


www.hilti.com

Company:
 Address:
 Phone | Fax: |
 Design: Sea World Netting Posts - N98
 Fastening point:

Page: 1
 Specifier:
 E-Mail:
 Date: 11/20/2023

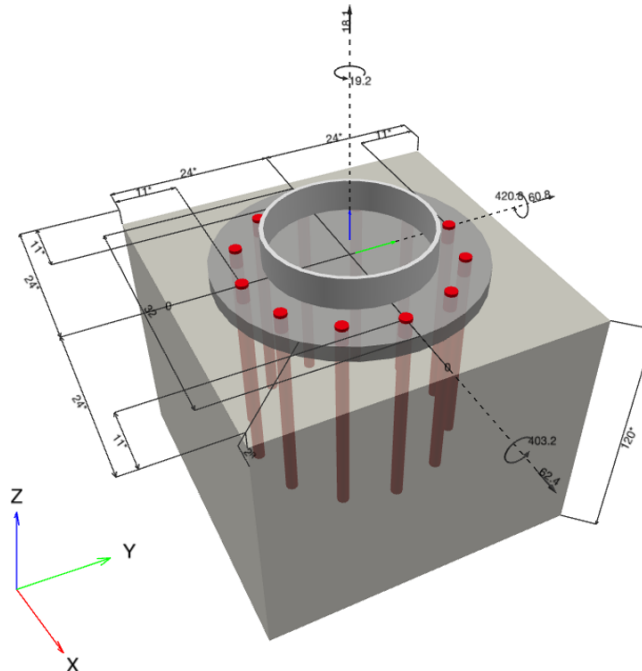
Specifier's comments:

1 Input data

Anchor type and diameter:	Heavy Hex Head ASTM F 1554 GR. 36 1 1/2	
Item number:	not available	
Effective embedment depth:	$h_{ef} = 25.000$ in.	
Material:	ASTM F 1554	
Evaluation Service Report:	Hilti Technical Data	
Issued Valid:	- -	
Proof:	Design Method ACI 318-19 / CIP	
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 2.000$ in.	
Anchor plate ^R :	$l_x \times l_y \times t = 32.000$ in. x 32.000 in. x 2.000 in.; (Recommended plate thickness: not calculated)	
Profile:	Round HSS (AISC), HSS20X.500; (L x W x T) = 20.000 in. x 20.000 in. x 0.500 in.	
Base material:	cracked concrete, 3000, $f'_c = 3,000$ psi; $h = 120.000$ in.	
Reinforcement:	tension: not present, shear: not present; edge reinforcement: none or < No. 4 bar	

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

Geometry [in.] & Loading [kip, ft.kip]



www.hilti.com

Company:	Page: 2
Address:	Specifier:
Phone Fax:	E-Mail:
Design: Sea World Netting Posts - N98	Date: 11/20/2023
Fastening point:	

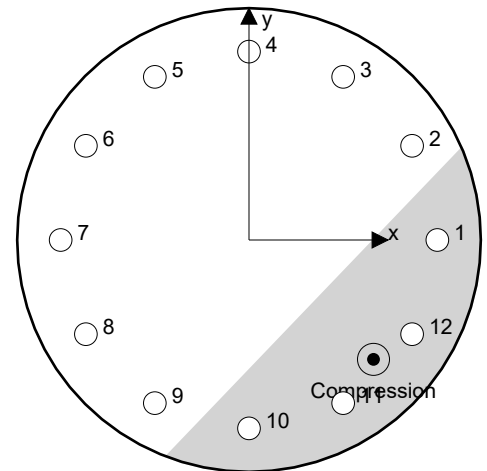
1.1 Design results

Case	Description	Forces [kip] / Moments [ft.kip]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 18.100; V _x = 62.400; V _y = 60.800; M _x = 403.20000; M _y = 420.80000; M _z = 19.20000;	no	1,203

