W-VIZ/A4

W-VIZ-A/A4

Stainless steel - A4 (AISI 316): M8 - M24

W-VIZ-A/HCR

High corrosion resistant steel HCR: M8 - M24

WIT-VIZ

WIT-VIZ EXPRESS

Approved for:
Concrete C20/25 to C50/60, non-cracked & cracked

Suitable for:
Concrete C12/15, Natural stone with dense structure

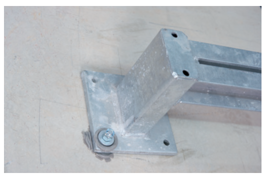
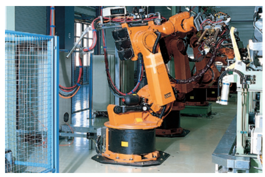
Type of installation		
Pre-positioned	In-place	Stand-off
✓	✓	✓

Installation condition		
Dry concrete	Wet concrete	Flooded drill hole
✓	✓	✓

Drilling method		
Hammer drill	Diamond drill	Hollow drill
✓	✓	✓

Applications



Approvals and certificates

ETA CE LEED tested VOC conforming solvent reduced

Description	Authority/laboratory	Guideline for assessment	No./date of issue
European Technical Assessment	DIBt, Berlin	ETAG 001-T5	ETA-04/0095, 11.05.2017
Fire resistance	MFPA Leipzig GmbH	TR 020	GS 3.2/18-075-1
LEED	eurofins		14.06.13
VOC Emissions Test report	eurofins	DEVL 1101903D, DEVL 1104875A	07.01.14

Basic load data (for a single anchor)

All data in this section applies when:
- Installation is correct (see installation instructions)
- No edge distance and spacing influence
- Base material thickness is according to anchor characteristics
- Anchor material is as specified in anchor material specification table
- Concrete C 20/25, f_{ck} = 20 N/mm^2
- Concrete C 50/60, f_{ck} = 60 N/mm^2
- Bonding expansion system WIT-VIZ consists of an anchor rod WIT-VIZ-A/A4 or WIT-VIZ-A/HCR and injection mortar WIT-VIZ or WIT-EXPRESS
- Temperature range I: -40°C to +80°C (max. long term/short term base material temperature +50°C/+80°C)
- Dry or wet conditions of drill hole, hammer and diamond core drilling
- Installation temperature range +5°C to +40°C

Mean ultimate resistance

Anchor type: WIT-VIZ, M8 - M12

Thread size				M8	M8	M10	M10	M12	M12	M12
Effective anchorage depth		h_{ef}	[mm]	40	50	60	75	75	70	80
Non-cracked concrete										
Tension	C20/25	$N_{Ru,m}$	[kN]	15.0	22.0	30.9	30.9	38.4	40.6	61.6
Shear	C20/25	$V_{Ru,m}$	[kN]	17.6	17.6	27.8	27.8	40.5	40.5	40.5
Cracked concrete										
Tension	C20/25	$N_{Ru,m}$	[kN]	11.2	17.8	25.5	26.9	31.8	37.5	44.0
Shear	C20/25	$V_{Ru,m}$	[kN]	17.6	17.6	27.8	27.8	40.5	40.5	40.5

Anchor type: WIT-VIZ, M12 - M16

Thread size				M12	M12	M12	M12	M16	M16	M16
Effective anchorage depth		h_{ef}	[mm]	95	100	110	125	90	105	125
Non-cracked concrete										
Tension	C20/25	$N_{Ru,m}$	[kN]	61.6	65.9	65.9	65.9	62.2	80.9	100.9
Shear	C20/25	$V_{Ru,m}$	[kN]	40.5	40.5	40.5	40.5	75.4	75.4	75.4
Cracked concrete										
Tension	C20/25	$N_{Ru,m}$	[kN]	47.1	61.3	61.3	61.3	44.7	68.3	99.2
Shear	C20/25	$V_{Ru,m}$	[kN]	40.5	40.5	40.5	40.5	75.4	75.4	75.4

Anchor type: WIT-VIZ, M16 - M24

Thread size				M16	M16	M20	M20	M20	M24	M24	M24
Effective anchorage depth		h_{ef}	[mm]	145	160	115	170	190	170	200	225
Non-cracked concrete											
Tension	C20/25	$N_{Ru,m}$	[kN]	100.9	115.9	107.9	171.5	171.5	201.0	237.6	237.6
Shear	C20/25	$V_{Ru,m}$	[kN]	75.4	75.4	102.9	102.9	102.9	147.8	147.8	147.8
Cracked concrete											
Tension	C20/25	$N_{Ru,m}$	[kN]	99.2	104.7	94.3	136.6	136.6	133.5	183.4	183.4
Shear	C20/25	$V_{Ru,m}$	[kN]	75.4	75.4	102.9	102.9	102.9	147.8	147.8	147.8

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Characterstic loads

Anchor type: WIT-VIZ, M8 - M12

Thread size				M8	M8	M10	M10	M12	M12	M12
Effective anchorage depth		h_{ef}	[mm]	40	50	60	75	75	70	80
Non-cracked concrete										
Tension	C20/25	N_{Rk}	[kN]	9.0	17.4	22.9	25.0	32.0	28.8	35.2
	C50/60			14.2	18.0	25.0	25.0	35.0	45.6	54.0
Shear	≥ C20/25	V_{Rk}	[kN]	14.0	14.0	21.0	21.0	34.0	34.0	34.0
Cracked concrete										
Tension	C20/25	N_{Rk}	[kN]	8.7	12.2	16.0	22.4	22.4	20.2	24.6
	C50/60			13.8	18.0	25.0	25.0	35.0	31.9	39.0
Shear	≥ C20/25	V_{Rk}	[kN]	14.0	14.0	21.0	21.0	34.0	34.0	34.0

Anchor type: WIT-VIZ, M12 - M16

Thread size				M12	M12	M12	M12	M16	M16	M16
Effective anchorage depth		h_{ef}	[mm]	95	100	110	125	90	105	125
Non-cracked concrete										
Tension	C20/25	N_{Rk}	[kN]	40.0	49.2	50.0	50.0	42.0	52.9	68.8
	C50/60			54.0	57.0	57.0	57.0	66.4	83.7	108.7
Shear	≥ C20/25	V_{Rk}	[kN]	34.0	34.0	34.0	34.0	63.0	63.0	63.0
Cracked concrete										
Tension	C20/25	N_{Rk}	[kN]	31.9	34.4	39.7	48.1	29.4	37.1	48.1
	C50/60			50.4	54.4	57.0	57.0	46.5	58.6	76.1
Shear	≥ C20/25	V_{Rk}	[kN]	34.0	34.0	34.0	34.0	58.8	63.0	63.0

Anchor type: WIT-VIZ, M16 - M24

Thread size				M16	M16	M20	M20	M20	M24	M24	M24
Effective anchorage depth		h_{ef}	[mm]	145	160	115	170	190	170	200	225
Non-cracked concrete											
Tension	C20/25	N_{Rk}	[kN]	75.0	90.0	60.7	109.0	128.8	109.0	139.1	166.0
	C50/60			111.0	97.0	95.9	172.4	188.0	172.4	220.0	222.0
Shear	≥ C20/25	V_{Rk}	[kN]	63.0	63.0	70.0	98.0	98.0	141.0	141.0	141.0
Cracked concrete											
Tension	C20/25	N_{Rk}	[kN]	60.1	69.7	42.5	76.3	90.2	76.3	97.4	116.2
	C50/60			95.1	97.0	67.1	120.7	142.6	120.7	154.0	183.8
Shear	≥ C20/25	V_{Rk}	[kN]	63.0	63.0	70.0	98.0	98.0	141.0	141.0	141.0

Design loads

Anchor type: WIT-VIZ, M8 - M12

Thread size				M8	M8	M10	M10	M12	M12	M12
Effective anchorage depth		h_{ef}	[mm]	40	50	60	75	75	70	80
Non-cracked concrete										
Tension	C20/25	N_{Rd}	[kN]	6.0	11.6	15.2	16.7	21.3	19.2	23.5
	C50/60			9.5	12.0	16.7	16.7	23.3	30.4	36.0
Shear	≥ C20/25	V_{Rd}	[kN]	11.2	11.2	16.8	16.8	27.2	27.2	27.2
Cracked concrete										
Tension	C20/25	N_{Rd}	[kN]	5.8	8.1	10.7	14.9	14.9	13.4	16.4
	C50/60			9.2	12.0	16.7	16.7	23.3	21.3	26.0
Shear	≥ C20/25	V_{Rd}	[kN]	11.2	11.2	16.8	16.8	27.2	26.9	27.2

Anchor type: WIT-VIZ, M12 - M16

Thread size				M12	M12	M12	M12	M16	M16	M16
Effective anchorage depth		h_{ef}	[mm]	95	100	110	125	90	105	125
Non-cracked concrete										
Tension	C20/25	N_{Rd}	[kN]	26.7	32.8	33.3	33.3	28.0	35.3	45.8
	C50/60			36.0	38.0	38.0	38.0	44.3	55.8	72.5
Shear	≥ C20/25	V_{Rd}	[kN]	27.2	27.2	27.2	27.2	50.4	50.4	50.4
Cracked concrete										
Tension	C20/25	N_{Rd}	[kN]	21.3	23.0	26.5	32.1	19.6	24.7	32.1
	C50/60			33.6	36.3	38.0	38.0	31.0	39.1	50.7
Shear	≥ C20/25	V_{Rd}	[kN]	27.2	27.2	27.2	27.2	39.2	49.4	50.4

Anchor type: WIT-VIZ, M16 - M24

Thread size				M16	M16	M20	M20	M20	M24	M24	M24
Effective anchorage depth		h_{ef}	[mm]	145	160	115	170	190	170	200	225
Non-cracked concrete											
Tension	C20/25	N_{Rd}	[kN]	50.0	60.0	40.4	72.7	85.9	72.7	92.8	110.7
	C50/60			74.0	64.7	57.1	114.9	125.3	114.9	146.7	148.0
Shear	≥ C20/25	V_{Rd}	[kN]	50.4	50.4	50.0	78.4	78.4	112.8	112.8	112.8
Cracked concrete											
Tension	C20/25	N_{Rd}	[kN]	40.1	46.5	28.3	50.9	60.1	50.9	64.9	77.5
	C50/60			63.4	64.7	44.8	80.5	95.1	80.5	102.7	122.5
Shear	≥ C20/25	V_{Rd}	[kN]	50.4	50.4	50.0	78.4	78.4	101.8	112.8	112.8

