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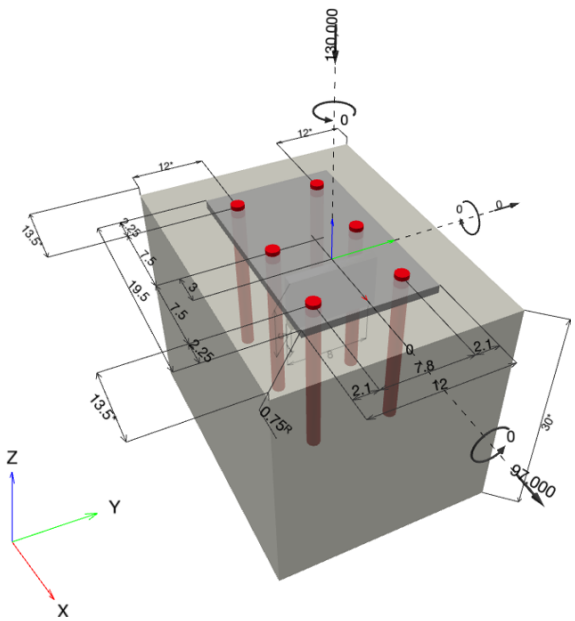
Specifier's comments:

1 Input data

Anchor type and diameter:	**Heavy Hex Head ASTM F 1554 GR. 36 1 1/4**
Item number:	not available
Effective embedment depth:	h_{ef} = 15.000 in.
Material:	ASTM F 1554
Evaluation Service Report:	Hilti Technical Data
Issued I Valid:	- | -
Proof:	Design Method ACI 318-19 / CIP
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.750 in.
Anchor plate[R]:	l_x x l_y x t = 19.500 in. x 12.000 in. x 0.750 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Shear Lug:	Rectangular plates and bars (AISC), 8 - 1, (L x W x D x T) = 8.000 in. x 1.000 in. x 5.000 in. x N/A, rotation angle: 90°
Base material:	cracked concrete, Custom, f_c' = 4,500 psi; h = 30.000 in.
Reinforcement:	tension: present, shear: present; anchor reinforcement: tension, shear
	edge reinforcement: > No. 4 bar with stirrups

[R] - The anchor calculation is based on a rigid anchor plate assumption.

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



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1.1 Design results

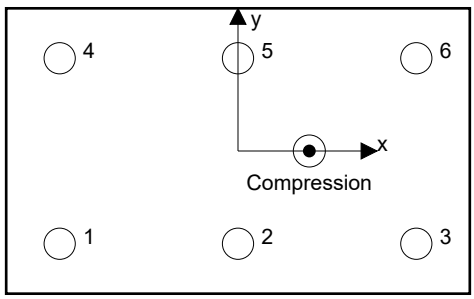
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = -130,000; V_x = 97,000; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	451

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	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0



max. concrete compressive strain: 0.25 [‰]
max. concrete compressive stress: 1,068 [psi]
resulting tension force in (x/y)=(0.000/0.000): 0 [lb]
resulting compression force in (x/y)=(3.000/0.000): 130,000 [lb]

Shear lug reactions [lb]

Shear Lug	Shear force	Shear force x	Shear force y
	97,000	97,000	0

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

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	N/A	N/A	N/A	N/A
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**[1]	N/A	N/A	N/A	N/A
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

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

[1] Tension Anchor Reinforcement has been selected!

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4 Shear load

	Load V_{ua} [lb]	Capacity ϕ 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*	N/A	N/A	N/A	N/A
Shear lug bearing strength	97,000	118,849	82	OK
Shear lug stress limit	N/A	N/A	N/A	N/A
Concrete breakout strength of shear lug in direction x+[1]	97,000	21,528	451	not recommended

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

[1] Shear Anchor Reinforcement has been selected!

