

DTFC - DOUBLE-TEE FLEXIBLE CONNECTION FOR PARKING GARAGES


NORTHFORD STRUCTURAL CONNECTIONS

DTFC - Technical Supplement



PRODUCT DESCRIPTION

Double-Tee Flexible Connection for Parking Garages

 <p style="text-align: center;">DTFC</p>	<p>Benefits</p> <ul style="list-style-type: none"> • Retrofit double-tee flange connection for replacement of existing connections • Eliminates welding and concrete repairs • Transmits seismic forces and vertical shear loads from vehicles while allowing expansion and contraction across the joint to reduce stress in the deck. • TC bolts are not subject to fatigue and eliminate failures of the connection • Erection anchors hold brackets in place overhead for safe and easy installation. • Anchorage of connection can be designed with Hilti PROFIS Engineering software for varying project conditions. • Recommended(1) and designed for anchorage with anchors(2): <ul style="list-style-type: none"> ○ Hilti HIT-HY-200 V3 w/ 1/2" HAS-B-105 Threaded Rod <ul style="list-style-type: none"> ▪ $h_{nom} = 3-3/4$-in. ○ Hilti Kwik-X Dual Action Anchor 1/2" <ul style="list-style-type: none"> ▪ $h_{nom} = 3$-in.
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1 See Design of Anchorage section of this document for information on post-installed anchor design
 2 System Load Capability is dependent upon anchorage and base-material, verify with Engineer of Record

Materials

Part	Material/Mechanical properties or standard
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Bracket Plate

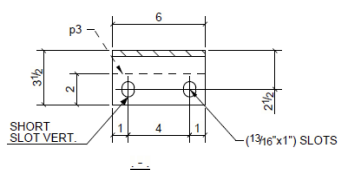
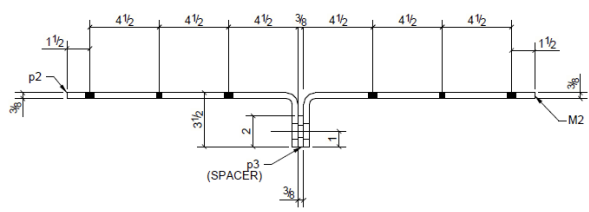
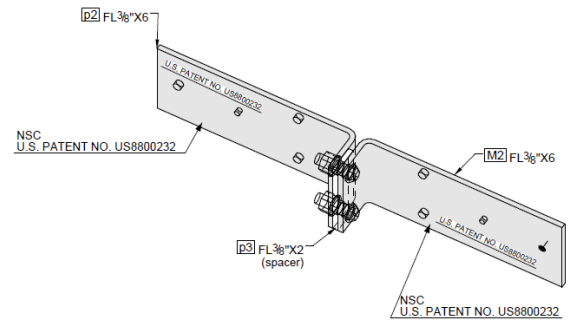
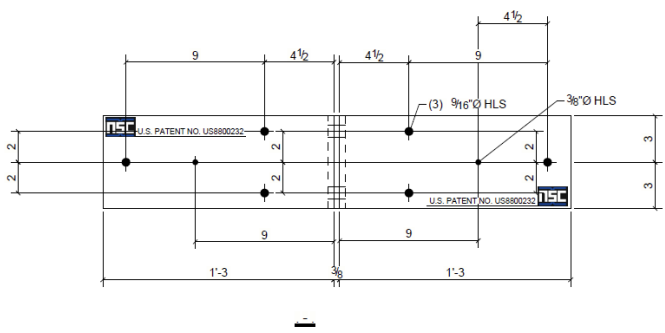
ASTM A-240, Grade 304

Bracket Control Plate

ASTM A-240, Grade 304

Tension Control Bolts

ASTM F3125, Grade A325 TC

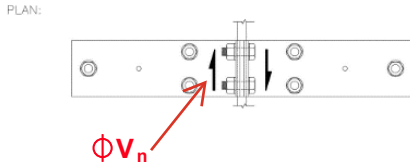


Information Regarding Load Data

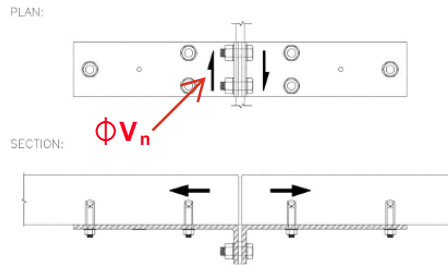
The following data tables are based on example anchorage design calculations where one side of the double-tee connection is considered (see "Design of Anchorage"). For the vertical/out-of-plane calculations, per PCI Design Handbook 7th Edition the vertical load is distributed between the two adjacent double-tees. Please reach out to Northford Structural Connections for additional information regarding the loading data and calculation methods used.

