

www.hilti.com

Company:
 Address:
 Phone | Fax: |
 Design: Uplift and Horizontal 5.3.1a
 Fastening point:

Page: 1
 Specifier:
 E-Mail:
 Date: 1/12/2024

Specifier's comments:

1 Input data

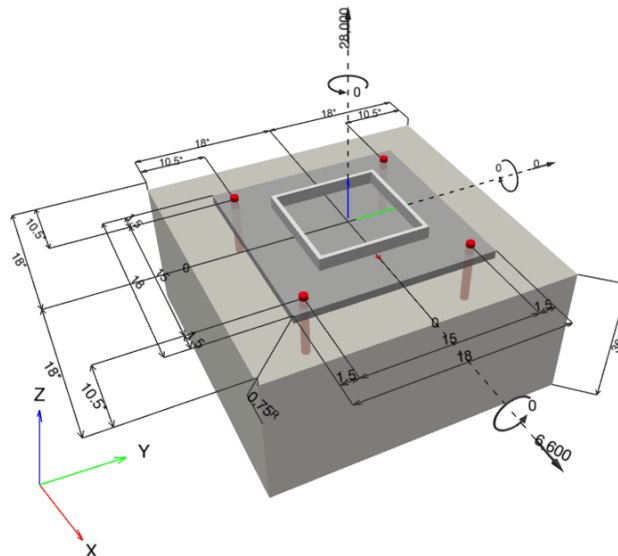


Anchor type and diameter:	KWIK HUS-EZ (KH-EZ) 3/4 (6 1/4)
Item number:	418085 KH-EZ 3/4"x7"
Effective embedment depth:	$h_{ef,act} = 4.840$ in., $h_{nom} = 6.250$ in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-3027
Issued Valid:	4/1/2022 12/1/2023
Proof:	Design Method ACI 318-19 / Mech
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.750$ in.
Anchor plate ^R :	$l_x \times l_y \times t = 18.000$ in. x 18.000 in. x 0.750 in.; (Recommended plate thickness: not calculated)
Profile:	Square HSS (AISC), HSS10X10X.375; (L x W x T) = 10.000 in. x 10.000 in. x 0.375 in.
Base material:	uncracked concrete, 3000, $f'_c = 3,000$ psi; $h = 36.000$ in.
Installation:	hammer drilled hole, Installation condition: Dry
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar

Application also possible with KWIK-X 3/4 (4 1/2) hnom2 under the selected boundary conditions.
 More information in section Alternative fastening data of this report.

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

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



www.hilti.com

Company:	Page: 2
Address:	Specifier:
Phone Fax:	E-Mail:
Design: Uplift and Horizontal 5.3.1a	Date: 1/12/2024
Fastening point:	

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 28,000; V _x = 6,600; V _y = 0; M _x = 0; M _y = 0; M _z = 0;	no	75

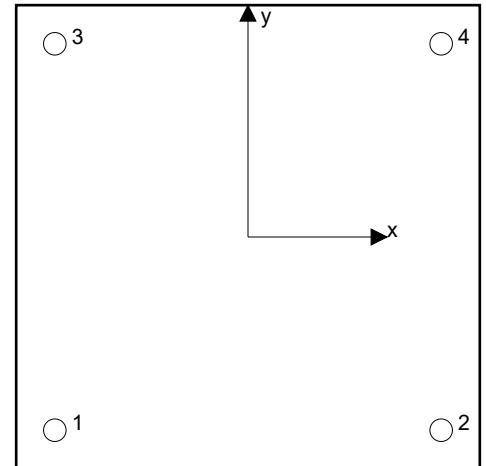
2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	7,000	1,650	1,650	0
2	7,000	1,650	1,650	0
3	7,000	1,650	1,650	0
4	7,000	1,650	1,650	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]



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*	7,000	20,808	34	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	28,000	40,942	69	OK

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



www.hilti.com

Company:		Page:	3
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Uplift and Horizontal 5.3.1a	Date:	1/12/2024
Fastening point:			

3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-3027
 $\phi N_{sa} \geq N_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,N}$ [in. ²]	f_{uta} [psi]
0.39	81,600

Calculations

N_{sa} [lb]
32,013

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
32,013	0.650	20,808	7,000



www.hilti.com

Company:
 Address:
 Phone | Fax: |
 Design: Uplift and Horizontal 5.3.1a
 Fastening point:

Page: 4
 Specifier:
 E-Mail:
 Date: 1/12/2024

3.2 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.]	$\psi_{c,N}$
4.840	0.000	0.000	10.500	1.000
c_{ac} [in.]	k_c	λ_a	f'_c [psij]	
7.280	27	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 [lb]
843.32	210.83	1.000	1.000	1.000	1.000	15,747

Results

N_{cbg} [lb]	$\phi_{concrete}$	ϕN_{cbg} [lb]	N_{ua} [lb]
62,987	0.650	40,942	28,000



www.hilti.com

Company:		Page:	5
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Uplift and Horizontal 5.3.1a	Date:	1/12/2024
Fastening point:			

4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	1,650	9,996	17	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	6,600	88,182	8	OK
Concrete edge failure in direction x+**	6,600	16,534	40	OK

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

4.1 Steel Strength

V_{sa} = ESR value refer to ICC-ES ESR-3027
 $\phi V_{steel} \geq V_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,V}$ [in. ²]	f_{uta} [psi]
0.39	81,600

Calculations

V_{sa} [lb]
16,660

Results

V_{sa} [lb]	ϕ_{steel}	ϕV_{sa} [lb]	V_{ua} [lb]
16,660	0.600	9,996	1,650



www.hilti.com

Company:
 Address:
 Phone | Fax: |
 Design: Uplift and Horizontal 5.3.1a
 Fastening point:

Page: 6
 Specifier:
 E-Mail:
 Date: 1/12/2024

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	4.840	0.000	0.000	10.500
$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f_c [psi]
1.000	7.280	27	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 [lb]
843.32	210.83	1.000	1.000	1.000	1.000	15,747

Results

$V_{cp,g}$ [lb]	$\phi_{concrete}$	$\phi V_{cp,g}$ [lb]	V_{ua} [lb]
125,974	0.700	88,182	6,600



www.hilti.com

Company:		Page:	7
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Uplift and Horizontal 5.3.1a	Date:	1/12/2024
Fastening point:			

4.3 Concrete edge failure in direction x+

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

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

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

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

$$\Psi_{ec,V} = \left(\frac{1}{1 + \frac{e_v}{1.5c_{a1}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.7.2.3.1)}$$

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

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

$$V_b = \left(7 \left(\frac{l_e}{d_a} \right)^{0.2} \sqrt{d_a} \right) \lambda_a \sqrt{f'_c} c_{a1}^{1.5} \quad \text{ACI 318-19 Eq. (17.7.2.2.1a)}$$

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\Psi_{c,V}$	h_a [in.]
10.500	10.500	0.000	1.400	36.000
l_e [in.]	λ_a	d_a [in.]	f'_c [psi]	$\Psi_{parallel,V}$
4.840	1.000	0.750	3,000	1.000

Calculations

A_{Vc} [in. ²]	A_{Vc0} [in. ²]	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{h,V}$	V_b [lb]
567.00	496.13	1.000	0.900	1.000	16,403

Results

V_{cbg} [lb]	$\phi_{concrete}$	ϕV_{cbg} [lb]	V_{ua} [lb]
23,621	0.700	16,534	6,600

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

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.684	0.399	5/3	75	OK

$$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} \leq 1$$



www.hilti.com

Company:		Page:	8
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Uplift and Horizontal 5.3.1a	Date:	1/12/2024
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.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-19, Section 26.7.

Fastening meets the design criteria!

www.hilti.com

Company:
 Address:
 Phone | Fax: |
 Design: Uplift and Horizontal 5.3.1a
 Fastening point:

Page: 9
 Specifier:
 E-Mail:
 Date: 1/12/2024

7 Installation data

Profile: Square HSS (AISC), HSS10X10X.375; (L x W x T) = 10.000 in. x 10.000 in. x 0.375 in.

Hole diameter in the fixture: $d_f = 0.875$ in.

Plate thickness (input): 0.750 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: KWIK HUS-EZ (KH-EZ) 3/4 (6 1/4)

Item number: 418085 KH-EZ 3/4"x7"

Maximum installation torque: 1,140 in.lb

Hole diameter in the base material: 0.750 in.