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Recommended/allowable loads [1)]

Anchor type: WIT-VIZ, M8 - M12

Thread size				M8	M8	M10	M10	M12	M12	M12
Effective anchorage depth		h_{ef}	[mm]	40	50	60	75	75	70	80
Non-cracked concrete										
Tension	C20/25	N_{rec}	[kN]	4.3	8.3	10.9	11.9	15.2	13.7	16.8
	C50/60			6.8	8.6	11.9	11.9	16.7	21.7	25.7
Shear	≥ C20/25	V_{rec}	[kN]	8.0	8.0	12.0	12.0	19.4	19.4	19.4
Cracked concrete										
Tension	C20/25	N_{rec}	[kN]	4.1	5.8	7.6	10.7	10.7	9.6	11.7
	C50/60			6.6	8.6	11.9	11.9	16.7	15.2	18.6
Shear	≥ C20/25	V_{rec}	[kN]	8.0	8.0	12.0	12.0	19.4	19.2	19.4

1) Material safety factor γ_M and safety factor for action γ_L = 1.4 are included. The material safety factor depends on the failure mode.

Anchor type: WIT-VIZ, M12 - M16

Thread size				M12	M12	M12	M12	M16	M16	M16
Effective anchorage depth		h_{ef}	[mm]	95	100	110	125	90	105	125
Non-cracked concrete										
Tension	C20/25	N_{rec}	[kN]	19.0	23.4	23.8	23.8	20.0	25.2	32.7
	C50/60			25.7	27.1	27.1	27.1	31.6	39.9	51.8
Shear	≥ C20/25	V_{rec}	[kN]	19.4	19.4	19.4	19.4	36.0	36.0	36.0
Cracked concrete										
Tension	C20/25	N_{rec}	[kN]	15.2	16.4	18.9	22.9	14.0	17.6	22.9
	C50/60			24.0	25.9	27.1	27.1	22.1	27.9	36.2
Shear	≥ C20/25	V_{rec}	[kN]	19.4	19.4	19.4	19.4	28.0	35.3	36.0

1) Material safety factor γ_M and safety factor for action γ_L = 1.4 are included. The material safety factor depends on the failure mode.

Anchor type: WIT-VIZ, M16 - M24

Thread size				M16	M16	M20	M20	M20	M24	M24	M24
Effective anchorage depth		h_{ef}	[mm]	145	160	115	170	190	170	200	225
Non-cracked concrete											
Tension	C20/25	N_{rec}	[kN]	35.7	42.9	28.9	51.9	61.4	51.9	66.3	79.1
	C50/60			52.9	46.2	40.8	82.1	89.5	82.1	104.8	105.7
Shear	≥ C20/25	V_{rec}	[kN]	36.0	36.0	35.7	56.0	56.0	80.6	80.6	80.6
Cracked concrete											
Tension	C20/25	N_{rec}	[kN]	28.6	33.2	20.2	36.3	42.9	36.3	46.4	55.3
	C50/60			45.3	46.2	32.0	57.5	67.9	57.5	73.3	87.5
Shear	≥ C20/25	V_{rec}	[kN]	36.0	36.0	35.7	56.0	56.0	72.7	80.6	80.6

1) Material safety factor γ_M and safety factor for action γ_L = 1.4 are included. The material safety factor depends on the failure mode.

Design method (simplified)

Simplified version of the design method according to Eurocode 2 - Design of concrete structures - Part 4: Design of fastenings for use in concrete (EN 1992-4):

- Influence factors related to concrete strength, edge distance, spacing and others must be considered when applicable
- Valid for a group of anchors. The influencing factors must then be considered for each edge distance and spacing. The calculated design resistances are on the safe side. They will be lower than the exact values according to EN 1992-4. For an economical optimization, we recommend using the anchor design module of the Würth Technical Software II
- The design method is based on the simplification that no different loads are acting on individual anchors (no eccentricity)
- Concrete strength for design load values is C20/25 unless stated otherwise
- Dry or wet conditions of drill hole, hammer drilling
- Anchor material as specified in anchor material specification table

I. Tension loading

The decisive design resistance in tension is the lowest value of the following failure modes:

1. Steel failure $N_{Rd,s}$
2. Pull-out failure $N_{Rd,p} = N^0_{Rd,p} \cdot f_{b,N}$
3. Concrete cone failure $N_{Rd,c} = N^0_{Rd,c} \cdot f_{b,N} \cdot f_{sx} \cdot f_{sy} \cdot f_{cx,1} \cdot f_{cx,2} \cdot f_{cy}$
4. Concrete splitting failure $N_{Rd,sp} = N^0_{Rd,sp} \cdot f_{b,N} \cdot f_{sx,sp} \cdot f_{sy,sp} \cdot f_{cx,1,sp} \cdot f_{cx,2,sp} \cdot f_{cy,sp} \cdot f_h$

1. Design steel tensile resistance

Table 1: Design value of steel resistance under tension load $N_{Rd,s}$ of a single anchor

Anchor type: WIT-VIZ, M8 - M12

Thread size			**M8**	**M8**	**M10**	**M10**	**M12**	**M12**	**M12**
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	75	70	80
Design steel resistance	$N_{Rd,s}$	[kN]	10.0	12.0	16.7	16.7	23.3	32.7	36.0

Anchor type: WIT-VIZ, M12 - M16

Thread size			**M12**	**M12**	**M12**	**M12**	**M16**	**M16**	**M16**
Effective anchorage depth	h_{ef}	[mm]	95	100	110	125	90	105	125
Design steel resistance	$N_{Rd,s}$	[kN]	36.0	38.0	38.0	38.0	58.7	63.3	74.0

Anchor type: WIT-VIZ, M16 - M24

Thread size			**M16**	**M16**	**M20**	**M20**	**M20**	**M24**	**M24**	**M24**
Effective anchorage depth	h_{ef}	[mm]	145	160	115	170	190	170	200	225
Design steel resistance	$N_{Rd,s}$	[kN]	74.0	64.7	57.1	125.3	125.3	148.0	148.0	148.0

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2. Design pullout resistance

$$N_{Rd,p} = N^0_{Rd,p} \cdot f_{b,N}$$

Table 2: Basic design resistance $N^0_{Rd,p}$ in case of pull-out failure of a single anchor

Anchor type: WIT-VIZ, M8 - M12

Thread size			M8	M8	M10	M10	M12	M12	M12
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	75	70	80
Non-cracked concrete									
Design pull-out resistance	$N^0_{Rd,p}$	[kN]	6.0	11.6	15.2	21.3	21.3	19.2	23.5
Cracked concrete									
Design pull-out resistance	$N^0_{Rd,p}$	[kN]	5.8	8.1	10.7	14.9	14.9	13.4	16.4

Anchor type: WIT-VIZ, M12 - M16

Thread size			M12	M12	M12	M12	M16	M16	M16
Effective anchorage depth	h_{ef}	[mm]	95	100	110	125	90	105	125
Non-cracked concrete									
Design pull-out resistance	$N^0_{Rd,p}$	[kN]	26.7	32.8	33.3	33.3	28.0	35.3	45.8
Cracked concrete									
Design pull-out resistance	$N^0_{Rd,p}$	[kN]	21.3	23.0	26.5	32.1	19.6	24.7	32.1

Anchor type: WIT-VIZ, M16 - M24

Thread size			M16	M16	M20	M20	M20	M24	M24	M24
Effective anchorage depth	h_{ef}	[mm]	145	160	115	170	190	170	200	225
Non-cracked concrete										
Design pull-out resistance	$N^0_{Rd,p}$	[kN]	50.0	60.0	40.4	72.7	85.9	72.7	92.8	110.7
Cracked concrete										
Design pull-out resistance	$N^0_{Rd,p}$	[kN]	40.1	46.5	28.3	50.9	60.1	50.9	64.9	77.5

a. Influence of concrete strength

Table 3: Influence of concrete strength on pull-out resistance

Concrete strength classes (EN 206:2000)			C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Characteristic compressive strength of concrete determined by testing cylinders[1]	f_{ck}	[N/mm²]	12	16	20	25	30	35	40	45	50
Characteristic compressive strength of concrete determined by testing cube[2]	$f_{ck,cube}$	[N/mm²]	15	20	25	30	37	45	50	55	60
Influencing factor	$f_{b,N}$	[-]	0.77	0.89	1.00	1.12	1.22	1.32	1.41	1.50	1.58

[1] strength at 28 days of 150 mm diameter by 300 mm cylinders

[2] strength at 28 days of 150 mm cubes

3. Design concrete cone resistance

$$N_{Rd,c} = N^0_{Rd,c} \cdot f_{b,N} \cdot f_{sx} \cdot f_{sy} \cdot f_{cx,1} \cdot f_{cx,2} \cdot f_{cy}$$

Table 4: Basic design resistance $N^0_{Rd,c}$ in case of concrete cone failure of a single anchor

Anchor type: WIT-VIZ, M8 - M12

Thread size			**M8**	**M8**	**M10**	**M10**	**M12**	**M12**	**M12**
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	75	70	80
Non-cracked concrete									
Design concrete cone resistance	$N^0_{Rd,c}$	[kN]	8.3	11.6	15.2	21.3	21.3	19.2	23.5
Cracked concrete									
Design concrete cone resistance	$N^0_{Rd,c}$	[kN]	5.8	8.1	10.7	14.9	14.9	13.4	16.4

