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Design:	Concrete - May 28, 2019	Date:	10/26/2020
Fastening point:			

**Specifier's comments:**

**1 Input data**



**Anchor type and diameter:** HIT-HY 200 + HAS-V-36 (ASTM F1554 Gr.36) 5/8

Item number: not available (element) / 2022793 HIT-HY 200-R (adhesive)

Effective embedment depth:  $h_{ef,act} = 12.000$  in. ( $h_{ef,limit} = -$  in.)

Material: ASTM A 1554 Grade 36

Evaluation Service Report: ESR-3187

Issued | Valid: 4/1/2020 | 3/1/2022

Proof: Design Method ACI 318-14 / Chem

Stand-off installation:

Profile:

Base material: cracked concrete, 2500,  $f'_c = 2,500$  psi;  $h = 15.000$  in., Temp. short/long: 32/32 °F

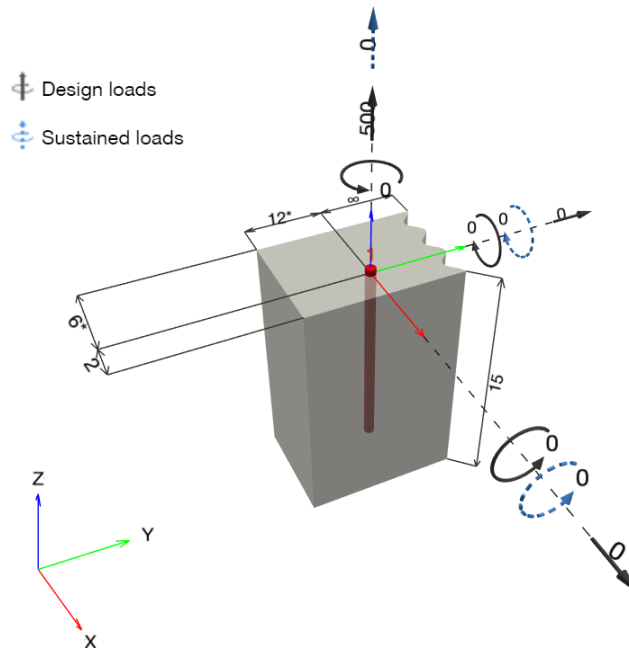
**Installation:** **hammer drilled hole, Installation condition: Dry**

Reinforcement: tension: condition B, shear: condition B; no supplemental splitting reinforcement present

edge reinforcement: none or < No. 4 bar

Seismic loads (cat. C, D, E, or F) Tension load: yes (17.2.3.4.3 (d))  
Shear load: yes (17.2.3.5.3 (c))

**Geometry [in.] & Loading [lb, in.lb]**





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1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 500; V <sub>x</sub> = 0; V <sub>y</sub> = 0; M <sub>x</sub> = 0; M <sub>y</sub> = 0; M <sub>z</sub> = 0; N <sub>sus</sub> = 0; M <sub>x,sus</sub> = 0; M <sub>y,sus</sub> = 0;	yes	22

2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	500	0	0	0

max. concrete compressive strain: - [%]  
max. concrete compressive stress: - [psi]  
resulting tension force in (x/y)=(0.000/0.000): 0 [lb]  
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]

3 Tension load

	Load N <sub>ua</sub> [lb]	Capacity $\phi$ N <sub>n</sub> [lb]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	500	9,833	6	OK
Bond Strength**	500	4,623	11	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	500	2,344	22	OK

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



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**3.1 Steel Strength**

$N_{sa}$  = ESR value refer to ICC-ES ESR-3187  
 $\phi N_{sa} \geq N_{ua}$  ACI 318-14 Table 17.3.1.1

**Variables**

$A_{se,N}$ [in. <sup>2</sup> ]	$f_{uta}$ [psi]
0.23	58,000

**Calculations**

$N_{sa}$ [lb]
13,110

**Results**

$N_{sa}$ [lb]	$\phi_{steel}$	$\phi N_{sa}$ [lb]	$N_{ua}$ [lb]
13,110	0.750	9,833	500



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**3.2 Bond Strength**

$$N_a = \left( \frac{A_{Na}}{A_{Na0}} \right) \Psi_{ed,Na} \Psi_{cp,Na} N_{ba} \quad \text{ACI 318-14 Eq. (17.4.5.1a)}$$

$$\phi N_a \geq N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

$$A_{Na} \text{ see ACI 318-14, Section 17.4.5.1, Fig. R 17.4.5.1(b)}$$

$$A_{Na0} = (2 c_{Na})^2 \quad \text{ACI 318-14 Eq. (17.4.5.1c)}$$

$$c_{Na} = 10 d_a \sqrt{\frac{\tau_{uncr}}{1100}} \quad \text{ACI 318-14 Eq. (17.4.5.1d)}$$

$$\Psi_{ed,Na} = 0.7 + 0.3 \left( \frac{c_{a,min}}{c_{Na}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.5.4b)}$$

$$\Psi_{cp,Na} = \text{MAX} \left( \frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.5.5b)}$$

$$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \alpha_{N,seis} \cdot \pi \cdot d_a \cdot h_{ef} \quad \text{ACI 318-14 Eq. (17.4.5.2)}$$