Example Loading Calculations

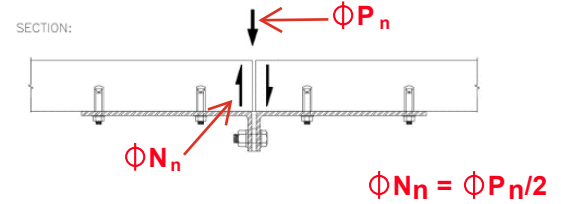
Shear



Shear and Tension



Out of Plane Loading (Vehicle Loading)



Concrete (5,000 psi)	Anchor System	Anchor Dimensions (diameter x embedment)(in. x in.)	Shear Load Parallel to Joint (ϕV_n) @ Max. Utilization (lbs)		Simultaneous Shear due to joint opening/closing			
					1,500 lbs Shear Load ¹ normal to joint		-1,500 lbs Shear Load ¹ normal to joint	
Thickness			Rigid	CBFEM	Shear Load (ϕV_n) Parallel to Joint @ Max. Utilization (lbs)	Shear Load (ϕV_n) Parallel to Joint @ Max. Utilization (lbs)	Rigid	CBFEM
4.0"	HY 200 V3 w/ HAS-B-105	1/2 x 2 3/4	2225	3250	1900	2850	2350	6550
	Kwik-X	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4.5"	HY 200 V3 w/ HAS-B-105	1/2 x 3 1/4	2450	3550	2125	3200	2575	7175
	Kwik-X	3/8 x 2 1/2	2125	3075	1775	2675	2250	6250
5"	HY 200 V3 w/ HAS-B-105	1/2 x 3 3/4	2650	3850	2350	3525	2800	7800
	Kwik-X	1/2 x 3	2525	3675	2225	3325	2675	7450
5.5"	HY 200 V3 w/ HAS-B-105	1/2 x 4 1/4	2825	4100	2525	3775	2950	8275
	Kwik-X	1/2 x 3 1/2	2750	3975	2450	3650	2875	8075
6"	HY 200 V3 w/ HAS-B-105	1/2 x 4 3/4	2950	4275	2650	3975	3075	8650
	Kwik-X	1/2 x 4	2950	4275	2650	3975	3075	8650

Note 1: Positive shear indicates joint opening; negative shear indicates joint closing.

Concrete (5,000 psi)	Anchor System	Anchor Dimensions (diameter x embedment)(in. x in.)	Vertical/Out-of-Plane Shear Load (ϕN_n) @ Max. Utilization (lbs)	Vertical/Out-of-Plane Load (ϕP_n) @ Max. Utilization (lbs)
Thickness				
4.0"	HY 200 V3 w/HAS-B-105	1/2 x 2 3/4	2425	4850
	Kwik-X	n/a	n/a	n/a
4.5"	HY 200 V3 w/HAS-B-105	1/2 x 3 1/4	2850	5700
	Kwik-X	3/8 x 2 1/2	1875	3750
5.0"	HY 200 V3 w/HAS-B-105	1/2 x 3 3/4	3300	6600
	Kwik-X	1/2 x 3	4100	8200
5.5"	HY 200 V3 w/HAS-B-105	1/2 x 4 1/4	3750	7500
	Kwik-X	1/2 x 3 1/2	4600	9200
6"	HY 200 V3 w/HAS-B-105	1/2 x 4 3/4	4175	8350
	Kwik-X	1/2 x 4 3/4	5100	10200

Important Notes

The concrete deck to which the DTFC attaches must be in good sound condition. Any visible cracking, spalling, or other signs of deterioration or corrosion are unacceptable. Do not install DTFC within 6" of existing double-tee flange connections.

Design of anchorage

The design of the anchorage for the DTFC must be ensured for varying load conditions (i.e. varying directions, dynamic effects, etc.). The anchorage for the DTFC has to be designed according to extreme load cases: a concrete anchor can only be considered as suitable for use with the DTFC if the approved anchor satisfies the following load scenarios (e.g. by PROFIS calculation) based on post-installed anchor design provisions per ACI 318-19 Chapter 17 or CSA A23.3-14 Annex D.