Anchor type: WIT-VIZ, M12 - M16

Thread size			**M12**	**M12**	**M12**	**M12**	**M16**	**M16**	**M16**
Effective anchorage depth	h_{ef}	[mm]	95	100	110	125	90	105	125
Non-cracked concrete									
Design concrete cone resistance	$N^0_{Rd,c}$	[kN]	30.4	32.8	37.8	45.8	28.0	35.3	45.8
Cracked concrete									
Design concrete cone resistance	$N^0_{Rd,c}$	[kN]	21.3	23.0	26.5	32.1	19.6	24.7	32.1

Anchor type: WIT-VIZ, M16 - M24

Thread size			**M16**	**M16**	**M20**	**M20**	**M20**	**M24**	**M24**	**M24**
Effective anchorage depth	h_{ef}	[mm]	145	160	115	170	190	170	200	225
Non-cracked concrete										
Design concrete cone resistance	$N^0_{Rd,c}$	[kN]	57.3	66.4	40.4	72.7	85.9	72.7	92.8	110.7
Cracked concrete										
Design concrete cone resistance	$N^0_{Rd,c}$	[kN]	40.1	46.5	28.3	50.9	60.1	50.9	64.9	77.5

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Table 5: Characteristic edge distance $c_{cr,N}$ and spacing $s_{cr,N}$

Anchor type: WIT-VIZ, M8 - M12

Thread size			M8	M8	M10	M10	M12	M12	M12
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	75	70	80
Spacing	$s_{cr,N}$	[mm]	120.0	150.0	180.0	225.0	225.0	210.0	240.0
Edge distance	$c_{cr,N}$	[mm]	60.0	75.0	90.0	112.5	112.5	105.0	120.0

Anchor type: WIT-VIZ, M12 - M16

Thread size			M12	M12	M12	M12	M16	M16	M16
Effective anchorage depth	h_{ef}	[mm]	95	100	110	125	90	105	125
Spacing	$s_{cr,N}$	[mm]	285.0	300.0	330.0	375.0	270.0	315.0	375.0
Edge distance	$c_{cr,N}$	[mm]	142.5	150.0	165.0	187.5	135.0	157.5	187.5

Anchor type: WIT-VIZ, M16 - M24

Thread size			M16	M16	M20	M20	M20	M24	M24	M24
Effective anchorage depth	h_{ef}	[mm]	145	160	115	170	190	170	200	225
Spacing	$s_{cr,N}$	[mm]	435.0	480.0	345.0	510.0	570.0	510.0	600.0	675.0
Edge distance	$c_{cr,N}$	[mm]	217.5	240.0	172.5	255.0	285.0	255.0	300.0	337.5

a. Influence of concrete strength

Table 6: Influence of concrete strength on concrete cone resistance

Concrete strength classes (EN 206:2000)			C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Characteristic compressive strength of concrete determined by testing cylinders [1)	f_{ck}	[N/mm²]	12	16	20	25	30	35	40	45	50
Characteristic compressive strength of concrete determined by testing cube [2)	$f_{ck,cube}$	[N/mm²]	15	20	25	30	37	45	50	55	60
Influencing factor	$f_{b,N}$	[-]	0.77	0.89	1.00	1.12	1.22	1.32	1.41	1.50	1.58

[1) strength at 28 days of 150 mm diameter by 300 mm cylinders

[2) strength at 28 days of 150 mm cubes

b. Influence of spacing

$$f_{sx} = f_{sy} = \left(1 + \left(n_{x(y)} - 1\right)\frac{s_{x(y)}}{s_{cr,N}}\right) \cdot \frac{1}{n_{x(y)}} \leq 1$$

Table 7: Influence of spacing on concrete cone resistance

Number of fixing per direction	$s/s_{cr,N}$ [1]	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.70	0.75	0.90	0.95	≥ 1.0
2	f_{sx}, f_{sy}	0.55	0.58	0.60	0.63	0.65	0.68	0.70	0.73	0.75	0.78	0.80	0.83	0.85	0.88	0.85	0.88	0.95	0.98	1.00
3	f_{sx}, f_{sy}	0.40	0.43	0.47	0.50	0.53	0.57	0.60	0.63	0.67	0.70	0.73	0.77	0.80	0.83	0.80	0.83	0.93	0.97	1.00
4	f_{sx}, f_{sy}	0.33	0.36	0.40	0.44	0.48	0.51	0.55	0.59	0.63	0.66	0.70	0.74	0.78	0.81	0.78	0.81	0.93	0.96	1.00
5	f_{sx}, f_{sy}	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.76	0.80	0.76	0.80	0.92	0.96	1.00

[1] Choose always the lowest value of the spacing s, when there are different spacings in one row

c. Influence of edge distance

$$f_{cx,1} = 0.7 + 0.3\frac{c_x}{c_{cr,N}} \leq 1 \qquad f_{cx,2} = f_{cy} = \left(1 + \frac{c_{x(y)}}{c_{cr,N}}\right) \cdot \frac{1}{2} \leq 1$$

Table 8: Influence of edge distance on concrete cone resistance

$c/c_{cr,N}$	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.70	0.75	0.90	0.95	≥ 1.0
$f_{cx,1}$	0.73	0.75	0.76	0.78	0.79	0.81	0.82	0.84	0.85	0.87	0.88	0.90	0.91	0.93	0.91	0.93	0.97	0.99	1.00
$f_{cx,2}$, f_{cy}	0.55	0.58	0.60	0.63	0.65	0.68	0.70	0.73	0.75	0.78	0.80	0.83	0.85	0.88	0.85	0.88	0.95	0.98	1.00

4. Design splitting resistance

$$N_{Rd,sp} = N^0_{Rd,sp} \cdot f_{b,N} \cdot f_{sx,sp} \cdot f_{sy,sp} \cdot f_{cx,1,sp} \cdot f_{cx,2,sp} \cdot f_{cy,sp} \cdot f_h$$

No verification of splitting is required if at least one of the conditions is fulfilled:

a) The edge distance in all directions is $c \geq c_{cr,sp}$ for single fasteners and $c \geq 1.2\ c_{cr,sp}$ for fastener groups and the member depth is $h \geq h_{min}$ in both cases

b) The characteristic resistance for concrete cone failure and pull-out failure is calculated for cracked concrete and reinforcement resists the splitting forces and limits the crack width to $w_k \leq 0.3$ mm

Table 9: Design resistance $N^0_{Rd,sp}$ in case of concrete splitting failure of a single anchor

Anchor type: WIT-VIZ, M8 - M12

Thread size			**M8**	**M8**	**M10**	**M10**	**M12**	**M12**	**M12**
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	75	70	80
Non-cracked concrete									
Design splitting resistance	$N^0_{Rd,sp}$	[kN]	5.0	6.0	10.7	13.3	13.3	13.3	23.5

Anchor type: WIT-VIZ, M12 - M16

Thread size			**M12**	**M12**	**M12**	**M12**	**M16**	**M16**	**M16**
Effective anchorage depth	h_{ef}	[mm]	95	100	110	125	90	105	125
Non-cracked concrete									
Design splitting resistance	$N^0_{Rd,sp}$	[kN]	20.0	26.7	26.7	26.7	26.7	33.3	33.3

Anchor type: WIT-VIZ, M16 - M24

Thread size			**M16**	**M16**	**M20**	**M20**	**M20**	**M24**	**M24**	**M24**
Effective anchorage depth	h_{ef}	[mm]	145	160	115	170	190	170	200	225
Non-cracked concrete										
Design splitting resistance	$N^0_{Rd,sp}$	[kN]	40.0	53.3	40.4	72.7	76.7	72.7	92.8	93.3

Table 10: Characteristic edge distance $c_{cr,sp}$ and spacing $s_{cr,sp}$

Anchor type: WIT-VIZ, M8 - M12

Thread size			M8	M8	M10	M10	M12	M12	M12
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	75	70	80
Characteristic spacing	$s_{cr, sp}$	[mm]	120.0	150.0	180.0	225.0	225.0	210.0	240.0
Characteristic edge distance	$c_{cr, sp}$	[mm]	60.0	75.0	90.0	112.5	112.5	105.0	120.0
Minimum member thickness	h_{min}	[mm]	100	100	120	150	150	140	160

Anchor type: WIT-VIZ, M12 - M16

Thread size			M12	M12	M12	M12	M16	M16	M16
Effective anchorage depth	h_{ef}	[mm]	95	100	110	125	90	105	125
Characteristic spacing	$s_{cr, sp}$	[mm]	285.0	300.0	330.0	375.0	270.0	315.0	375.0
Characteristic edge distance	$c_{cr, sp}$	[mm]	142.5	150.0	165.0	187.5	135.0	157.5	187.5
Minimum member thickness	h_{min}	[mm]	190	200	220	250	180	200	250

Anchor type: WIT-VIZ, M16 - M24

Thread size			M16	M16	M20	M20	M20	M24	M24	M24
Effective anchorage depth	h_{ef}	[mm]	145	160	115	170	190	170	200	225
Characteristic spacing	$s_{cr, sp}$	[mm]	435.0	480.0	345.0	510.0	570.0	510.0	600.0	675.0
Characteristic edge distance	$c_{cr, sp}$	[mm]	217.5	240.0	172.5	255.0	285.0	255.0	300.0	337.5
Minimum member thickness	h_{min}	[mm]	290	320	230	340	380	340	400	450

a. Influence of concrete strength

Table 11: Influence of concrete strength on splitting resistance

Concrete strength classes (EN 206:2000)			C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Characteristic compressive strength of concrete determined by testing cylinders [1)]	f_{ck}	[N/mm²]	12	16	20	25	30	35	40	45	50
Characteristic compressive strength of concrete determined by testing cube [2)]	$f_{ck,cube}$	[N/mm²]	15	20	25	30	37	45	50	55	60
Influencing factor	$f_{b,N}$	[-]	0.77	0.89	1.00	1.12	1.22	1.32	1.41	1.50	1.58

[1)] strength at 28 days of 150 mm diameter by 300 mm cylinders

[2)] strength at 28 days of 150 mm cubes

b. Influence of spacing

$$f_{sx,sp} = f_{sy,sp} = \left(1 + \left(n_{x(y)} - 1\right)\frac{s_{x(y)}}{s_{cr,sp}}\right) \cdot \frac{1}{n_{x(y)}} \leq 1$$

