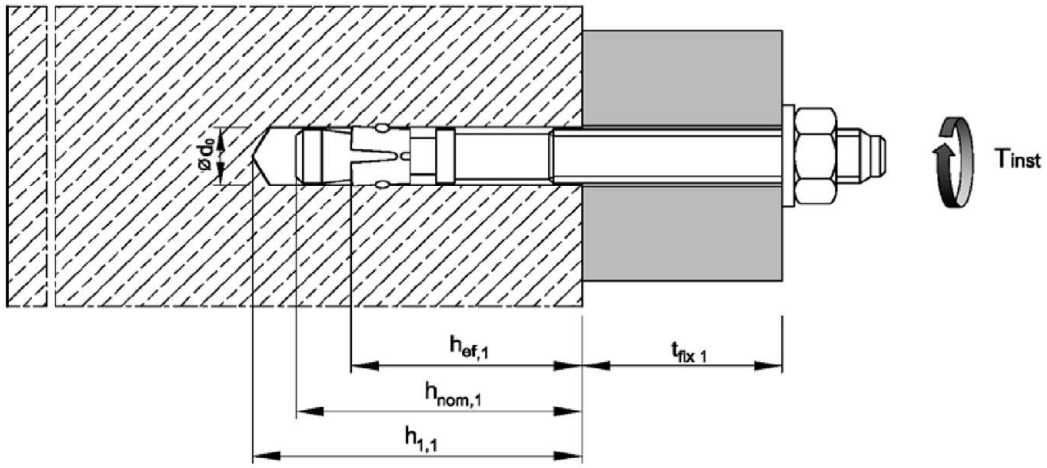
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Hole drilling by hammer drill bit or vacuum drill bit
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR	**Annex B1**
Intended use Specifications	

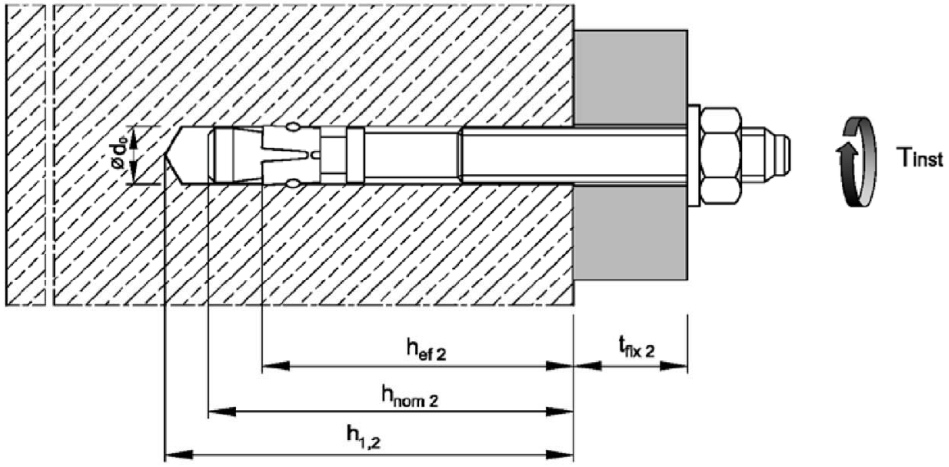
Deutsches Institut für Bautechnik DIBt

Installation parameters

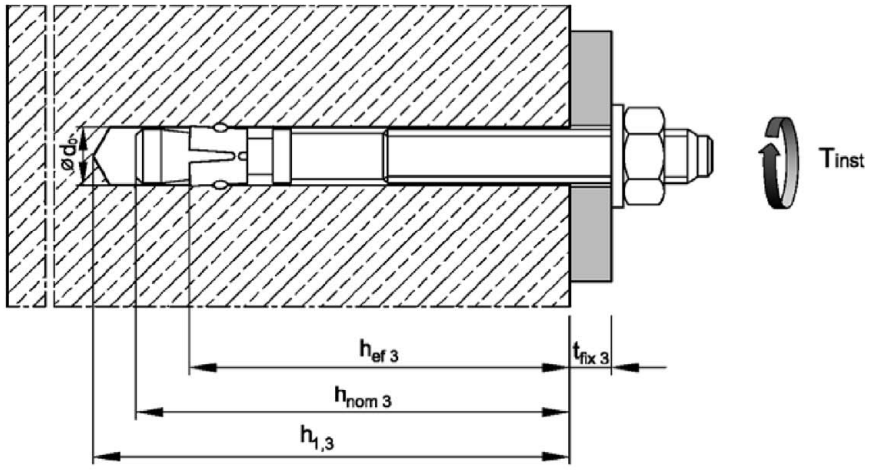
Effective embedment depths $h_{ef,1}$



Effective embedment depths $h_{ef,2}$



Effective embedment depths $h_{ef,3}$



MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Intended use
Installation parameters

