

**Specifier's comments:**

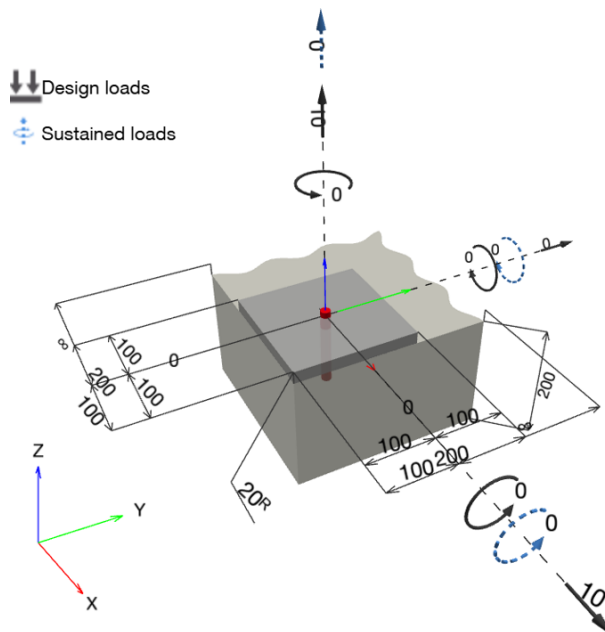
**1 Input data**



<b>Anchor type and diameter:</b>	<b>HIT-RE 500 V3 + HAS-U 5.8 M16</b>
Item number:	2223829 HAS-U 5.8 M16x165 (element) / 2123403 HIT-RE 500 V3 (adhesive)
Specification text:	Hilti HAS-U 5.8 threaded rod with HIT-RE 500 V3 injection mortar with 100 mm embedment hef, M16, Steel galvanized, Hammer drilled installation per ESR-3814
Effective embedment depth:	$h_{ef,act} = 100.0 \text{ mm}$ ( $h_{ef,limit} = - \text{ mm}$ )
Material:	5.8
Evaluation Service Report:	ESR-3814
Issued   Valid:	2023. 3. 1.   2025. 1. 1.
Proof:	Design Method KDS 14 20 54:2021 / Chem
Stand-off installation:	$e_b = 0.0 \text{ mm}$ (no stand-off); $t = 20.0 \text{ mm}$
Anchor plate <sup>R</sup> :	$l_x \times l_y \times t = 200.0 \text{ mm} \times 200.0 \text{ mm} \times 20.0 \text{ mm}$ ; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	uncracked lightweight concrete, 27MPa, $f_{ck} = 27 \text{ N/mm}^2$ ; $h = 200.0 \text{ mm}$ , Temp. short/long: 54/43 °C
<b>Installation:</b>	<b>Hammer drilled hole, Installation condition: Dry</b>
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < D13

<sup>R</sup> - The anchor calculation is based on a rigid anchor plate assumption.

**Geometry [mm] & Loading [kN, kNm]**



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1.1 Design results

Case	Description	Forces [kN] / Moments [kNm]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 10.000; V <sub>x</sub> = 10.000; V <sub>y</sub> = 0.000; M <sub>x</sub> = 0.000; M <sub>y</sub> = 0.000; M <sub>z</sub> = 0.000; N <sub>sus</sub> = 0.000; M <sub>x,sus</sub> = 0.000; M <sub>y,sus</sub> = 0.000;	no	143

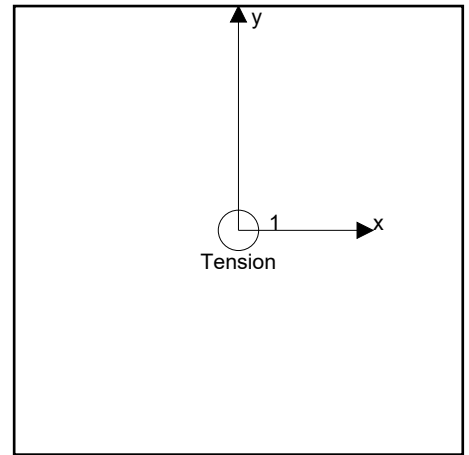
2 Load case/Resulting anchor forces

Anchor reactions [kN]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	10.000	10.000	10.000	0.000

Max. concrete compressive strain: - [%]  
 Max. concrete compressive stress: - [N/mm<sup>2</sup>]  
 Resulting tension force in (x/y)=(0.0/0.0): 10.000 [kN]  
 Resulting compression force in (x/y)=(-/-): 0.000 [kN]



Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N <sub>ua</sub> [kN]	Capacity $\phi N_n$ [kN]	Utilization $\beta_N = N_{ua} / \phi N_n$	Status
Steel Strength*	10.000	51.025	20	OK
Bond Strength**	10.000	13.827	73	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	10.000	13.176	76	OK