Table 12: Influence of spacing on splitting resistance

Number of fixing per direction	$s/s_{cr,sp}$ [1)]	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.70	0.75	0.90	0.95	≥ 1.0
2	$f_{sx,sp}$, $f_{sy,sp}$	0.55	0.58	0.60	0.63	0.65	0.68	0.70	0.73	0.75	0.78	0.80	0.83	0.85	0.88	0.85	0.88	0.95	0.98	1.00
3	$f_{sx,sp}$, $f_{sy,sp}$	0.40	0.43	0.47	0.50	0.53	0.57	0.60	0.63	0.67	0.70	0.73	0.77	0.80	0.83	0.80	0.83	0.93	0.97	1.00
4	$f_{sx,sp}$, $f_{sy,sp}$	0.33	0.36	0.40	0.44	0.48	0.51	0.55	0.59	0.63	0.66	0.70	0.74	0.78	0.81	0.78	0.81	0.93	0.96	1.00
5	$f_{sx,sp}$, $f_{sy,sp}$	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.76	0.80	0.76	0.80	0.92	0.96	1.00

[1)] Choose always the lowest value of the spacing s, when there are different spacings in one row

c. Influence of edge distance

$$f_{cx,1,sp} = 0.7 + 0.3\frac{c_x}{c_{cr,sp}} \leq 1 \qquad f_{cx,2,sp} = f_{cy,sp} = \left(1 + \frac{c_{x(y)}}{c_{cr,sp}}\right) \cdot \frac{1}{2} \leq 1$$

Table 13: Influence of edge distance on splitting resistance

$c/c_{cr,sp}$	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.70	0.75	0.90	0.95	≥ 1.0
$f_{cx,1,sp}$	0.73	0.75	0.76	0.78	0.79	0.81	0.82	0.84	0.85	0.87	0.88	0.90	0.91	0.93	0.91	0.93	0.97	0.99	1.00
$f_{cx,2,sp}$, $f_{cy,sp}$	0.55	0.58	0.60	0.63	0.65	0.68	0.70	0.73	0.75	0.78	0.80	0.83	0.85	0.88	0.85	0.88	0.95	0.98	1.00

d. Influence of concrete member thickness

$$f_h = \left(\frac{h}{h_{min}}\right)^{2/3} \leq max\left(1; \left(\frac{h_{ef} + 1\,5c_1}{h_{min}}\right)^{2/3}\right)$$

Table 14: Influence of concrete member thickness on splitting resistance

h/h_{min}	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.30	2.40	2.70	2.80	2.90
f_h	1.00	1.07	1.13	1.19	1.25	1.31	1.37	1.42	1.48	1.53	1.59	1.64	1.69	1.74	1.79	1.74	1.79	1.94	1.99	2.00

II. Shear loading

The decisive design resistance in shear is the lowest value of the following failure modes:

1. Steel failure $V_{Rd,s}$
2. Concrete pry-out failure $V_{Rd,c} = k \cdot N_{Rd,c}$
3. Concrete edge failure $V_{Rd,c} = V^0_{Rd,c} \cdot f_{b,V} \cdot f_{s,V} \cdot f_{c2,V} \cdot f_a \cdot f_h$

1. Design steel shear resistance

Table 15: Design value of steel resistance $V_{Rd,s}$ of a single anchor

Anchor type: WIT-VIZ, M8 - M12

Thread size			**M8**	**M8**	**M10**	**M10**	**M12**	**M12**	**M12**
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	75	70	80
Design steel resistance	$V_{Rd,s}$	[kN]	11.2	11.2	16.8	16.8	27.2	27.2	27.2

Anchor type: WIT-VIZ, M12 - M16

Thread size			**M12**	**M12**	**M12**	**M12**	**M16**	**M16**	**M16**
Effective anchorage depth	h_{ef}	[mm]	95	100	110	125	90	105	125
Design steel resistance	$V_{Rd,s}$	[kN]	27.2	27.2	27.2	27.2	50.4	50.4	50.4

Anchor type: WIT-VIZ, M16 - M24

Thread size			**M16**	**M16**	**M20**	**M20**	**M20**	**M24**	**M24**	**M24**
Effective anchorage depth	h_{ef}	[mm]	145	160	115	170	190	170	200	225
Design steel resistance	$V_{Rd,s}$	[kN]	50.4	50.4	50.0	78.4	78.4	112.8	112.8	112.8

2. Concrete pry-out resistance

$$V_{Rd,c} = k_8 \cdot N_{Rd,c}$$

Table 16: factor k_8 for calculating design pry-out resistance

Anchor type: WIT-VIZ, M8 - M12

Thread size			**M8**	**M8**	**M10**	**M10**	**M12**	**M12**	**M12**
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	75	70	80
Concrete pry-out resistance factor	k_8	[-]	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Anchor type: WIT-VIZ, M12 - M16

Thread size			**M12**	**M12**	**M12**	**M12**	**M16**	**M16**	**M16**
Effective anchorage depth	h_{ef}	[mm]	95	100	110	125	90	105	125
Concrete pry-out resistance factor	k_8	[-]	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Anchor type: WIT-VIZ, M16 - M24

Thread size			**M16**	**M16**	**M20**	**M20**	**M20**	**M24**	**M24**	**M24**
Effective anchorage depth	h_{ef}	[mm]	145	160	115	170	190	170	200	225
Concrete pry-out resistance factor	k_8	[-]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

W-VIZ/A4

3. Concrete edge resistance

$$V_{Rd,c} = V^0_{Rd,c} \cdot f_{b,V} \cdot f_{s,V} \cdot f_{c2,V} \cdot f_a \cdot f_h$$

Verification of concrete edge failure may be omitted for single fasteners and groups with an edge distance in all directions $c \geq \max\ (10\ h_{ef}\ ;\ 60\ d)$. For anchorages with more than one edge, the resistance for all edges shall be calculated. The smallest value should be used in the verification.

Table 17: Design resistance $V^0_{Rd,c}$ in case of concrete edge failure

Anchor type: WIT-VIZ, M8 - M12

Thread size	M8		M8		M10		M10		M12		M12		M12	
h_{ef} [mm]	40		50		60		75		75		70		80	
Edge distance c_1	$V^0_{Rd,c}$													
[mm]	[kN]													
	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked
40	3.0	2.1	3.1	2.2	-	2.4	-	2.5	-	-	-	-	-	-
45	3.5	2.5	3.7	2.6	-	2.8	-	2.9	-	-	-	-	-	-
50	4.1	2.9	4.2	3.0	4.5	3.2	4.7	3.4	4.7	3.4	-	-	-	3.5
55	4.6	3.3	4.8	3.4	5.1	3.6	5.4	3.8	5.4	3.8	5.4	3.8	5.6	4.0
60	5.2	3.7	5.4	3.8	5.7	4.1	6.0	4.3	6.0	4.3	6.1	4.3	6.3	4.4
65	5.8	4.1	6.0	4.3	6.4	4.5	6.7	4.7	6.7	4.7	6.7	4.8	6.9	4.9
70	6.4	4.5	6.6	4.7	7.0	5.0	7.3	5.2	7.3	5.2	7.4	5.3	7.6	5.4
75	7.0	5.0	7.3	5.2	7.7	5.5	8.0	5.7	8.0	5.7	8.1	5.8	8.3	5.9
80	7.7	5.4	8.0	5.6	8.4	6.0	8.8	6.2	8.8	6.2	8.8	6.3	9.1	6.4
85	8.4	5.9	8.6	6.1	9.1	6.5	9.5	6.7	9.5	6.7	9.6	6.8	9.8	7.0
90	9.0	6.4	9.3	6.6	9.8	7.0	10.2	7.2	10.2	7.2	10.3	7.3	10.6	7.5
95	9.7	6.9	10.0	7.1	10.6	7.5	11.0	7.8	11.0	7.8	11.1	7.9	11.4	8.1
100	10.4	7.4	10.8	7.6	11.3	8.0	11.8	8.3	11.8	8.3	11.9	8.4	12.2	8.6
110	11.9	8.4	12.3	8.7	12.9	9.1	13.4	9.5	13.4	9.5	13.5	9.6	13.8	9.8
120	13.4	9.5	13.8	9.8	14.5	10.3	15.0	10.6	15.0	10.6	15.2	10.7	15.5	11.0
130	15.0	10.6	15.5	11.0	16.2	11.5	16.7	11.9	16.7	11.9	16.9	12.0	17.3	12.2
140	16.7	11.8	17.1	12.1	17.9	12.7	18.5	13.1	18.5	13.1	18.7	13.2	19.1	13.5
150	18.3	13.0	18.9	13.4	19.7	13.9	20.3	14.4	20.3	14.4	20.5	14.5	20.9	14.8
160	20.1	14.2	20.6	14.6	21.5	15.2	22.2	15.7	22.2	15.7	22.4	15.9	22.8	16.2
170	21.9	15.5	22.4	15.9	23.4	16.6	24.1	17.1	24.1	17.1	24.3	17.2	24.8	17.6
180	23.7	16.8	24.3	17.2	25.3	17.9	26.1	18.5	26.1	18.5	26.3	18.6	26.8	19.0
190	25.6	18.1	26.2	18.6	27.3	19.3	28.1	19.9	28.1	19.9	28.3	20.0	28.8	20.4
200	27.5	19.5	28.2	19.9	29.3	20.7	30.1	21.3	30.1	21.3	30.4	21.5	30.9	21.9
250	37.6	26.7	38.5	27.3	39.9	28.3	41.0	29.0	41.0	29.0	41.3	29.2	42.0	29.8
300	48.8	34.5	49.8	35.3	51.5	36.5	52.8	37.4	52.8	37.4	53.2	37.7	54.0	38.3
350	60.7	43.0	61.9	43.9	64.0	45.3	65.5	46.4	65.5	46.4	65.9	46.7	66.9	47.4
400	73.4	52.0	74.9	53.0	77.2	54.7	79.0	55.9	79.0	55.9	79.4	56.3	80.6	57.1
450	86.9	61.6	88.5	62.7	91.2	64.6	93.2	66.0	93.2	66.0	93.7	66.4	95.0	67.3
500	101.1	71.6	102.9	72.9	105.9	75.0	108.1	76.6	108.1	76.6	108.7	77.0	110.2	78.0
550	115.9	82.1	117.9	83.5	121.2	85.9	123.7	87.6	123.7	87.6	124.3	88.1	126.0	89.2
600	131.3	93.0	133.5	94.6	137.2	97.2	139.9	99.1	139.9	99.1	140.6	99.6	142.4	100.9
650	-	-	-	-	153.8	108.9	156.7	111.0	156.7	111.0	157.5	111.6	159.4	112.9
700	-	-	-	-	170.9	121.0	174.1	123.3	174.1	123.3	174.9	123.9	177.0	125.4
750	-	-	-	-	-	-	192.0	136.0	192.0	136.0	193.0	136.7	195.2	138.3
800	-	-	-	-	-	-	-	-	-	-	211.5	149.8	213.9	151.5