Annex B2

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Table B1: Installation parameters

Fastener size				M6	M8	M10	M12	M16	M20
Nominal drill hole diameter		d_0 =	[mm]	6	8	10	12	16	20
Cutting diameter of drill bit		$d_{cut} \leq$	[mm]	6,40	8,45	10,45	12,5	16,5	20,55
Installation torque	Through Anchor vz	T_{inst} =	[Nm]	8	15	30	50	100	200
	Through Anchor fvz	T_{inst} =	[Nm]	-	15	30	40	90	120
	Through Anchor sh	T_{inst} =	[Nm]	5	15	30	40	90	120
	Through Anchor A2 / A4 / HCR	T_{inst} =	[Nm]	6	15	25	50	100	160
Diameter of clearance hole in the fixture		$d_f \leq$	[mm]	7	9	12	14	18	22
Embedment depth $h_{ef,1}$									
Effective embedment depth		$h_{ef,1} \geq$	[mm]	30	35	42	50	64	78
Depth of drill hole		$h_{1,1} \geq$	[mm]	45	55	65	75	95	110
Embedment depth		$h_{nom,1} \geq$	[mm]	39	47	56	67	84	99
Embedment depth $h_{ef,2}$									
Effective embedment depth		$h_{ef,2} \geq$	[mm]	40	44	48	65	82 (80)[1)]	100
Depth of drill hole		$h_{1,2} \geq$	[mm]	55	65	70	90	110	130
Embedment depth		$h_{nom,2} \geq$	[mm]	49	56	62	82	102	121
Embedment depth $h_{ef,3}$									
Effective embedment depth		$h_{ef,3} \geq$	[mm]	60	70	80	100	120	115
Depth of drill hole		$h_{1,3} \geq$	[mm]	75	91	102	125	148	145
Embedment depth		$h_{nom,3} \geq$	[mm]	69	82	94	117	140	136

[1)] Fastener version Through Anchor A2 / A4 / HCR

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Intended use
Installation data

Annex B3

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Table B2: Minimum spacings and edge distances for Through Anchor vz / fvz[1] / sh

Fastener size			M6	M8	M10	M12	M16	M20
Embedment depth $h_{ef,1}$								
Minimum member thickness	h_{min}	[mm]	80	80	100	100	130	160
Minimum spacing	s_{min}	[mm]	35	40	55	100	100	140
Minimum edge distance	c_{min}	[mm]	40	45	65	100	100	140
Embedment depth $h_{ef,2}$								
Minimum member thickness	h_{min}	[mm]	100	100	100	130	170	200
Minimum spacing	s_{min}	[mm]	35	40	55	75	90	105
Minimum edge distance	c_{min}	[mm]	40	45	65	90	105	125
Embedment depth $h_{ef,3}$								
Minimum member thickness	h_{min}	[mm]	120	126	132	165	208	215
Minimum spacing	s_{min}	[mm]	35	40	55	75	90	105
Minimum edge distance	c_{min}	[mm]	40	45	65	90	105	125

[1] Fastener version Through Anchor fvz: M8-M20

Table B3: Minimum spacings and edge distances for Through Anchor A2 / A4 / HCR

Fastener size			M6	M8	M10	M12	M16	M20
Embedment depth $h_{ef,1}$								
Minimum member thickness	h_{min}	[mm]	80	80	100	100	130	160
Minimum spacing	s_{min}	[mm]	35	60	55	100	110	140
Minimum edge distance	c_{min}	[mm]	40	60	65	100	110	140
Embedment depth $h_{ef,2}$								
Minimum member thickness	h_{min}	[mm]	100	100	100	130	160	200
Minimum spacing	s_{min}	[mm]	35	35	45	60	80	100
	for c ≥	[mm]	40	65	70	100	120	150
Minimum edge distance	c_{min}	[mm]	35	45	55	70	80	100
	for s ≥	[mm]	60	110	80	100	140	180
Embedment depth $h_{ef,3}$								
Minimum member thickness	h_{min}	[mm]	120	126	132	165	200	215
Minimum spacing	s_{min}	[mm]	35	35	45	60	80	100
	for c ≥	[mm]	40	65	70	100	120	150
Minimum edge distance	c_{min}	[mm]	35	45	55	70	80	100
	for s ≥	[mm]	60	110	80	100	140	180