The use of the recommended HIT-HY 200 V3 and Kwik-X anchor systems are based on the design assumptions noted below. In case of different design parameters, a new calculation should be performed.

Load conditions:

Load values from the above data tables are based on the anchorage design in PROFIS Engineering. Values are input as the total static load resulting in a max. utilization of 100% (see example calculation). PROFIS will only provide the design limit of the anchoring system, and strength and deflection limits for the brackets will be provided separately through the results of laboratory testing

Design parameters per ACI 318-19 Chapter 17 or CSA A23.3-14 Annex D:

- Cracked concrete
- 5000 psi concrete compressive strength
- No supplemental reinforcement present (Condition B).
- 5" concrete thickness
- 4.5" edge distance

Recommended Hilti anchors (not provided):

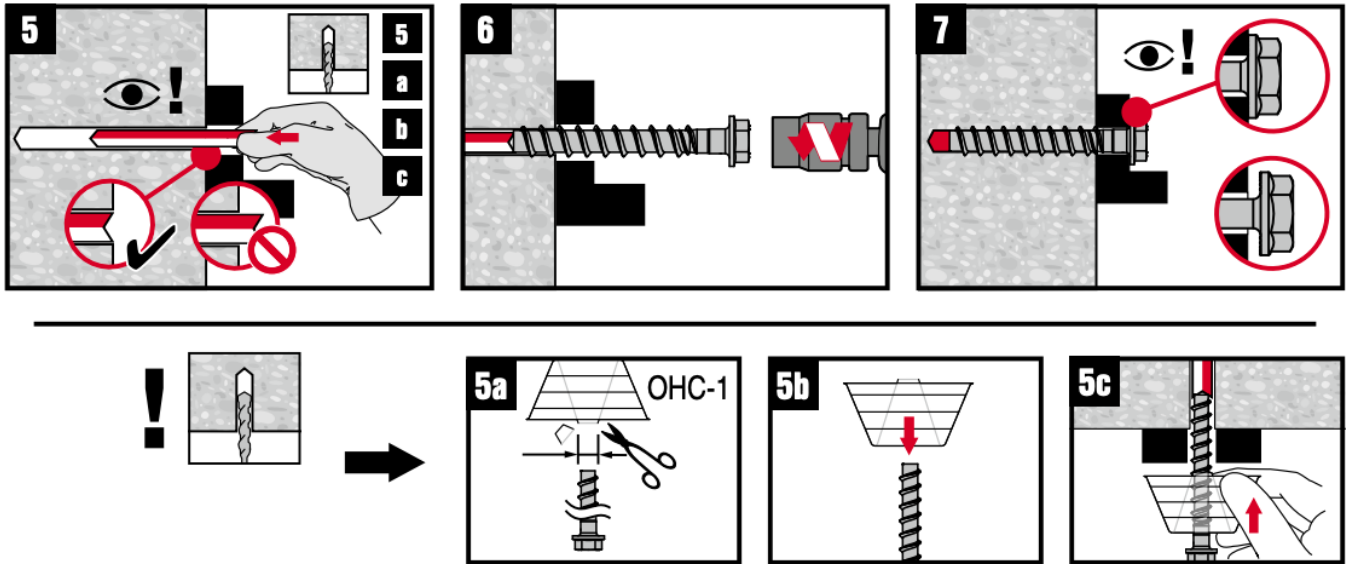
- Hilti HIT-HY 200 V3 with 1/2" HAS-B-105 threaded rod at 3 3/4" nominal embedment
 - Design parameters from ICC-ES ESR-4868
- Hilti Kwik-X Dual Action Anchor 1/2" diameter at 3" nominal embedment
 - 1/2" x 3 1/2" KH-EZ (element)
 - KHC 1/2" SMALL (adhesive capsule)
 - Design parameters from ICC-ES ESR-5065
- *Post-installed anchor selection based on base material geometry/ conditions