Anchor type: WIT-VIZ, M12 - M16

Thread size	M12		M12		M12		M12		M16		M16		M16	
h_{ef} [mm]	95		100		110		125		90		105		125	
Edge distance c_1	$V^0_{Rd,c}$													
[mm]	[kN]													
	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked
50	-	3.7	-	3.7	-	3.8	-	4.0	5.4	3.8	-	4.0	-	-
55	5.8	4.1	5.9	4.2	6.1	4.3	6.3	4.4	6.1	4.3	-	4.5	-	-
60	6.5	4.6	6.6	4.7	6.8	4.8	7.0	4.9	6.7	4.8	7.0	5.0	7.4	5.2
65	7.2	5.1	7.3	5.2	7.5	5.3	7.7	5.5	7.5	5.3	7.8	5.5	8.1	5.8
70	7.9	5.6	8.0	5.7	8.2	5.8	8.5	6.0	8.2	5.8	8.5	6.0	8.9	6.3
75	8.7	6.1	8.8	6.2	9.0	6.3	9.2	6.5	8.9	6.3	9.3	6.6	9.7	6.9
80	9.4	6.7	9.5	6.7	9.7	6.9	10.0	7.1	9.7	6.9	10.1	7.1	10.5	7.4
85	10.2	7.2	10.3	7.3	10.5	7.4	10.8	7.7	10.5	7.4	10.9	7.7	11.3	8.0
90	11.0	7.8	11.1	7.9	11.3	8.0	11.6	8.2	11.3	8.0	11.7	8.3	12.2	8.6
95	11.8	8.3	11.9	8.4	12.1	8.6	12.5	8.8	12.1	8.6	12.5	8.9	13.0	9.2
100	12.6	8.9	12.7	9.0	13.0	9.2	13.3	9.4	13.0	9.2	13.4	9.5	13.9	9.9
110	14.3	10.1	14.4	10.2	14.7	10.4	15.1	10.7	14.7	10.4	15.1	10.7	15.7	11.1
120	16.0	11.3	16.2	11.4	16.4	11.6	16.9	11.9	16.4	11.6	16.9	12.0	17.6	12.5
130	17.8	12.6	18.0	12.7	18.3	12.9	18.7	13.3	18.3	12.9	18.8	13.3	19.5	13.8
140	19.6	13.9	19.8	14.0	20.1	14.3	20.6	14.6	20.1	14.3	20.7	14.7	21.5	15.2
150	21.5	15.3	21.7	15.4	22.1	15.6	22.6	16.0	22.1	15.6	22.7	16.1	23.5	16.6
160	23.5	16.6	23.7	16.8	24.1	17.0	24.6	17.4	24.1	17.0	24.7	17.5	25.5	18.1
170	25.5	18.0	25.7	18.2	26.1	18.5	26.7	18.9	26.1	18.5	26.8	19.0	27.7	19.6
180	27.5	19.5	27.7	19.6	28.2	19.9	28.8	20.4	28.2	19.9	28.9	20.5	29.8	21.1
190	29.6	21.0	29.8	21.1	30.3	21.4	30.9	21.9	30.3	21.4	31.1	22.0	32.0	22.7
200	31.7	22.5	32.0	22.6	32.4	23.0	33.1	23.5	32.4	23.0	33.3	23.6	34.3	24.3
250	43.0	30.4	43.3	30.7	43.9	31.1	44.7	31.7	43.9	31.1	44.9	31.8	46.2	32.7
300	55.2	39.1	55.6	39.4	56.3	39.9	57.3	40.6	56.3	39.9	57.5	40.7	59.0	41.8
350	68.3	48.4	68.7	48.7	69.5	49.3	70.7	50.1	69.6	49.3	71.0	50.3	72.7	51.5
400	82.2	58.2	82.7	58.6	83.6	59.2	84.9	60.2	83.6	59.2	85.3	60.4	87.2	61.8
450	96.8	68.6	97.4	69.0	98.4	69.7	99.9	70.8	98.5	69.7	100.3	71.0	102.5	72.6
500	112.1	79.4	112.8	79.9	113.9	80.7	115.6	81.9	114.0	80.7	116.0	82.2	118.5	83.9
550	128.2	90.8	128.8	91.3	130.1	92.2	132.0	93.5	130.2	92.2	132.4	93.8	135.2	95.7
600	144.8	102.6	145.5	103.1	147.0	104.1	149.0	105.5	147.0	104.1	149.5	105.9	152.5	108.0
650	162.0	114.8	162.8	115.4	164.4	116.5	166.6	118.0	164.5	116.5	167.1	118.4	170.4	120.7
700	179.9	127.4	180.7	128.0	182.4	129.2	184.8	130.9	182.5	129.3	185.4	131.3	188.9	133.8
750	198.3	140.4	199.2	141.1	201.0	142.4	203.5	144.2	201.1	142.4	204.2	144.6	207.9	147.3
800	217.2	153.8	218.2	154.6	220.1	155.9	222.8	157.8	220.2	156.0	223.6	158.3	227.5	161.2
850	236.6	167.6	237.7	168.4	239.8	169.8	242.6	171.9	239.9	169.9	243.4	172.4	247.7	175.4
900	256.6	181.8	257.7	182.6	259.9	184.1	263.0	186.3	260.1	184.2	263.8	186.9	268.3	190.1
950	277.0	196.2	278.3	197.1	280.6	198.7	283.8	201.0	280.7	198.8	284.7	201.7	289.5	205.0
1000	-	-	299.3	212.0	301.7	213.7	305.1	216.1	301.9	213.8	306.1	216.8	311.1	220.4
1100	-	-	-	-	345.3	244.6	349.1	247.3	-	-	-	-	355.8	252.0
1200	-	-	-	-	-	-	394.9	279.7	-	-	-	-	402.2	284.9
1300	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1400	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1600	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1700	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1900	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2125	-	-	-	-	-	-	-	-	-	-	-	-	-	-

W-VIZ/A4

Anchor type: WIT-VIZ, M16 - M24

Thread size	M16		M16		M20		M20		M20	
h_{ef} [mm]	145		160		115		170		190	
Edge distance c_1	$V^0_{Rd,c}$									
[mm]	[kN]									
	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked
60	7.7	5.5	7.9	5.6	-	-	-	-	-	-
65	8.5	6.0	8.7	6.2	-	-	-	-	-	-
70	9.3	6.6	9.6	6.8	-	-	-	-	-	-
75	10.1	7.2	10.4	7.4	-	-	-	-	-	-
80	10.9	7.7	11.2	8.0	10.7	7.6	12.2	8.6	12.6	8.9
85	11.8	8.3	12.1	8.6	11.5	8.2	13.1	9.3	13.6	9.6
90	12.6	9.0	13.0	9.2	12.4	8.8	14.0	9.9	14.5	10.3
95	13.5	9.6	13.9	9.8	13.3	9.4	15.0	10.6	15.5	11.0
100	14.4	10.2	14.8	10.5	14.2	10.0	15.9	11.3	16.5	11.7
110	16.3	11.5	16.7	11.8	16.0	11.3	17.9	12.7	18.5	13.1
120	18.2	12.9	18.6	13.2	17.8	12.6	19.9	14.1	20.5	14.5
130	20.1	14.3	20.6	14.6	19.8	14.0	22.0	15.6	22.6	16.0
140	22.1	15.7	22.6	16.0	21.8	15.4	24.1	17.1	24.8	17.6
150	24.2	17.1	24.7	17.5	23.8	16.9	26.3	18.6	27.0	19.2
160	26.3	18.6	26.8	19.0	25.9	18.3	28.6	20.2	29.3	20.8
170	28.5	20.2	29.0	20.6	28.0	19.9	30.8	21.8	31.6	22.4
180	30.7	21.7	31.3	22.1	30.2	21.4	33.2	23.5	34.0	24.1
190	32.9	23.3	33.5	23.8	32.4	23.0	35.5	25.2	36.4	25.8
200	35.2	24.9	35.9	25.4	34.7	24.6	38.0	26.9	38.9	27.5
250	47.3	33.5	48.1	34.1	46.7	33.1	50.7	35.9	51.8	36.7
300	60.4	42.8	61.3	43.4	59.7	42.3	64.4	45.6	65.7	46.5
350	74.3	52.6	75.4	53.4	73.5	52.0	79.0	55.9	80.5	57.0
400	89.0	63.1	90.3	64.0	88.1	62.4	94.4	66.8	96.1	68.1
450	104.5	74.0	105.9	75.0	103.5	73.3	110.5	78.3	112.4	79.6
500	120.7	85.5	122.3	86.6	119.6	84.7	127.4	90.2	129.5	91.7
550	137.6	97.5	139.4	98.7	136.4	96.6	144.9	102.7	147.3	104.3
600	155.2	109.9	157.0	111.2	153.8	109.0	163.1	115.5	165.7	117.3
650	173.3	122.7	175.3	124.2	171.9	121.7	181.9	128.9	184.7	130.8
700	192.0	136.0	194.2	137.6	190.5	134.9	201.3	142.6	204.3	144.7
750	211.3	149.7	213.7	151.3	209.7	148.5	221.3	156.8	224.5	159.0
800	231.2	163.7	233.7	165.5	229.4	162.5	241.8	171.3	245.2	173.7
850	251.5	178.2	254.2	180.1	249.7	176.8	262.9	186.2	266.5	188.8
900	272.4	193.0	275.2	195.0	270.4	191.6	284.5	201.5	288.3	204.2
950	293.8	208.1	296.8	210.2	291.7	206.6	306.5	217.1	310.6	220.0
1000	315.7	223.6	318.8	225.8	313.5	222.0	329.1	233.1	333.3	236.1
1100	360.8	255.6	364.3	258.0	358.4	253.9	375.6	266.1	380.3	269.4
1200	407.7	288.8	411.5	291.5	405.1	287.0	424.0	300.3	429.1	303.9
1300	456.4	323.3	460.5	326.2	453.5	321.3	474.1	335.8	479.6	339.7
1400	506.6	358.9	511.1	362.1	-	-	525.8	372.4	531.8	376.7
1500	-	-	563.3	399.0	-	-	579.1	410.2	585.5	414.8
1600	-	-	617.1	437.1	-	-	634.0	449.1	640.9	453.9
1700	-	-	-	-	-	-	690.4	489.0	697.7	494.2
1800	-	-	-	-	-	-	-	-	755.9	535.4
1900	-	-	-	-	-	-	-	-	815.6	577.7