Intermediate values by linear interpolation

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Intended use
Minimum spacings and edge distances

Annex B4

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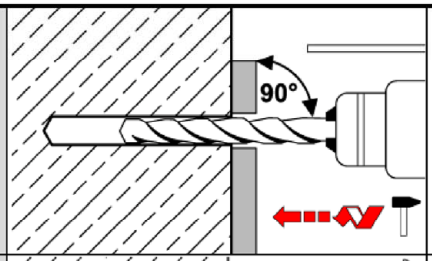
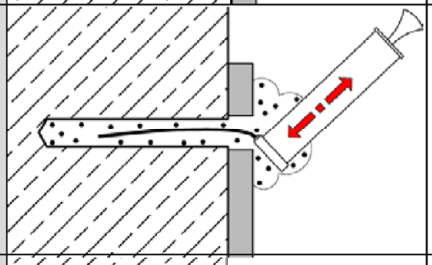
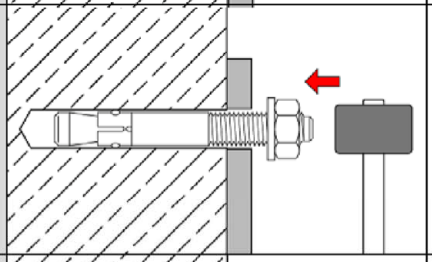
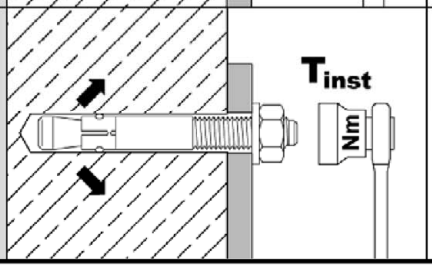
Installation instructions

1		Drill hole perpendicular to concrete surface, positioning of the drill holes without damaging the reinforcement. If using a vacuum drill bit, proceed with step 3.
2		Blow out dust. Alternatively, vacuum clean down to the bottom of the hole.
3		Drive in fastener, such that the selected embedment depth is met.
4		Apply installation torque T_{inst} as specified in Table B1.

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Intended use
Installation instructions

Annex B5

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Table C1: Characteristic values for **tension loads for Through Anchor vz / fvz[1] / sh**

Fastener size				**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Installation factor		γ_{inst}	[-]	1,0					
Steel failure									
Characteristic resistance		$N_{Rk,s}$	[kN]	8,7	15,3	26	35	65	107
Partial factor		γ_{Ms}	[-]	1,5				1,6	
Pull-out									
Characteristic resistance in uncracked concrete C20/25	for $h_{ef,1}$	$N_{Rk,p}$	[kN]	6,5 [2]	10,2 [2]	13,4	17,4	25,2	33,9
	for $h_{ef,2}$	$N_{Rk,p}$	[kN]	10	13	16,4	25,8	36,5	49,2
	for $h_{ef,3}$	$N_{Rk,p}$	[kN]	10	13	16,4	26	40	55
Increasing factor for $N_{Rk,p}$ $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25)		ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$			$\left(\frac{f_{ck}}{20}\right)^{0,29}$	$\left(\frac{f_{ck}}{20}\right)^{0,33}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$
Splitting									
Characteristic resistance in uncracked concrete C20/25		$N^0_{Rk,sp}$	[kN]	min [$N_{Rk,p}$; $N^0_{Rk,c}$ [3]]					
Embedment depth $h_{ef,1}$									
Spacing		$s_{cr,sp}$	[mm]	180	210	230	240	320	400
Edge distance		$c_{cr,sp}$	[mm]	90	105	115	120	160	200
Embedment depth $h_{ef,2}$									
Spacing		$s_{cr,sp}$	[mm]	160	220	240	330	410	500
Edge distance		$c_{cr,sp}$	[mm]	80	110	120	165	205	250
Embedment depth $h_{ef,3}$									
Spacing		$s_{cr,sp}$	[mm]	360	420	480	600	720	690
Edge distance		$c_{cr,sp}$	[mm]	180	210	240	300	360	345
Concrete cone failure									
Effective embedment depth	for $h_{ef,1}$		[mm]	30 [2]	35 [2]	42	50	64	78
	for $h_{ef,2}$		[mm]	40	44	48	65	82	100
	for $h_{ef,3}$		[mm]	60	70	80	100	120	115
Spacing		$s_{cr,N}$	[mm]	3 $h_{ef\ (1,2,3)}$					
Edge distance		$c_{cr,N}$	[mm]	1,5 $h_{ef\ (1,2,3)}$					
Factor	uncracked concrete	$k_{ucr,N}$	[-]	11,0					
	cracked concrete	$k_{cr,N}$	[-]	No performance assessed					