4.1 Bearing strength of attachments with shear lugs

$\phi V_{brg,sl} \geq V_u$ ACI 318-19 Table 17.5.2

$V_{brg,sl} = 1.7 \cdot f_c' \cdot A_{ef,sl} \cdot \psi_{brg,sl}$ ACI 318-19 Eq. (17.11.2.1)

$\psi_{brg,sl} = 1 + 4 \cdot \frac{P_u}{A_{bp} \cdot f_c'} \leq 2.0$ ACI 318-19 Eq. (17.11.2.2.1b)

Variables

$A_{ef,sl}$ [in.^{2}]	P_u [lb]	n	N_{sa} [lb]	A_{bp} [in.^{2}]	f_c' [psi]
16.00	130,000	0	56,202	234.00	4,500

Calculations

$\psi_{brg,sl}$
1.494

Results

$V_{brg,sl}$ [lb]	ϕ	$\phi V_{brg,sl}$ [lb]	V_u [lb]
182,844	0.650	118,849	97,000

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4.2 Concrete breakout strength of shear lug in direction x+

$V_{cb,sl} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ed,V} \psi_{c,V} \psi_{h,V} \psi_{parallel,V} V_b$ — ACI 318-19 Eq. (17.7.2.1a)

$\phi V_{cb,sl} \geq V_u$ — ACI 318-19 Table 17.5.2

A_{Vc} see ACI 318-19, Section 17.11.3.1.1, 17.11.3.4

$A_{Vc0} = 4.5 \cdot c_{a1}^2$ — ACI 318-19 Eq. (17.7.2.1.3)

$\psi_{ed,V} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5c_{a1}}\right) \leq 1.0$ — ACI 318-19 Eq. (17.7.2.4.1b)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ — ACI 318-19 Eq. (17.7.2.6.1)

$V_b = 9 \cdot \lambda_a \cdot \sqrt{f_c'} \cdot c_a^{1.5}$ — ACI 318-19 Eq. (17.7.2.2.1b)

Variables

c_{a1} [in.]	c_{a2} [in.]	$\psi_{c,v}$	h_a [in.]	$\psi_{parallel,v}$	λ_a	f_c' [psi]
17.500	11.900	1.400	30.000	1.000	1.000	4,500

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
882.35	1,378.13	0.836	1.000	44,198

Results

$V_{cb,sl}$ [lb]	ϕ	$\phi V_{cb,sl}$ [lb]	V_{ua} [lb]
33,120	0.650	21,528	97,000

5 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.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/
- The design of Anchor Reinforcement is beyond the scope of PROFIS Engineering. Refer to ACI 318-19, Section 17.5.2.1 (a) for information about Anchor Reinforcement.
- The design of Anchor Reinforcement is beyond the scope of PROFIS Engineering. Refer to ACI 318-19, Section 17.5.2.1 (b) for information about Anchor Reinforcement.
- Anchor Reinforcement has been selected as a design option, calculations should be compared with PROFIS Engineering calculations.

Fastening does not meet the design criteria!

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6 Installation data

Anchor type and diameter: Heavy Hex Head ASTM F 1554 GR. 36 1 1/4

Profile: no profile

Item number: not available

Hole diameter in the fixture: d_f = 1.312 in.

Maximum installation torque: -

Plate thickness (input): 0.750 in.