\* highest loaded anchor \*\*anchor group (anchors in tension)

3.1 Steel Strength

N<sub>sa</sub> = ESR value refer to ICC-ES ESR-3814  
 $\phi N_{sa} \geq N_{ua}$  KDS 14 20 54:2021 Table 4.2-1

Variables

A <sub>se,N</sub> [mm <sup>2</sup> ]	f <sub>uta</sub> [N/mm <sup>2</sup> ]
157	500.00

Calculations

N <sub>sa</sub> [kN]
78.500

Results

N <sub>sa</sub> [kN]	$\phi_{steel}$	$\phi N_{sa}$ [kN]	N <sub>ua</sub> [kN]
78.500	0.650	51.025	10.000

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**3.2 Bond Strength**

$$N_a = \left( \frac{A_{Na}}{A_{Na0}} \right) \Psi_{ed,Na} \Psi_{cp,Na} N_{ba} \quad \text{KDS 14 20 54:2021 Eq. (4.3-18)}$$

$$\phi N_a \geq N_{ua} \quad \text{KDS 14 20 54:2021 Table 4.2-1}$$

$$A_{Na} \text{ see KDS 14 20 54:2021, section 4.3.5(1)}$$

$$A_{Na0} = (2 c_{Na})^2 \quad \text{KDS 14 20 54:2021 Eq. (4.3-20)}$$

$$c_{Na} = 10 d_a \sqrt{\frac{\tau_{uncr}}{7.6}} \quad \text{KDS 14 20 54:2021 Eq. (4.3-21)}$$

$$\Psi_{ed,Na} = 0.7 + 0.3 \left( \frac{c_{a,min}}{c_{Na}} \right) \leq 1.0 \quad \text{KDS 14 20 54:2021 Eq. (4.3-25)}$$

$$\Psi_{cp,Na} = \text{MAX} \left( \frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}} \right) \leq 1.0 \quad \text{KDS 14 20 54:2021 Eq. (4.3-27)}$$

$$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \pi \cdot d_a \cdot h_{ef} \quad \text{KDS 14 20 54:2021 Eq. (4.3-22)}$$

**Variables**

$\tau_{k,c,uncr}$ [N/mm <sup>2</sup> ]	$d_a$ [mm]	$h_{ef}$ [mm]	$c_{a,min}$ [mm]	$\alpha_{overhead}$	$\tau_{k,c}$ [N/mm <sup>2</sup> ]
17.00	16.0	100.0	100.0	1.000	17.00
$c_{ac}$ [mm]	$\lambda_a$				
192.3	0.600				

**Calculations**

$c_{Na}$ [mm]	$A_{Na}$ [mm <sup>2</sup> ]	$A_{Na0}$ [mm <sup>2</sup> ]	$\Psi_{ed,Na}$
239.3	115,145	229,116	0.825
$\Psi_{cp,Na}$	$N_{ba}$ [kN]		
1.000	51.285		

**Results**

$N_a$ [kN]	$\phi_{bond}$	$\phi N_a$ [kN]	$N_{ua}$ [kN]
21.273	0.650	13.827	10.000

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### 3.3 Concrete Breakout Failure

$$N_{cb} = \left( \frac{A_{Nc}}{A_{Nc0}} \right) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \quad \text{KDS 14 20 54:2021 Eq. (4.3-19)}$$

$$\phi N_{cb} \geq N_{ua} \quad \text{KDS 14 20 54:2021 Table 4.2-1}$$

$$A_{Nc} \geq N_{ua} \quad \text{see KDS 14 20 54:2021, section 4.3.2(1)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{KDS 14 20 54:2021 Eq. (4.3-4)}$$

$$\Psi_{ed,N} = 0.7 + 0.3 \left( \frac{c_{a,min}}{1.5h_{ef}} \right) \leq 1.0 \quad \text{KDS 14 20 54:2021 Eq. (4.3-9)}$$

$$\Psi_{cp,N} = \text{MAX} \left( \frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{KDS 14 20 54:2021 Eq. (4.3-11)}$$

$$N_b = k_c \lambda_a \sqrt{f_{ck}} h_{ef}^{1.5} \quad \text{KDS 14 20 54:2021 Eq. (4.3-5)}$$

#### Variables

$h_{ef}$ [mm]	$c_{a,min}$ [mm]	$\Psi_{c,N}$	$c_{ac}$ [mm]	$k_c$	$\lambda_a$	$f_{ck}$ [N/mm <sup>2</sup> ]
100.0	100.0	1.000	192.3	10.0	0.800	27.00