[1] Fastener version Through Anchor fvz: M8-M20

[2] Restricted to the use of structural components with $h_{ef} < 40$mm which are statically indeterminate and subject to internal exposure conditions only

[3] $N^0_{Rk,c}$ according to EN 1992-4:2018

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Performance
Characteristic values for **tension loads for Through Anchor vz / fvz / sh**

Annex C1

Deutsches Institut für Bautechnik DIBt

Table C2: Characteristic values for **tension loads for Through Anchor A2 / A4 / HCR**

Fastener size				**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Installation factor		γ_{inst}	[-]	1,0					
Steel failure									
Characteristic resistance		$N_{Rk,s}$	[kN]	10	18	30	44	88	134
Partial factor		γ_{Ms}	[-]	1,50					1,68
Pull-out									
Characteristic resistance in uncracked concrete C20/25	for $h_{ef,1}$	$N_{Rk,p}$	[kN]	6,5 [1]	9 [1]	12	17,4	25,2	33,9
	for $h_{ef,2}$	$N_{Rk,p}$	[kN]	8	15	16,4	25	35,2	49,2
	for $h_{ef,3}$	$N_{Rk,p}$	[kN]	8	15	16,4	25	42	60
Increasing factor for $N_{Rk,p}$ $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25)		ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$					
Splitting									
Characteristic resistance in uncracked concrete C20/25		$N^0_{Rk,sp}$	[kN]	min [$N_{Rk,p}$; $N^0_{Rk,c}$ [2]]					
Embedment depth $h_{ef,1}$									
Spacing		$s_{cr,sp}$	[mm]	180	180	180	180	180	180
Edge distance		$c_{cr,sp}$	[mm]	90	90	90	90	90	90
Embedment depth $h_{ef,2}$									
The higher one of the decisive resistances of Case 1 and Case 2 is applicable									
Case 1									
Characteristic resistance in uncracked concrete C20/25		$N^0_{Rk,sp}$	[kN]	6	9	12	20	30	40
Spacing		$s_{cr,sp}$	[mm]	3 h_{ef}					
Edge distance		$c_{cr,sp}$	[mm]	1,5 h_{ef}					
Increasing factor for $N^0_{Rk,sp}$ $N^0_{Rk,sp} = \psi_c \cdot N^0_{Rk,sp}$ (C20/25)		ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$					
Case 2									
Spacing		$s_{cr,sp}$	[mm]	160	220	240	340	410	560
Edge distance		$c_{cr,sp}$	[mm]	80	110	120	170	205	280
Embedment depth $h_{ef,3}$									
Spacing		$s_{cr,sp}$	[mm]	360	420	480	600	720	690
Edge distance		$c_{cr,sp}$	[mm]	180	210	240	300	360	345
Concrete cone failure									
Effective Embedment depth	for $h_{ef,1}$		[mm]	30 [1]	35 [1]	42	50	64	78
	for $h_{ef,2}$		[mm]	40	44	48	65	80	100
	for $h_{ef,3}$		[mm]	60	70	80	100	120	115
Spacing		$s_{cr,N}$	[mm]	3 h_{ef}					
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}					
Factor	uncracked concrete	$k_{ucr,N}$	[-]	11,0					
	cracked concrete	$k_{cr,N}$	[-]	No performance assessed					

[1] Restricted to the use of structural components with $h_{ef} < 40$mm which are statically indeterminate and subject to internal exposure conditions only

[2] $N^0_{Rk,c}$ according to EN 1992-4:2018

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Performance
Characteristic values for **tension loads for Through Anchor A2 / A4 / HCR**

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C3: Characteristic values for **shear loads**