2 Load case/Resulting anchor forces
Anchor reactions [kip]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0.000	8.358	5.200	6.544
2	9.846	7.757	4.462	6.346
3	35.193	7.005	3.921	5.805
4	57.412	6.287	3.723	5.067
5	70.549	5.840	3.921	4.328
6	71.084	5.852	4.462	3.788
7	58.874	6.319	5.200	3.590
8	37.190	7.044	5.938	3.788
9	11.843	7.792	6.479	4.328
10	0.000	8.382	6.677	5.067
11	0.000	8.699	6.479	5.805
12	0.000	8.691	5.938	6.346



max. concrete compressive strain: 0.90 [%]
 max. concrete compressive stress: 3,910 [psi]
 resulting tension force in (x/y)=(0.000/0.000): 0.000 [kip]
 resulting compression force in (x/y)=(24.593/7.762): 333.892 [kip]

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

3 Tension load

	Load N _{ua} [kip]	Capacity ϕN_n [kip]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	71.084	61.335	116	not recommended
Pullout Strength*	71.084	52.382	136	not recommended
Concrete Breakout Failure**	351.992	46.879	751	not recommended
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

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



www.hilti.com

Company:
Address:
Phone | Fax: |
Design: Sea World Netting Posts - N98
Fastening point:

Page: 3
Specifier:
E-Mail:
Date: 11/20/2023

3.1 Steel Strength

$N_{sa} = A_{se,N} f_{uta}$ ACI 318-19 Eq. (17.6.1.2)
 $\phi N_{sa} \geq N_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,N}$ [in. ²]	f_{uta} [psi]
1.41	58,000

Calculations

N_{sa} [kip]
81.780

Results

N_{sa} [kip]	ϕ_{steel}	ϕN_{sa} [kip]	N_{ua} [kip]
81.780	0.750	61.335	71.084

3.2 Pullout Strength

$N_{pN} = \psi_{c,p} N_p$ ACI 318-19 Eq. (17.6.3.1)
 $N_p = 8 A_{brg} f'_c$ ACI 318-19 Eq. (17.6.3.2.2a)
 $\phi N_{pN} \geq N_{ua}$ ACI 318-19 Table 17.5.2

Variables

$\psi_{c,p}$	A_{brg} [in. ²]	λ_a	f'_c [psi]
1.000	3.12	1.000	3,000

Calculations

N_p [kip]
74.832

Results

N_{pn} [kip]	$\phi_{concrete}$	ϕN_{pn} [kip]	N_{ua} [kip]
74.832	0.700	52.382	71.084

www.hilti.com

Company:		Page:	4
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Sea World Netting Posts - N98	Date:	11/20/2023
Fastening point:			

3.3 Concrete Breakout Failure

$$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \quad \text{ACI 318-19 Eq. (17.6.2.1b)}$$

$$\phi N_{cbg} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

$$A_{Nc} \text{ see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-19 Eq. (17.6.2.1.4)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.3.1)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.4.1b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.6.1b)}$$

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \quad \text{ACI 318-19 Eq. (17.6.2.2.1)}$$

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
8.494	2.349	2.087	11.000	1.000
c_{ac} [in.]	k_c	λ_a	f'_c [psij]	
-	24	1.000	3,000	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [kip]
1,920.72	649.41	0.844	0.859	0.959	1.000	32.544

Results

N_{cbg} [kip]	$\phi_{concrete}$	ϕN_{cbg} [kip]	N_{ua} [kip]
66.970	0.700	46.879	351.992



www.hilti.com

Company:		Page:	5
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Sea World Netting Posts - N98	Date:	11/20/2023
Fastening point:			

4 Shear load

	Load V_{ua} [kip]	Capacity ϕV_n [kip]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	8.699	31.894	28	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	87.123	112.762	78	OK
Concrete edge failure in direction x+**	87.123	12.589	693	not recommended

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

4.1 Steel Strength

$$V_{sa} = 0.6 A_{se,V} f_{uta} \quad \text{ACI 318-19 Eq. (17.7.1.2b)}$$

$$\phi V_{steel} \geq V_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

Variables

$A_{se,V}$ [in. ²]	f_{uta} [psi]
1.41	58,000

Calculations

V_{sa} [kip]
49.068

Results

V_{sa} [kip]	ϕ_{steel}	ϕV_{sa} [kip]	V_{ua} [kip]
49.068	0.650	31.894	8.699



www.hilti.com

Company:
 Address:
 Phone | Fax: |
 Design: Sea World Netting Posts - N98
 Fastening point:

Page: 6
 Specifier:
 E-Mail:
 Date: 11/20/2023

4.2 Pryout Strength

$$V_{cp,g} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \right] \quad \text{ACI 318-19 Eq. (17.7.3.1b)}$$

$$\phi V_{cp,g} \geq V_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

A_{Nc} see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-19 Eq. (17.6.2.1.4)}$$

$$\Psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.3.1)}$$

$$\Psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.4.1b)}$$

$$\Psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.6.1b)}$$

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \quad \text{ACI 318-19 Eq. (17.6.2.2.1)}$$

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	7.333	1.846	1.894	11.000
$\Psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	∞	24	1.000	3,000

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\Psi_{ec1,N}$	$\Psi_{ec2,N}$	$\Psi_{ed,N}$	$\Psi_{cp,N}$	N_b [kip]
2,044.16	484.00	0.856	0.853	1.000	1.000	26.105

Results

$V_{cp,g}$ [kip]	$\phi_{concrete}$	$\phi V_{cp,g}$ [kip]	V_{ua} [kip]
161.089	0.700	112.762	87.123

www.hilti.com

Company:		Page:	7
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Sea World Netting Posts - N98	Date:	11/20/2023
Fastening point:			

4.3 Concrete edge failure in direction x+

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

$$\phi V_{cb} \geq V_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

$$A_{Vc} \text{ see ACI 318-19, Section 17.7.2.1, Fig. R 17.7.2.1(b)}$$

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

$$\Psi_{ed,V} = 0.7 + 0.3 \left(\frac{c_{a2}}{1.5c_{a1}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.7.2.4.1b)}$$

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

$$V_b = 9 \lambda_a \sqrt{f'_c} c_{a1}^{1.5} \quad \text{ACI 318-19 Eq. (17.7.2.2.1b)}$$

Variables

c_{a1} [in.]	c_{a2} [in.]	$\Psi_{c,V}$	h_a [in.]	l_e [in.]
11.000	24.000	1.000	120.000	12.000
λ_a	d_a [in.]	f'_c [psi]	$\Psi_{parallel,V}$	
1.000	1.500	3,000	1.000	

Calculations

A_{Vc} [in. ²]	A_{Vc0} [in. ²]	$\Psi_{ed,V}$	$\Psi_{h,V}$	V_b [kip]
544.50	544.50	1.000	1.000	17.984

Results

V_{cb} [kip]	$\phi_{concrete}$	ϕV_{cb} [kip]	V_{ua} [kip]
17.984	0.700	12.589	87.123

5 Combined tension and shear loads, per ACI 318-19 section 17.8

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
7.508	6.921	1.000	1,203	not recommended

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



www.hilti.com

Company:		Page:	8
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Sea World Netting Posts - N98	Date:	11/20/2023
Fastening point:			

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.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>

Fastening does not meet the design criteria!

www.hilti.com

Company:
 Address:
 Phone | Fax: |
 Design: Sea World Netting Posts - N98
 Fastening point:

Page: 9
 Specifier:
 E-Mail:
 Date: 11/20/2023

7 Installation data

Profile: Round HSS (AISC), HSS20X.500; (L x W x T) = 20.000 in. x 20.000 in. x 0.500 in.

Hole diameter in the fixture: $d_f = 1.562$ in.

Plate thickness (input): 2.000 in.