#### Calculations

$A_{Nc}$ [mm <sup>2</sup> ]	$A_{Nc0}$ [mm <sup>2</sup> ]	$\Psi_{ed,N}$	$\Psi_{cp,N}$	$N_b$ [kN]
62,500	90,000	0.900	0.780	41.569

#### Results

$N_{cb}$ [kN]	$\phi_{concrete}$	$\phi N_{cb}$ [kN]	$N_{ua}$ [kN]
20.270	0.650	13.176	10.000



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## 4 Shear load

	Load $V_{ua}$ [kN]	Capacity $\phi V_n$ [kN]	Utilization $\beta_v = V_{ua}/\phi V_n$	Status
Steel Strength*	10.000	28.200	36	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Concrete Breakout Strength controls)**	10.000	28.378	36	OK
Concrete edge failure in direction x+**	10.000	10.579	95	OK

\* highest loaded anchor    \*\*anchor group (relevant anchors)

### 4.1 Steel Strength

$V_{sa}$  = ESR value      refer to ICC-ES ESR-3814  
 $\phi V_{steel} \geq V_{ua}$       KDS 14 20 54:2021 Table 4.2-1

#### Variables

$A_{se,v}$ [mm <sup>2</sup> ]	$f_{uta}$ [N/mm <sup>2</sup> ]
157	500.00

#### Calculations

$V_{sa}$ [kN]
47.000

#### Results

$V_{sa}$ [kN]	$\phi_{steel}$	$\phi V_{sa}$ [kN]	$V_{ua}$ [kN]
47.000	0.600	28.200	10.000

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**4.2 Pryout Strength (Concrete Breakout Strength controls)**

$$V_{cp} = k_{cp} \left[ \left( \frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \right] \quad \text{KDS 14 20 54:2021 Eq. (4.4-14)}$$

$$\phi V_{cp} \geq V_{ua} \quad \text{KDS 14 20 54:2021 Table 4.2-1}$$

$A_{Nc}$  see KDS 14 20 54:2021, section 4.3.2(1)

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{KDS 14 20 54:2021 Eq. (4.3-4)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left( \frac{c_{a,min}}{1.5h_{ef}} \right) \leq 1.0 \quad \text{KDS 14 20 54:2021 Eq. (4.3-9)}$$

$$\psi_{cp,N} = \text{MAX} \left( \frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{KDS 14 20 54:2021 Eq. (4.3-11)}$$

$$N_b = k_c \lambda_a \sqrt{f_{ck}} h_{ef}^{1.5} \quad \text{KDS 14 20 54:2021 Eq. (4.3-5)}$$

**Variables**

$k_{cp}$	$h_{ef}$ [mm]	$c_{a,min}$ [mm]	$\psi_{c,N}$
2	100.0	100.0	1.000
$c_{ac}$ [mm]	$k_c$	$\lambda_a$	$f_{ck}$ [N/mm <sup>2</sup> ]
192.3	10.0	0.800	27.00

**Calculations**

$A_{Nc}$ [mm <sup>2</sup> ]	$A_{Nc0}$ [mm <sup>2</sup> ]	$\psi_{ed,N}$	$\psi_{cp,N}$	$N_b$ [kN]
62,500	90,000	0.900	0.780	41.569

**Results**

$V_{cp}$ [kN]	$\phi_{concrete}$	$\phi V_{cp}$ [kN]	$V_{ua}$ [kN]
40.540	0.700	28.378	10.000

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**4.3 Concrete edge failure in direction x+**

$$V_{cb} = \left( \frac{A_{Vc}}{A_{Vc0}} \right) \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} \Psi_{parallel,V} V_b \quad \text{KDS 14 20 54:2021 Eq. (4.4-3)}$$

$$\phi V_{cb} \geq V_{ua} \quad \text{KDS 14 20 54:2021 Table 4.2-1}$$

 $A_{Vc}$  see KDS 14 20 54:2021, section 4.4.2(1)

$$A_{Vc0} = 4.5 c_{a1}^2 \quad \text{KDS 14 20 54:2021 Eq. (4.4-5)}$$

$$\Psi_{ed,V} = 0.7 + 0.3 \left( \frac{c_{a2}}{1.5c_{a1}} \right) \leq 1.0 \quad \text{KDS 14 20 54:2021 Eq. (4.4-11)}$$

$$\Psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0 \quad \text{KDS 14 20 54:2021 Eq. (4.4-12)}$$

$$V_b = \left( 0.6 \left( \frac{l_e}{d_a} \right)^{0.2} \sqrt{d_a} \right) \lambda_a \sqrt{f_{ck}} c_{a1}^{1.5} \quad \text{KDS 14 20 54:2021 Eq. (4.4-6)}$$