Fastener size				**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Installation factor		γ_{inst}	[-]	1,0					
Steel failure without lever arm									
Characteristic resistance	**Through Anchor vz / fvz[1] / sh**	$V^0_{Rk,s}$	[kN]	5	11	17	25	44	69
	Through Anchor A2 / A4 / HCR	$V^0_{Rk,s}$	[kN]	7	12	19	27	50	86
Ductility factor		k_7	[-]	1,0					
Steel failure with lever arm									
Characteristic bending resistance	**Through Anchor vz / fvz[1] / sh**	$M^0_{Rk,s}$	[Nm]	9	23	45	78	186	363
	Through Anchor A2 / A4 / HCR	$M^0_{Rk,s}$	[Nm]	10	24	49	85	199	454
Partial factor for $V^0_{Rk,s}$ and $M^0_{Rk,s}$	**Through Anchor vz / fvz[1] / sh**	γ_{Ms}	[-]	1,25				1,33	
	Through Anchor A2 / A4 / HCR	γ_{Ms}	[-]	1,25					1,4
Concrete pry-out failure									
Factor for $\mathbf{h_{ef}}$	**Through Anchor vz / fvz[1] / sh**	k_8	[-]	1,0	2,3	2,5	2,9	2,8	3,1
	Through Anchor A2 / A4 / HCR	k_8	[-]	1,0	2,3	2,8	2,8	3,0	3,3
Concrete edge failure									
Effective length of fastener in shear loading	for $\mathbf{h_{ef,1}}$	l_f	[mm]	30 [2]	35 [2]	42	50	64	78
	for $\mathbf{h_{ef,2}}$	l_f	[mm]	40	44	48	65	82 (80) [3]	100
	for $\mathbf{h_{ef,3}}$	l_f	[mm]	60	70	80	100	120	115
Outside diameter of fastener		d_{nom}	[mm]	6	8	10	12	16	20

[1] Fastener version Through Anchor fvz: M8-M20

[2] Restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only

[3] Fastener version Through Anchor A2 / A4 / HCR

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Performance
Characteristic values for **shear loads**

Annex C3

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Table C5: Displacements under tension loads

Fastener size			M6	M8	M10	M12	M16	M20
Embedment depth $h_{ef,1}$								
Through Anchor vz / fvz[1] / sh								
Tension load	N	[kN]	2,9	5,0	6,5	8,5	12,3	16,6
Displacement	δ_{N0}	[mm]	0,3	0,4				
	$\delta_{N\infty}$	[mm]	0,6	1,8				
Through Anchor A2 / A4 / HCR								
Tension load	N	[kN]	2,9	4,3	5,7	8,5	12,3	16,6
Displacement	δ_{N0}	[mm]	0,4	0,7	0,4	0,4	0,6	1,5
	$\delta_{N\infty}$	[mm]	1,3					2,9
Embedment depth $h_{ef,2}$ and $h_{ef,3}$								
Through Anchor vz / fvz[1] / sh								
Tension load	N	[kN]	4,3	5,8	7,6	11,9	16,7	23,8
Displacement	δ_{N0}	[mm]	0,4	0,5				
	$\delta_{N\infty}$	[mm]	0,7	2,3				
Through Anchor A2 / A4 / HCR								
Tension load	N	[kN]	3,6	5,7	7,6	11,9	17,2	24,0
Displacement	δ_{N0}	[mm]	0,7	0,9	0,5	0,6	0,9	2,1
	$\delta_{N\infty}$	[mm]	1,8					4,2

[1] Fastener version Through Anchor fvz: M8-M20

Table C6: Displacements under shear loads

Fastener size			M6	M8	M10	M12	M16	M20
Through Anchor vz / fvz[1] / sh								
Shear load	V	[kN]	2,9	6,3	9,7	14,3	23,6	37,0
Displacement	δ_{V0}	[mm]	1,2	1,5	1,6	2,6	3,1	4,4
	$\delta_{V\infty}$	[mm]	2,4	2,2	2,4	3,9	4,6	6,6
Through Anchor A2 / A4 / HCR								
Shear load	V	[kN]	4,0	6,9	10,9	15,4	28,6	43,7
Displacement	δ_{V0}	[mm]	1,1	2,0	1,2	2,0	2,2	2,1
	$\delta_{V\infty}$	[mm]	1,7	3,0	1,8	3,0	3,3	3,2

[1] Fastener version Through Anchor fvz: M8-M20

MÜPRO Through Anchor vz / fvz / sh / A2 / A4 / HCR

Performance
Displacements

Annex C4