Anchor type: WIT-VIZ, M24

Thread size	M24		M24		M24	
h_{ef} [mm]	170		200		225	
Edge distance c_1	$V^0_{Rd,c}$					
[mm]	[kN]					
	non-cracked	cracked	non-cracked	cracked	non-cracked	cracked
80	12.4	8.8	-	9.3	-	9.7
85	13.3	9.4	-	9.9	-	10.3
90	14.3	10.1	-	10.6	-	11.1
95	15.2	10.8	-	11.3	-	11.8
100	16.2	11.5	-	12.0	-	12.5
110	18.2	12.9	19.1	13.5	19.7	14.0
120	20.2	14.3	21.2	15.0	21.9	15.5
130	22.3	15.8	23.3	16.5	24.1	17.1
140	24.5	17.3	25.5	18.1	26.4	18.7
150	26.7	18.9	27.8	19.7	28.7	20.3
160	29.0	20.5	30.1	21.3	31.1	22.0
170	31.3	22.1	32.5	23.0	33.5	23.7
180	33.6	23.8	34.9	24.7	35.9	25.5
190	36.0	25.5	37.4	26.5	38.4	27.2
200	38.5	27.2	39.9	28.2	41.0	29.0
250	51.3	36.3	53.0	37.6	54.4	38.5
300	65.1	46.1	67.1	47.6	68.7	48.7
350	79.8	56.5	82.1	58.2	84.0	59.5
400	95.3	67.5	97.9	69.4	100.0	70.8
450	111.6	79.0	114.5	81.1	116.8	82.7
500	128.6	91.1	131.8	93.4	134.3	95.2
550	146.2	103.6	149.8	106.1	152.6	108.1
600	164.5	116.5	168.4	119.3	171.4	121.4
650	183.5	129.9	187.7	132.9	190.9	135.2
700	203.0	143.8	207.5	147.0	211.0	149.4
750	223.1	158.0	227.9	161.4	231.6	164.1
800	243.7	172.6	248.9	176.3	252.8	179.1
850	264.9	187.6	270.4	191.5	274.6	194.5
900	286.6	203.0	292.4	207.1	296.8	210.3
950	308.8	218.7	314.9	223.1	319.6	226.4
1000	331.5	234.8	337.9	239.4	342.9	242.9
1100	378.3	267.9	385.4	273.0	390.8	276.8
1200	426.9	302.4	434.6	307.8	440.5	312.0
1300	477.2	338.0	485.6	344.0	492.0	348.5
1400	529.2	374.9	538.3	381.3	545.2	386.2
1500	582.8	412.8	592.5	419.7	599.9	425.0
1600	638.0	451.9	648.3	459.2	656.2	464.8
1700	694.6	492.0	705.6	499.8	714.1	505.8
1800	-	-	764.4	541.4	773.3	547.8
1900	-	-	824.5	584.0	834.0	590.7
2000	-	-	886.1	627.6	896.0	634.7
2125	-	-	-	-	975.5	691.0
2250	-	-	-	-	1056.9	748.7

W-VIZ/A4

a. Influence of concrete strength

Table 18: Influence of concrete strength on concrete edge resistance

Concrete strength classes (EN 206:2000)			C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Characteristic compressive strength of concrete determined by testing cylinders[1]	f_{ck}	[N/mm²]	12	16	20	25	30	35	40	45	50
Characteristic compressive strength of concrete determined by testing cube[2]	$f_{ck,cube}$	[N/mm²]	15	20	25	30	37	45	50	55	60
Influencing factor	$f_{b,N}$	[-]	0.77	0.89	1.00	1.12	1.22	1.32	1.41	1.50	1.58

[1] strength at 28 days of 150 mm diameter by 300 mm cylinders

[2] strength at 28 days of 150 mm cubes

b. Influence of spacing

In groups loaded perpendicular to the edge only two adjacent anchors closest and parallel to the edge carry the load. The smallest spacing should be used for the verification.

$$f_{s,V} = \frac{1}{3} \cdot \frac{s}{c_1} + 1 \leq 2$$

Table 19: Influence of spacing on concrete edge resistance

s/c_1[1]	0.50	0.60	0.70	0.80	0.90	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40	2.60	2.80	2.60	2.80
$f_{s,V}$	1.17	1.20	1.23	1.27	1.30	1.33	1.40	1.47	1.53	1.60	1.67	1.73	1.80	1.87	1.93	1.87	1.93

[1] Always choose the lowest value of the spacing s, when there are different spacing in the row closest to the edge.

c. Influence of edge distance

$$f_{c2,V} = \left(\frac{1}{2} + \frac{1}{3}\frac{c_2}{c_1}\right)\left(0.7 + 0.3\frac{c_2}{1\,5c_1}\right) \leq 1$$

Table 20: Influence of edge distance on concrete edge resistance

c_2/c_1[1]	1.00	1.10	1.20	1.30	1.40	1.50
$f_{c,V}$	0.75	0.80	0.85	0.90	0.95	1.00

[1] Distance to the second edge: $c_1 \leq c_2$

d. Influence of load direction

$$f_\alpha = \sqrt{\frac{1}{\cos^2\alpha_V + \left(\frac{\sin\alpha_V}{2}\right)^2}} \leq 2$$

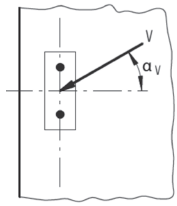


Table 21: Influence of load direction on concrete edge resistance

α[1]	0	10	20	30	40	50	60	70	80	90
$f_{\alpha,V}$	1.00	1.01	1.05	1.11	1.20	1.34	1.51	1.72	1.92	2.00

[1] For a ≥ 90° the component of the shear load acting away from the edge may be neglected and the verification may be done with component acting parallel to the edge only.

e. Influence of concrete member thickness

$$f_{h,V} = \left(\frac{h}{1.5c_1}\right)^{1/2}$$

Table 22: Influence of concrete member thickness on concrete edge resistance

h/c_1	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	≥ 1.50
$f_{h.V}$	0.26	0.37	0.45	0.52	0.58	0.63	0.68	0.73	0.77	0.82	0.86	0.89	0.93	0.97	1.00

Structural verification

N_{Ed} = Design value of tension load acting on a fastener
V_{Ed} = Design value of a shear load acting on a fastener

	Failure mode	Verification
1	Steel failure of fastener [1]	$\left(\frac{N_{Ed}}{N_{Rd}}\right)^2 + \left(\frac{V_{Ed}}{V_{Rd}}\right)^2 \leq 1$ If N_{Ed} and V_{Ed} are different for the individual fasteners of the group, the interaction shall be verified for all fasteners.
2	Failure modes other than steel failure	$\left(\frac{N_{Ed}}{N_{Rd,i}}\right)^{1.5} + \left(\frac{V_{Ed}}{V_{Rd,i}}\right)^{1.5} \leq 1$ or $\left(\frac{N_{Ed}}{N_{Rd,i}}\right) + \left(\frac{V_{Ed}}{V_{Rd,i}}\right) \leq 1{,}2$ With $N_{Ed} / N_{Rd,i} \leq 1$ and $V_{Ed} / V_{Rd,i} \leq 1$ The largest value of $N_{Ed} / N_{Rd,i}$ and $V_{Ed} / V_{Rd,i}$ for the different failure modes shall be taken.