Recommended plate thickness: not calculated

Anchor type and diameter: Heavy Hex Head ASTM F 1554
 GR. 36 1 1/2

Item number: not available

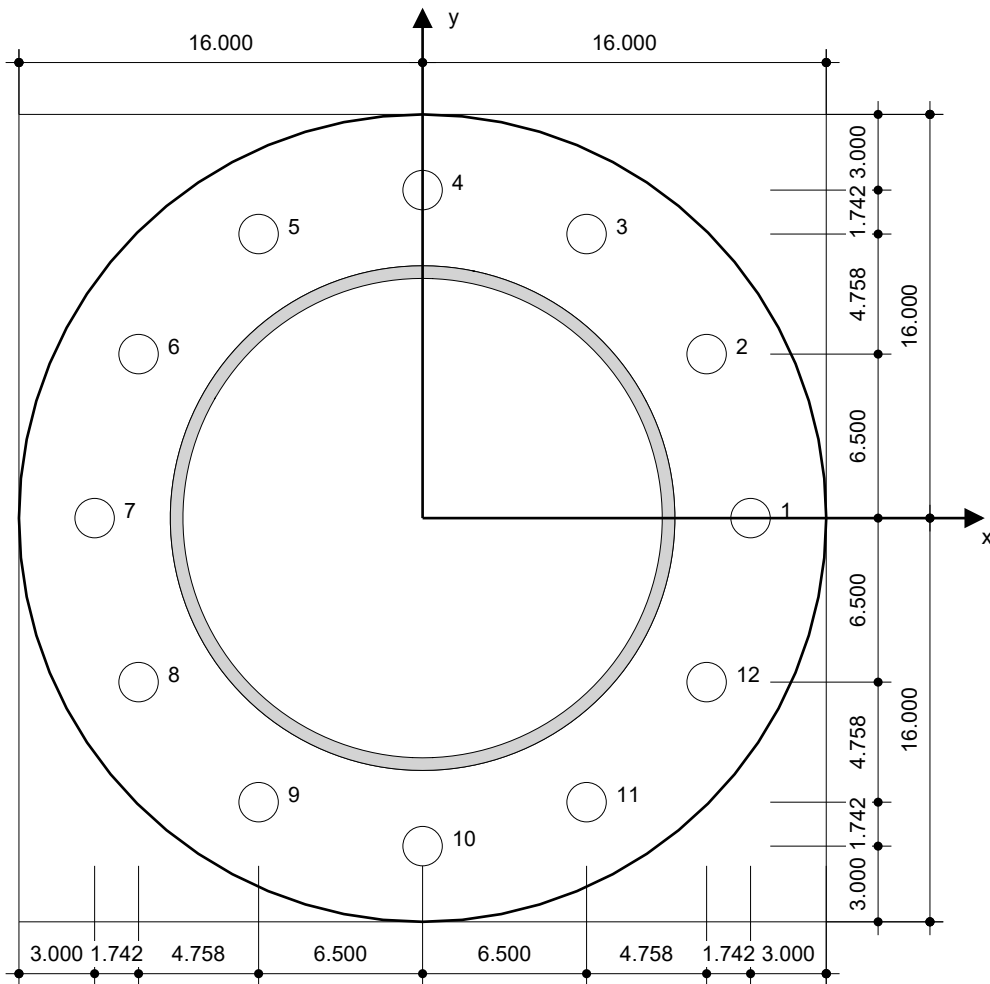
Maximum installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 25.000 in.

Minimum thickness of the base material: 26.500 in.

Hilti Heavy Hex Head headed stud anchor with 25 in embedment, 1 1/2, Steel galvanized, installation per instruction for use



Input data and results must be checked for conformity with the existing conditions and for plausibility!
 PROFIS Engineering (c) 2003-2023 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan



Hilti PROFIS Engineering 3.0.89

www.hilti.com

Company:
Address:
Phone | Fax: |
Design: Sea World Netting Posts - N98
Fastening point:

Page: 10
Specifier:
E-Mail:
Date: 11/20/2023

Coordinates Anchor [in.]

Anchor	x	y	C _{-x}	C _{+x}	C _{-y}	C _{+y}	Anchor	x	y	C _{-x}	C _{+x}	C _{-y}	C _{+y}
1	13.000	0.000	37.000	11.000	24.000	24.000	7	-13.000	0.000	11.000	37.000	24.000	24.000
2	11.258	6.500	35.258	12.742	30.500	17.500	8	-11.258	-6.500	12.742	35.258	17.500	30.500
3	6.500	11.258	30.500	17.500	35.258	12.742	9	-6.500	-11.258	17.500	30.500	12.742	35.258
4	-0.000	13.000	24.000	24.000	37.000	11.000	10	-0.000	-13.000	24.000	24.000	11.000	37.000
5	-6.500	11.258	17.500	30.500	35.258	12.742	11	6.500	-11.258	30.500	17.500	12.742	35.258
6	-11.258	6.500	12.742	35.258	30.500	17.500	12	11.258	-6.500	35.258	12.742	17.500	30.500



www.hilti.com

Company:		Page:	11
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Sea World Netting Posts - N98	Date:	11/20/2023
Fastening point:			

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.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.