Setting instructions

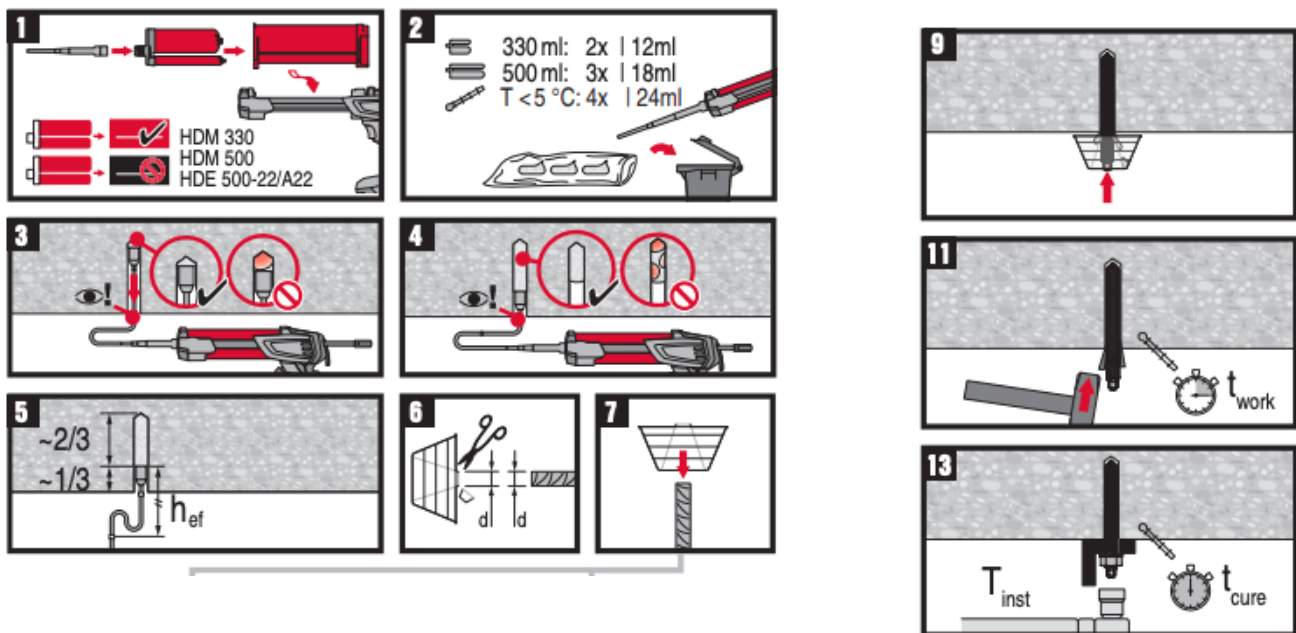
*For detailed information on Hilti HIT-HY 200V3 or Kwik-X installations see instruction for use included with the package of the product.

Setting Instructions Hilti Fasteners:

KWIK-X



Hilti HIT-HY 200-A/R V3



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 Design: NSC-DTFC PE Example Calc
 Fastening point:

Page: 1
 Specifier:
 E-Mail:
 Date:

Specifier's comments:

1 Input data

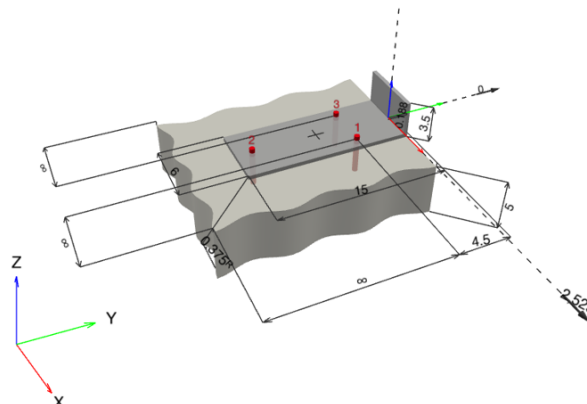


Anchor type and diameter:	KWIK-X 1/2 (3) hnom1
Item number:	418072 KH-EZ 1/2"x3 1/2" (element) / 2346810 KHC 1/2" SMALL (capsule)
Specification text:	Hilti KH-EZ screw anchor with KHC capsule mortar with 3 in embedment hef, 1/2 (3) hnom1, Carbon steel, , Hammer drilled installation per ESR-5065
Effective embedment depth:	$h_{ef,act} = 3.000$ in. ($h_{ef,limit} = -$ in.), $h_{nom} = 3.000$ 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); $t = 0.375$ in.
Ledger Angle ^R :	$L_1 \times L_2 \times t_{L1} \times t_{L2} \times l = 3.500$ in. x 15.000 in. x 0.375 in. x 0.375 in. x 6.000 in.;
Load Point Height:	$h_{pl} = 0.188$ in.
Base material:	cracked concrete, 5000, $f_c' = 5,000$ psi; $h = 5.000$ 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

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

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

Design loads
 Sustained loads



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 Fastening point:

Page: 2
 Specifier:
 E-Mail:
 Date:

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V _x = 2,525; V _y = 0; M _x = 0; M _y = 0; M _z = 0;	no	100

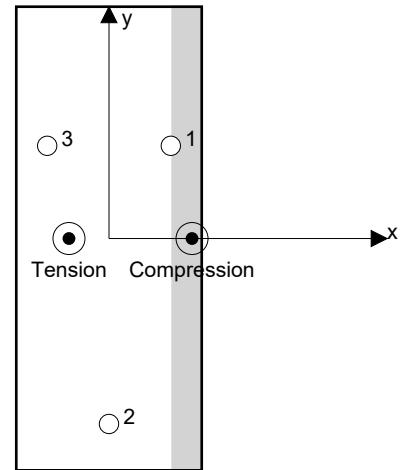
2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	1	1,834	1,735	-596
2	40	945	-945	0
3	78	1,834	1,735	596

max. concrete compressive strain: 0.00 [‰]
 max. concrete compressive stress: 17 [psi]
 resulting tension force in (x/y)=(-1.295/0.000): 119 [lb]
 resulting compression force in (x/y)=(2.687/0.000): 119 [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*	78	11,777	1	OK
Bond Strength**	119	7,881	2	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	119	7,707	2	OK

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



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Fastening point:

Page: 3
Specifier:
E-Mail:
Date:

3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-5065
 $\phi N_{sa} \geq N_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,N}$ [in. ²]	f_{uta} [psi]
0.16	112,540

Calculations

N_{sa} [lb]
18,119

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
18,119	0.650	11,777	78

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 Fastening point:

Page: 4
 Specifier:
 E-Mail:
 Date:

3.2 Bond Strength

$$N_{ag} = \left(\frac{A_{Na}}{A_{Na0}} \right) \Psi_{ec1,Na} \Psi_{ec2,Na} \Psi_{ed,Na} \Psi_{cp,Na} N_{ba} \quad \text{ACI 318-19 Eq. (17.6.5.1b)}$$

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

A_{Na} see ACI 318-19, Section 17.6.5.1, Fig. R 17.6.5.1(b)

$$A_{Na0} = (2 c_{Na})^2 \quad \text{ACI 318-19 Eq. (17.6.5.1.2a)}$$

$$c_{Na} = 10 d_a \sqrt{\frac{\tau_{uncr}}{1100}} \quad \text{ACI 318-19 Eq. (17.6.5.1.2b)}$$

$$\Psi_{ec,Na} = \left(\frac{1}{1 + \frac{e_N}{c_{Na}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.5.3.1)}$$

$$\Psi_{ed,Na} = 0.7 + 0.3 \left(\frac{c_{a,min}}{c_{Na}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.5.4.1b)}$$

$$\Psi_{cp,Na} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.5.5.1b)}$$

$$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \pi \cdot d_a \cdot h_{ef} \quad \text{ACI 318-19 Eq. (17.6.5.2.1)}$$

Variables

$\tau_{k,c,uncr}$ [psi]	d_a [in.]	h_{ef} [in.]	$c_{a,min}$ [in.]	$\alpha_{overhead}$	$\tau_{k,c}$ [psi]
2,408	0.500	3.000	4.500	1.000	2,094
$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	c_{ac} [in.]	λ_a		
1.295	0.000	7.023	1.000		

Calculations

c_{Na} [in.]	A_{Na} [in. ²]	A_{Na0} [in. ²]	$\Psi_{ed,Na}$
7.365	354.78	216.95	0.883
$\Psi_{ec1,Na}$	$\Psi_{ec2,Na}$	$\Psi_{cp,Na}$	N_{ba} [lb]
0.850	1.000	1.000	9,869

Results

N_{ag} [lb]	ϕ_{bond}	ϕN_{ag} [lb]	N_{ua} [lb]
12,124	0.650	7,881	119

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 Design: NSC-DTFC PE Example Calc
 Fastening point:

Page:
 Specifier:
 E-Mail:
 Date:

5

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.]	$\psi_{c,N}$
3.000	1.295	0.000	4.500	1.000
c_{ac} [in.]	k_c	λ_a	f'_c [psi]	
7.023	17	1.000	5,000	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
198.00	81.00	0.777	1.000	1.000	1.000	6,246

Results

N_{cbg} [lb]	$\phi_{concrete}$	ϕN_{cbg} [lb]	N_{ua} [lb]
11,857	0.650	7,707	119



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Company:		Page:	6
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	NSC-DTFC PE Example Calc	Date:	
Fastening point:			