[1] This verification is not required in case of shear load with lever arm

W-VIZ/A4

Mechanical characteristics

Anchor type: WIT-VIZ, M8 - M24

Thread size			M8	M8	M10	M10	M12	M12	M12	M12	M12	M12	M12	M16	M16	M16	M16	M20	M20	M20	M24	M24	M24
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	75	70	80	95	100	110	125	90	105	125	145	115	170	190	170	200	225
Governing cross section																							
Stressed cross section	A_s	[mm²]	18.9	22.9	32.2	32.2	43.0	62.2	69.4	69.4	77.0	77.0	77.0	111.2	120.8	141.0	141.0	162.9	237.8	237.8	280.6	280.6	280.6
Section modulus	W	[mm³]	11.6	15.5	25.7	25.7	39.8	69.2	81.5	81.5	95.3	95.3	95.3	165.4	187.2	236.2	236.2	293.1	517.2	517.2	662.8	662.8	662.8
Yield strength	f_y	[N/mm²]	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	560	560	560	560	560	560
Tensile strength	f_u	[N/mm²]	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	700	700	700	700	700	700
Stressed cross section of threaded part																							
Stressed cross section	A_s	[mm²]	36.6	36.6	58.0	58.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	157.0	157.0	157.0	157.0	245.0	245.0	245.0	352.0	352.0	352.0
Section modulus	W	[mm³]	31.2	31.2	62.3	62.3	109.2	109.2	109.2	109.2	109.2	109.2	109.2	277.5	277.5	277.5	277.5	540.9	540.9	540.9	931.5	931.5	931.5
Yield strength	f_y	[N/mm²]	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	560	560	560	560	560	560
Tensile strength	f_u	[N/mm²]	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	700	700	700	700	700	700
Design bending moment	$M^0_{Rd,s}$	[Nm]	24	24	48	48	84	84	84	84	84	84	84	213	213	213	213	324	363	363	627	627	627

Material specifications

No.	Part	Stainless steel A4	High corrosion resistant steel (HCR)
1	**Anchor rod**	Stainless steel, 1.4401, 1.4404, 1.4571, 1.4362, EN 10088:2005, coated	High corrosion resistant steel 1.4529, 1.4565 acc. to EN 10088:2005, coated
2a	**Washer**	Stainless steel 1.4401, 1.4571, EN 10088:2005	High corrosion resistant steel 1.4529, 1.4565 acc. to EN 10088:2005, coated
2b	**Washer with bore**		
3	**Hexagon nut**	ISO 3506:2009 A4-70, 1.4401, 1.4571, EN 10088-2005	ISO 3506:2009, Property class 70, high corrosion resistant steel 1.4529 or 1.4565, EN 10088:2005
4	**Mortar cartridge**	Vinyl Ester Resin, styrene free, mixing ratio 1:10	

Chemical resistance

Chemical Agent	Concentration	Resistant	Not Resistant
Acetic acid	>40		●
Acetic acid	10	●	
Acetone	5		●
Ammonia, aqueous solution	conc.		●
Aniline			●
Calcium hydroxide			●
Carbon tetrachloride		●	
Diesel fuel		●	
Boric Acid, aqueous solution	all	●	
Glycol		●	
Formic acid	30	●	
Calcium hydroxide, suspended in water	all		●
Caustic soda solution	all		●
Citric acid	50	●	
Hydrochloric acid	all		●
Lactic acid	<80	●	
Sea water		●	
Formaldehyde, aqueous solution	20		●
Fuel Oil		●	
Glycol (Ethylene glycol)		●	
Isopropyl alcohol		●	
Linseed oil		●	
Magnesium chloride, aqueous solution	all	●	
Methanol			●
Nitric acid	30		●
Oleic acid		●	
Phenol, aqueous solution	all		●
Phosphoric acid	<80	●	
Potassium carbonate, aqueous solution	all		●
Potassium chlorite, aqueous solution	all	●	
Potassium nitrate, aqueous solution	all	●	
Sodium Chloride, aqueous solution	all	●	
Sodium phosphate, aqueous solution	all	●	
Sodium silicate	all		●
Sulfuric acid	<50	●	
Tartaric acid		●	
Toluene			●
Trichloroethylene			●
Ethanol	96		●

Results shown in the table are applicable to brief periods of chemical contact with full cured adhesive (e.g. temporary contact with adhesive during a spill).

W-VIZ/A4

Properties of adhesive

Temperature range	Base material temperature	Maximum long term base material temperature	Maximum short term base material temperature
Temperature range I	-40 °C to +80 °C	+50 °C	+80 °C
Temperature range II	-40 °C to +120 °C	+72 °C	+120 °C

Property		Testing method	Results
Stability			
UV-resistance (sunlight)			not resistant
Temperature resistance			120 °C
Water resistancy			resistant
Cleaning agents			1% tenside solution: no effects
Physical properties			
Flexural properties	Flexural strength	DIN EN 196-1	after 24 hours: 19.2 N/mm²
Compressive properties	Compressive strength	DIN EN 196-1	after 24 hours: ≥ 96.1 N/mm²
Dynamic modulus of elasticity		DIN EN 12504-4	after 24 hours: 13.79 GPa
Thermal conductivity	Modified transient plane source method		0.88 / 0.82 W/mK
Specific contact resistance		IEC 93	4.8 x 109 Ωcm
Density		DIN 53479	1.74 ± 0.1 g/cm³
Workability features			
Watertightness / impermeability		DIN EN 12390-8	after 72 hours at 5bar: 0mm
Open time (10-20°C)			6 min
Curing time (10-20°C)			80 min
Shelf life			18 months

For information use only. Values are not to be considered as a specification and do not reflect the performance of the system. The given values are typical values and are subject to change without notice.

Working and curing times WIT-VIZ

Temperature of base material	Gelling – working time	Min. curing time – dry conditions[1)]
–5°C	90 min	6 h
–4°C to –1°C	45 min	6 h
0°C to 4°C	20 min	3 h
5°C to 9°C	12 min	2 h
10°C to 19°C	6 min	80 min
20°C to 29°C	4 min	45 min
30°C to 34°C	2 min	25 min
35°C to 39°C	80 s	20 min
40°C	80 s	15 min

[1)] for wet base material the curing time must be doubled

Working and curing times WIT-EXPRESS

Temperature of base material	Gelling – working time	Min. curing time – dry conditions[1)]
-5°C	40 min	4 h
-4°C to -1°C	20 min	4 h
-0°C to 4°C	10 min	2 h
5°C to 9°C	6 min	1 h
10°C to 19°C	3 min	40 min
20°C to 29°C	1 min	20 min
+30°C	1 min	10 min
35°C to 39°C	80 s	20 min
40°C	80 s	15 min

[1)] for wet base material the curing time must be doubled

W-VIZ/A4

Installation parameters

Anchor type: WIT-VIZ, M8 - M12

Anchor size			M8	M8	M10	M10	M12	M12	M12
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	50	60	75	75	70	80
Nominal drill hole diameter	d_0	[mm]	10	10	12	12	12	14	14
Drill-hole depth	$h_0 \geq$	[mm]	42	55	65	80	80	75	85
Diameter of cleaning brush	$D \geq$	[mm]	10,8	10,8	13	13	13	15	15
Maximum torque moment	$T_{inst} \leq$	[Nm]	10	10	15	15	25	25	25
Diameter of clearance in hole in the fixture	Pre-positioned $d_f \leq$	[mm]	9	9	12	12	14	14	14
	Push-through $d_f \leq$	[mm]	-	-	14	14	14 [1] / 16	16	16
Minimum thickness of member	h_{min}	[mm]	80	80	100	110 / 100 [2]	110	110	110
Non-cracked Concrete									
Minimum spacing	s_{min}	[mm]	40	40	50	50	50	55	55
Minimum edge distance	c_{min}	[mm]	40	40	50	50	50	55	55
Cracked concrete									
Minimum spacing	s_{min}	[mm]	40	40	40	40	50	55	40
Minimum edge distance	c_{min}	[mm]	40	40	40	40	50	55	50

Anchor type: WIT-VIZ, M12 - M16

Anchor size			M12	M12	M12	M12	M16	M16	M16
Effective anchorage depth	$h_{ef} \geq$	[mm]	95	100	110	125	90	105	125
Nominal drill hole diameter	d_0	[mm]	14	14	14	14	18	18	18
Drill-hole depth	$h_0 \geq$	[mm]	100	105	115	130	98	113	133
Diameter of cleaning brush	$D \geq$	[mm]	15	15	15	15	19	19	19
Maximum torque moment	$T_{inst} \leq$	[Nm]	25	30	30	30	50	50	50
Diameter of clearance in hole in the fixture	Pre-positioned $d_f \leq$	[mm]	14	14	14	14	18	18	18
	Push-through $d_f \leq$	[mm]	16	16	16	16	20	20	20
Minimum thickness of member	h_{min}	[mm]	130 / 125 [2]	130	140	160	130	150	170 / 160 [2]
Non-cracked Concrete									
Minimum spacing	s_{min}	[mm]	55	80 [3]	81 [3]	82 [3]	50	60	60
Minimum edge distance	c_{min}	[mm]	55	55 [2]	55 [2]	55 [2]	50	60	60
Cracked concrete									
Minimum spacing	s_{min}	[mm]	40	50	50	50	50	50	60
Minimum edge distance	c_{min}	[mm]	50	50	50	50	50	50	60

Anchor type: WIT-VIZ, M16 - M24

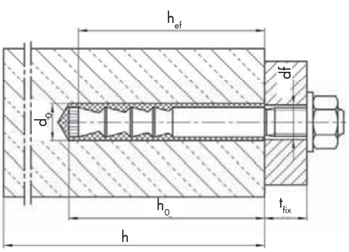
Anchor size			M16	M16	M20	M20	M20	M20	M24	M24
Effective anchorage depth	$h_{ef} \geq$	[mm]	145	160	115	170	190	170	200	225
Nominal drill hole diameter	d_0	[mm]	18	18	22	24	24	26	26	26
Drill-hole depth	$h_0 \geq$	[mm]	153	168	120	180	200	185	215	240
Diameter of cleaning brush	$D \geq$	[mm]	19	19	23	25	25	27	27	27
Maximum torque moment	$T_{inst} \leq$	[Nm]	50	50	80	80	80	100	120	120
Diameter of clearance in hole in the fixture	Pre-positioned $d_f \leq$	[mm]	18	18	22	24 (22)	24 (22)	26	26	26
	Push-through $d_f \leq$	[mm]	20	20	24	26	26	28	28	28
Minimum thickness of member	h_{min}	[mm]	190 / 180 [2)]	205 / 200 [2)]	160	230 / 220 [2)]	250 / 240 [2)]	230 / 220 [2)]	270 / 260 [2)]	300 / 290 [2)]
Non-cracked Concrete										
Minimum spacing	s_{min}	[mm]	60	60	80	80	80	80	105	105
Minimum edge distance	c_{min}	[mm]	60	60	80	80	80	105	105	105
Cracked concrete										
Minimum spacing	s_{min}	[mm]	60	60	80	80	80	80	80	80
Minimum edge distance	c_{min}	[mm]	60	60	80	80	80	80	80	80