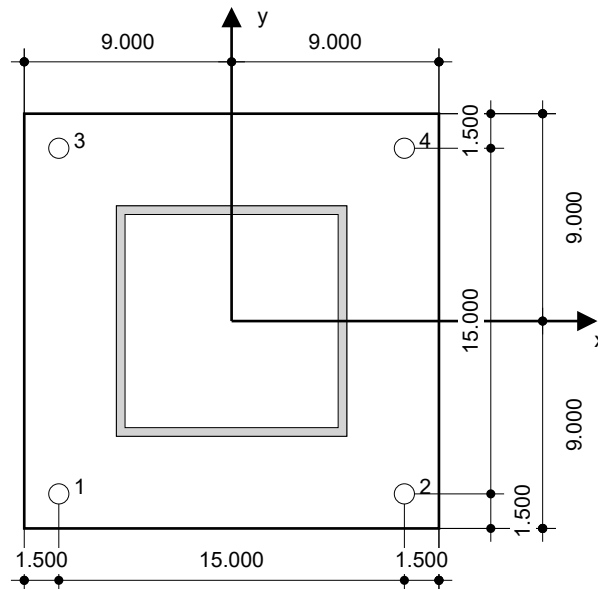
Hole depth in the base material: 6.625 in.

Minimum thickness of the base material: 8.125 in.

Hilti KH-EZ screw anchor with 6.25 in embedment, 3/4 (6 1/4), Carbon steel, installation per ESR-3027

7.1 Recommended accessories

Drilling	Cleaning	Setting
<ul style="list-style-type: none"> Suitable Rotary Hammer Properly sized drill bit 	<ul style="list-style-type: none"> Manual blow-out pump 	<ul style="list-style-type: none"> Torque wrench Hilti SIW 9-A22 Impact Wrench



Coordinates Anchor [in.]

Anchor	x	y	c _{-x}	c _{+x}	c _{-y}	c _{+y}
1	-7.500	-7.500	10.500	25.500	10.500	25.500
2	7.500	-7.500	25.500	10.500	10.500	25.500
3	-7.500	7.500	10.500	25.500	25.500	10.500
4	7.500	7.500	25.500	10.500	25.500	10.500

www.hilti.com

Company:		Page:	10
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Uplift and Horizontal 5.3.1a	Date:	1/12/2024
Fastening point:			

8 Alternative fastening

8.1 Alternative fastening data

Anchor type and diameter:	KWIK-X 3/4 (4 1/2) hnom2	
Item number:	418084 KH-EZ 3/4"x5 1/2" (element) / 2346813 KHC 3/4" LARGE (capsule)	
Effective embedment depth:	$h_{ef,opti} = 4.500$ in. ($h_{ef,limit} = 7.250$ in.), $h_{nom} = 4.500$ in.	
Material:	Carbon Steel	
Evaluation Service Report:	ESR-5065	
Issued Valid:	1/1/2023 12/1/2023	
Proof:	Design Method ACI 318-19 / Chem	
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.750$ in.	
Anchor plate ^R :	$l_x \times l_y \times t = 18.000$ in. x 18.000 in. x 0.750 in.; (Recommended plate thickness: not calculated)	
Profile:	Square HSS (AISC), HSS10X10X.375; (L x W x T) = 10.000 in. x 10.000 in. x 0.375 in.	
Base material:	uncracked concrete, 3000, $f'_c = 3,000$ psi; $h = 36.000$ in., Temp. short/long: 32/32 °F	
Installation:	hammer drilled hole, Installation condition: Dry	
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar	

**Max. Utilization with KWIK-X 3/4 (4 1/2) hnom2: 100 %
Fastening meets the design criteria!**

8.2 Installation data

Profile: Square HSS (AISC), HSS10X10X.375; (L x W x T) = 10.000 in. x 10.000 in. x 0.375 in.	Anchor type and diameter: KWIK-X 3/4 (4 1/2) hnom2
Hole diameter in the fixture: $d_f = 0.875$ in.	Item number: 418084 KH-EZ 3/4"x5 1/2" (element) / 2346813 KHC 3/4" LARGE (capsule)
Plate thickness (input): 0.750 in.	Maximum installation torque: -
Recommended plate thickness: not calculated	Hole diameter in the base material: 0.750 in.
Drilling method: Hammer drilled	Hole depth in the base material: 5.500 in.
Cleaning: No cleaning of the drilled hole is required	Minimum thickness of the base material: 7.000 in.

3/4 (4 1/2) hnom2 Hilti KH-EZ Carbon steel screw anchor with Hilti KHC

8.2.1 Recommended accessories

Drilling	Cleaning	Setting
<ul style="list-style-type: none"> • Suitable Rotary Hammer • Properly sized drill bit 	<ul style="list-style-type: none"> • No accessory required 	<ul style="list-style-type: none"> • SIW 6-A22 Impact Screw Driver



www.hilti.com

Company:		Page:	11
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Uplift and Horizontal 5.3.1a	Date:	1/12/2024
Fastening point:			

9 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.