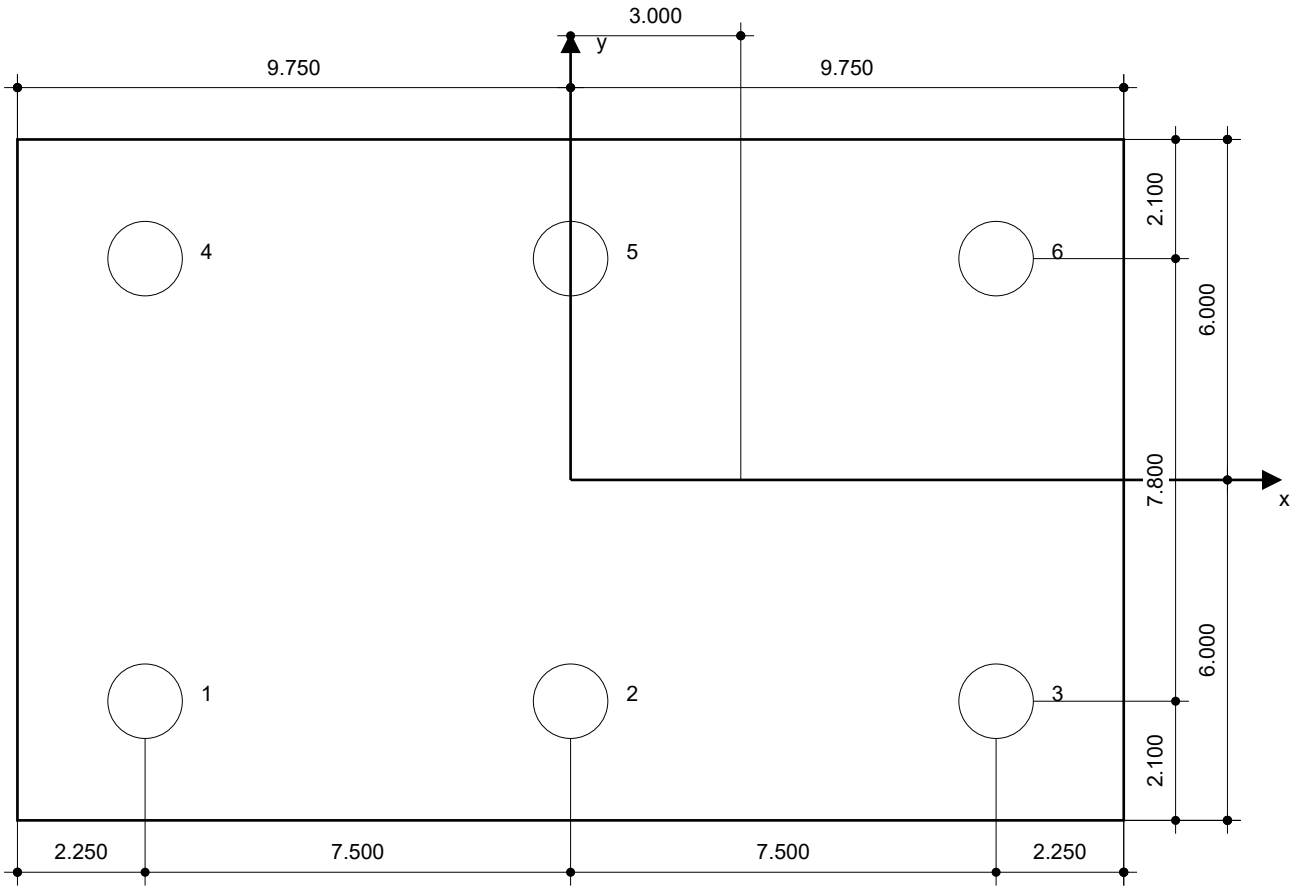
Hole diameter in the base material: - in.

Recommended plate thickness: not calculated

Hole depth in the base material: 15.000 in.

Minimum thickness of the base material: 16.344 in.

Hilti Heavy Hex Head headed stud anchor with 15 in embedment, 1 1/4, Steel galvanized, installation per instruction for use



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-7.500	-3.900	13.500	28.500	12.000	19.800
2	0.000	-3.900	21.000	21.000	12.000	19.800
3	7.500	-3.900	28.500	13.500	12.000	19.800
4	-7.500	3.900	13.500	28.500	19.800	12.000
5	0.000	3.900	21.000	21.000	19.800	12.000
6	7.500	3.900	28.500	13.500	19.800	12.000

7 Remarks; Your Cooperation Duties

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