[1)] Check installation instructions

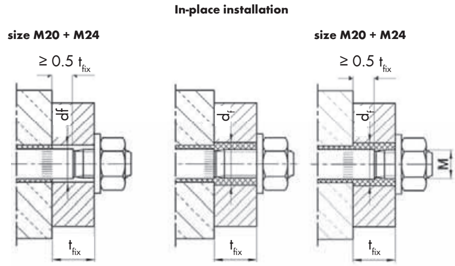
[2)] The remote face of the concrete member shall be inspected to ensure there has been no break-through by drilling. In case of break-through, the ground of the drill hole shall be closed with high strength mortar. The full bonded length hef shall be achieved and any potential loss of injection mortar shall be compensated

[3)] For an edge distance c ≥ 80 mm a minimum spacing s_{min} = 55 mm is applicable

Pre-positioned insatallation



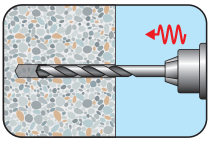
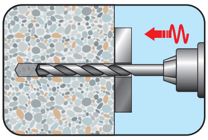
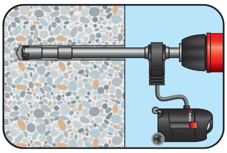
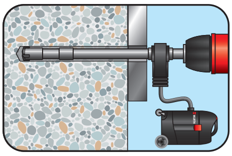
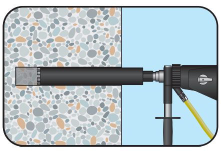
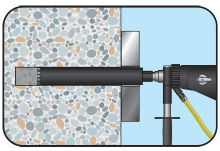
In-place installation



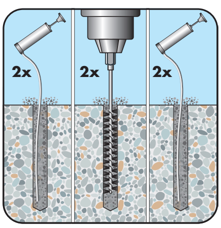
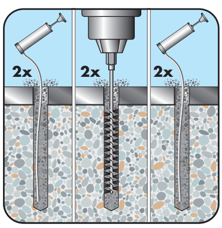
W-VIZ/A4

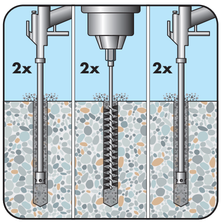
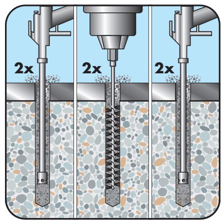
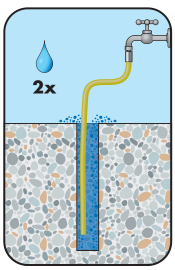
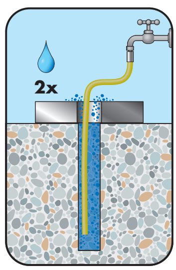
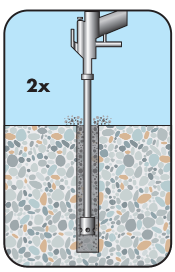
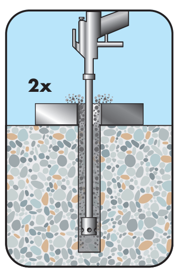
W-VIZ/A4

Installation instructions

A) Bore hole drilling			
Prepositioned	Push-through	**1a.**	**Hammer (HD) or compressed air drilling (CD)**
			Drill a hole into the base material to the size and embedment depth required by the selected anchor rod. Proceed with Step B1.
Prepositioned	Push-through	**1b.**	**Hollow drill bit system (HDB)**
			Drill hole perpendicular to concrete surface by using a vacuum drill bit. The nominal underpressure of the vacuum cleaner must be at least 230 mbar / 23kPa. Make sure the **dust extraction is working properly** throughout the whole drilling process. Additional cleaning is not necessary. Proceed with Step C.
Prepositioned	Push-through	**1c.**	**Diamond drilling (DD)**
			Use diamond drill with diamond drill bit and depth gauge. Drill perpendicular to concrete surface. Re-move drill core at least up to the nominal hole depth and check drill hole depth. Proceed with Step B2.

Attention! Standing water in the bore hole must be removed before cleaning.

B1) Bore hole cleaning			
MAC: Cleaning for rod threaded diameters shown below			
Prepositioned M8 – M16	Push-through M10 – M16	**2a.**	Starting from the bottom or back of the bore hole, blow the hole clean using a hand pump a minimum of <u>two</u> times.
		**2b.**	Check diameter of cleaning brush. If the brush can be pushed into the drill hole without any resistance, it must be replaced. Check brush into the drill machine. Turn on the drill machine. Brush drill hole back and forth along the entire drill hole depth at least <u>two</u> times while rotated by drill machine.
		2c.	Finally blow the hole clean again with a hand pump a minimum of <u>two</u> times. For prepositioned installation, the extension tube with reduced diameter must be added to the blow-out pump for diameter M8.

CAC: Cleaning for dry, wet and water-filled bore holes for threaded diameters shown below			
Prepositioned M20 – M24	Push-through M20 – M24	**2a.**	Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) a minimum of two times until return air stream is free of noticeable dust.
		**2b.**	Check diameter of cleaning brush. If the brush can be pushed into the drill hole without any resistance, it must be replaced. Check brush into the drill machine. Turn on the drill machine. Brush drill hole back and forth along the entire drill hole depth at least <u>two</u> times while rotated by drill machine.
		2c.	Finally blow the hole clean again with compressed air (min. 6 bar) a minimum of <u>two</u> times until return air stream is free of noticeable dust.
After cleaning, the bore hole has to be protected against re-contamination in an appropriate way until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must no contaminate the bore hole again.			
B2) Bore hole cleaning			
SPCAC: Cleaning for dry, wet and water-filled bore holes for all diameters in non-cracked concrete			
Prepositioned	Push-through	**2a.**	Flush drill hole with water, starting from the bottom, until clear water gets out of the drill hole.
			
Prepositioned	Push-through	**2b.**	Connect Air Blower to compressed air (min. 6 bar, oil-free). Open air valve and blow out drill hole along the entire depth with back and forth motion at least two times.
			
After cleaning, the bore hole has to be protected against re-contamination in an appropriate way until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must no contaminate the bore hole again.			

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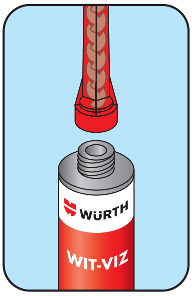
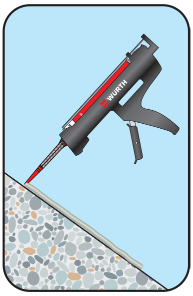
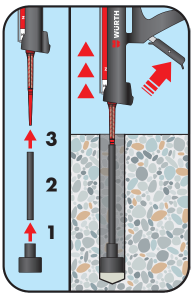
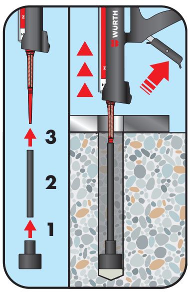
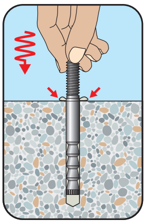
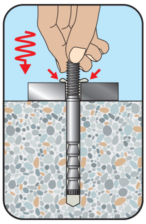
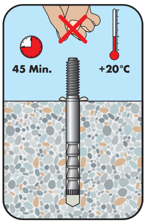
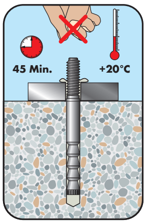
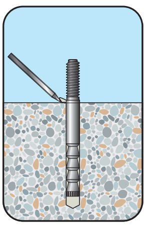
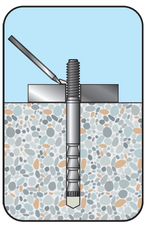
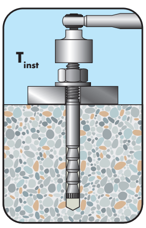
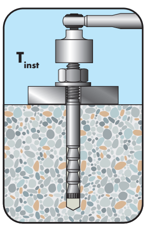
C) Preparation of bar and cartridge		
	**3a.**	Check expiration date on cartridge. Never use when expired. Remove cap from cartridge. Screw Mixer Nozzle on cartridge. When using a new cartridge, always use a new Mixer Nozzle. Never use cartridge without Mixer Nozzle and never use Mixer Nozzle without helix inside.
	**3b.**	Insert cartridge in Dispenser. Before injecting discard mortar (at least 2 full strokes or a line of 10 cm) until it shows a consistent grey colour. Never use this mortar.
D) Filling the bore hole		
Prepositioned  Push-through 	**4.**	Prior to injection, check if Mixer Nozzle reaches the bottom of the drill hole. If it does not reach the bottom, plug Mixer Extension onto Mixer Nozzle in order to fill the drill hole properly. Fill hole with a sufficient quantity of injection mortar. Start from the bottom of the drill hole and work out to avoid trapping air pockets.

E) Setting the anchor			
Prepositioned	Push-through	**5a.**	Insert the anchor rod WIT-VIZ-A by hand, rotating slightly up to the full embedment depth as marked on the anchor rod. In case of prepositioned installation, the anchor rod is properly set when excess mortar seeps from the hole. In case of push-through installation, the annular gap in the clearance hole in the fixture has to be filled completely by excess mortar after the installation. If the hole is not completely filled, pull out the anchor rod, let the mortar cure, drill out hole and repeat entire cleaning process.
			
Prepositioned	Push-through	**5b.**	Follow minimum curing times. During curing time, the anchor rod must not be moved or loaded.
			
Prepositioned	Push-through	**5c.**	Remove excess mortar.
			
Prepositioned	Push-through	**5d.**	For both installation types, the fixture can be mounted after curing time. Apply installation torque Tinst by using a torque wrench. In case of push through installation, the annular gap between the anchor rod and attachment may be optionally filled with mortar. Therefore, replace regular washer by washer with bore and plug on reducing adapter on static mixer. The annular gap is completely filled when excess mortar seeps out.
			

W-VIZ/A4

Filling Quantity

Anchor type: WIT-VIZ, M8 - M24

Thread size			**M8**	**M10**	**M12**	**M16**	**M20**	**M20**	**M24**
Nominal drill hole diameter	d_0	[mm]	10	12	14	18	22	24	26
Drill depth	h_0 / h_1	[mm]							
Filling volume per 10mm embedment depth		[ml]	1.05	1.20	1.20	1.50	2.29	2.30	2.30

Assumed waste of 15 % included.