**Variables**

$c_{a1}$ [mm]	$c_{a2}$ [mm]	$\Psi_{c,V}$	$h_a$ [mm]	$l_e$ [mm]
100.0	100.0	1.400	200.0	100.0
$\lambda_a$	$d_a$ [mm]	$f_{ck}$ [N/mm <sup>2</sup> ]	$\Psi_{parallel,V}$	
0.800	16.0	27.00	1.000	

**Calculations**

$A_{Vc}$ [mm <sup>2</sup> ]	$A_{Vc0}$ [mm <sup>2</sup> ]	$\Psi_{ed,V}$	$\Psi_{h,V}$	$V_b$ [kN]
37,500	45,000	0.900	1.000	14.393

**Results**

$V_{cb}$ [kN]	$\phi_{concrete}$	$\phi V_{cb}$ [kN]	$V_{ua}$ [kN]
15.113	0.700	10.579	10.000

**5 Combined tension and shear loads**

$\beta_N$	$\beta_V$	$\zeta$	Utilization $\beta_{N,V}$ [%]	Status
0.759	0.945	1.000	143	not recommended

$$\beta_{NV} = (\beta_N + \beta_V) / 1.2 \leq 1$$



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## 6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- Design Strengths of adhesive anchor systems are influenced by the cleaning method. Refer to the INSTRUCTIONS FOR USE given in the Evaluation Service Report for cleaning and installation instructions.
- Checking the transfer of loads into the base material is required in accordance with KDS 14 20 54:2021!
- Installation of Hilti adhesive anchor systems shall be performed by personnel trained to install Hilti adhesive anchors. Reference KDS 14 20 54:2021, Section 4.7.1

**Fastening does not meet the design criteria!**

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## 7 Installation data

Profile: no profile

Hole diameter in the fixture:  $d_f = 18.0$  mm

Plate thickness (input): 20.0 mm

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and diameter: HIT-RE 500 V3 + HAS-U 5.8 M16

Item number: 2223829 HAS-U 5.8 M16x165 (element) / 2123403 HIT-RE 500 V3 (adhesive)

Maximum installation torque: 80 Nm

Hole diameter in the base material: 18.0 mm

Hole depth in the base material: 100.0 mm

Minimum thickness of the base material: 136.0 mm

Hilti HAS-U 5.8 threaded rod with HIT-RE 500 V3 injection mortar with 100 mm embedment hef, M16, Steel galvanized, Hammer drilled installation per ESR-3814

### 7.1 Recommended accessories

#### Drilling

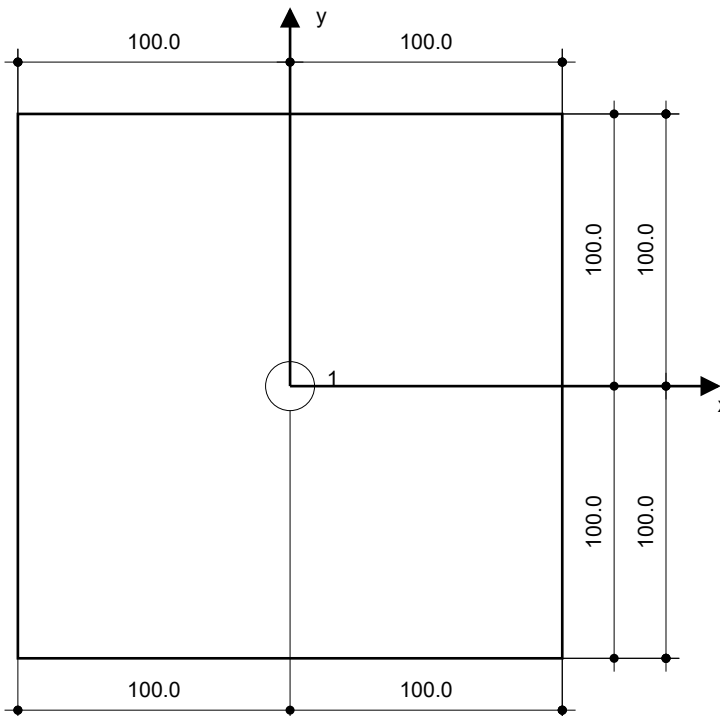
- Suitable Rotary Hammer
- Properly sized drill bit

#### Cleaning

- Compressed air with required accessories to blow from the bottom of the hole
- Proper diameter wire brush

#### Setting

- Dispenser including cassette and mixer
- Torque wrench



#### Coordinates Anchor [mm]

Anchor	x	y	c <sub>-x</sub>	c <sub>+x</sub>	c <sub>-y</sub>	c <sub>+y</sub>
1	0.0	0.0	-	100.0	100.0	-



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## 8 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
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