**Variables**

$\tau_{k,c,uncr}$ [psi]	$d_a$ [in.]	$h_{ef}$ [in.]	$c_{a,min}$ [in.]	$\alpha_{overhead}$	$\tau_{k,c}$ [psi]
2,220	0.625	12.000	2.000	1.000	1,170
$c_{ac}$ [in.]	$\lambda_a$	$\alpha_{N,seis}$			
33.964	1.000	0.990			

**Calculations**

$c_{Na}$ [in.]	$A_{Na}$ [in. <sup>2</sup> ]	$A_{Na0}$ [in. <sup>2</sup> ]	$\Psi_{ed,Na}$
8.839	141.42	312.50	0.768
$\Psi_{cp,Na}$	$N_{ba}$ [lb]		
1.000	27,292		

**Results**

$N_a$ [lb]	$\phi_{bond}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi N_a$ [lb]	$N_{ua}$ [lb]
9,484	0.650	0.750	1.000	4,623	500

Input data and results must be checked for conformity with the existing conditions and for plausibility!  
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**3.3 Concrete Breakout Failure**

$$N_{cb} = \left( \frac{A_{Nc}}{A_{Nc0}} \right) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \quad \text{ACI 318-14 Eq. (17.4.2.1a)}$$

$$\phi N_{cb} \geq N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

$$A_{Nc} \text{ see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-14 Eq. (17.4.2.1c)}$$

$$\Psi_{ed,N} = 0.7 + 0.3 \left( \frac{c_{a,min}}{1.5h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.5b)}$$

$$\Psi_{cp,N} = \text{MAX} \left( \frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.7b)}$$

$$N_b = k_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \quad \text{ACI 318-14 Eq. (17.4.2.2a)}$$

**Variables**

$h_{ef}$ [in.]	$c_{a,min}$ [in.]	$\Psi_{c,N}$	$c_{ac}$ [in.]	$k_c$	$\lambda_a$	$f_c$ [psi]
8.000	2.000	1.000	33.964	17	1.000	2,500

**Calculations**

$A_{Nc}$ [in. <sup>2</sup> ]	$A_{Nc0}$ [in. <sup>2</sup> ]	$\Psi_{ed,N}$	$\Psi_{cp,N}$	$N_b$ [lb]
192.00	576.00	0.750	1.000	19,233

**Results**

$N_{cb}$ [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi N_{cb}$ [lb]	$N_{ua}$ [lb]
4,808	0.650	0.750	1.000	2,344	500



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### 4 Shear load

	Load $V_{ua}$ [lb]	Capacity $\phi V_n$ [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	N/A	N/A	N/A	N/A
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Bond Strength controls)*	N/A	N/A	N/A	N/A
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

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

### 5 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2018, 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.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>
- An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-14, Chapter 17, Section 17.2.3.4.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.2.3.4.3 (b), Section 17.2.3.4.3 (c), or Section 17.2.3.4.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.2.3.5.3 (a), Section 17.2.3.5.3 (b), or Section 17.2.3.5.3 (c).
- Section 17.2.3.4.3 (b) / Section 17.2.3.5.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.2.3.4.3 (c) / Section 17.2.3.5.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.2.3.4.3 (d) / Section 17.2.3.5.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by  $\omega_0$ .
- Installation of Hilti adhesive anchor systems shall be performed by personnel trained to install Hilti adhesive anchors. Reference ACI 318-14, Section 17.8.1.

## Fastening meets the design criteria!



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## 6 Installation data

Profile: -

Hole diameter in the fixture: -

Plate thickness (input): -

Drilling method: Hammer drilled

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

5/8 Hilti HAS Carbon steel threaded rod with Hilti HIT-HY 200 Safe Set System

Anchor type and diameter: HIT-HY 200 + HAS-V-36

(ASTM F1554 Gr.36) 5/8

Item number: not available (element) / 2022793 HIT-HY 200-R (adhesive)

Installation torque: 720 in.lb

Hole diameter in the base material: 0.750 in.

Hole depth in the base material: 12.000 in.

Minimum thickness of the base material: 13.500 in.

### 6.1 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 in.

Anchor	x	y	C <sub>-x</sub>	C <sub>+x</sub>	C <sub>-y</sub>	C <sub>+y</sub>
1	0.000	0.000	6.000	2.000	12.000	-



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## 7 Remarks; Your Cooperation Duties

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