4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	1,834	5,547	34	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Bond Strength controls)*	1,834	5,352	35	OK
Concrete edge failure in direction y+**	3,521	3,556	100	OK

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

4.1 Steel Strength

V_{sa} = ESR value refer to ICC-ES ESR-5065
 $\phi V_{steel} \geq V_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,V}$ [in. ²]	f_{uta} [psi]
0.16	112,540

Calculations

V_{sa} [lb]
9,245

Results

V_{sa} [lb]	ϕ_{steel}	ϕV_{sa} [lb]	V_{ua} [lb]
9,245	0.600	5,547	1,834

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Company:
 Address:
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 Design: NSC-DTFC PE Example Calc
 Fastening point:

Page: 7
 Specifier:
 E-Mail:
 Date:

4.2 Pryout Strength (Bond Strength controls)

$$V_{cp} = k_{cp} \left[\left(\frac{A_{Na}}{A_{Na0}} \right) \psi_{ed,Na} \psi_{cp,Na} N_{ba} \right] \quad \text{ACI 318-19 Eq. (17.7.3.1a)}$$

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

A_{Na} see ACI 318-19, Section 17.6.5.1, Fig. R 17.6.5.1(b)

$$A_{Na0} = (2 c_{Na})^2 \quad \text{ACI 318-19 Eq. (17.6.5.1.2a)}$$

$$c_{Na} = 10 d_a \sqrt{\frac{\tau_{uncr}}{1100}} \quad \text{ACI 318-19 Eq. (17.6.5.1.2b)}$$

$$\psi_{ec,Na} = \left(\frac{1}{1 + \frac{e_N}{c_{Na}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.5.3.1)}$$

$$\psi_{ed,Na} = 0.7 + 0.3 \left(\frac{c_{a,min}}{c_{Na}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.5.4.1b)}$$

$$\psi_{cp,Na} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.5.5.1b)}$$

$$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \pi \cdot d_a \cdot h_{ef} \quad \text{ACI 318-19 Eq. (17.6.5.2.1)}$$

Variables

k_{cp}	$\alpha_{overhead}$	$\tau_{k,c,uncr}$ [psi]	d_a [in.]	h_{ef} [in.]	$c_{a,min}$ [in.]	$\tau_{k,c}$ [psi]
2	1.000	2,408	0.500	3.000	4.500	2,094
$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	c_{ac} [in.]	λ_a			
0.000	0.000	7.023	1.000			

Calculations

c_{Na} [in.]	A_{Na} [in. ²]	A_{Na0} [in. ²]	$\psi_{ed,Na}$
7.365	95.13	216.95	0.883
$\psi_{ec1,Na}$	$\psi_{ec2,Na}$	$\psi_{cp,Na}$	N_{ba} [lb]
1.000	1.000	1.000	9,869

Results

V_{cp} [lb]	$\phi_{concrete}$	ϕV_{cp} [lb]	V_{ua} [lb]
7,645	0.700	5,352	1,834

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 Address:
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 Design: NSC-DTFC PE Example Calc
 Fastening point:

 Page:
 Specifier:
 E-Mail:
 Date:

8
4.3 Concrete edge failure in direction y+

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

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

 A_{Vc} 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.]
4.500	-	0.338	1.000	5.000
l_e [in.]	λ_a	d_a [in.]	f'_c [psi]	$\Psi_{parallel,V}$
3.000	1.000	0.500	5,000	1.000

Calculations

A_{Vc} [in. ²]	A_{Vc0} [in. ²]	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{h,V}$	V_b [lb]
87.50	91.13	0.952	1.000	1.162	4,781

Results

V_{cbg} [lb]	$\phi_{concrete}$	ϕV_{cbg} [lb]	V_{ua} [lb]
5,079	0.700	3,556	3,521

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

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.015	0.990	1.000	84	OK

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



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Company:		Page:	9
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	NSC-DTFC PE Example Calc	Date:	
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.
- 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/>
- Installation of Hilti adhesive anchor systems shall be performed by personnel trained to install Hilti adhesive anchors. Reference ACI 318-19, Section 26.7.

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 Design: NSC-DTFC PE Example Calc
 Fastening point:

Page: 10
 Specifier:
 E-Mail:
 Date:

7 Installation data

Hole diameter in the fixture: $d_f = 0.625$ in.

Plate thickness (input): 0.375 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: No cleaning of the drilled hole is required

Anchor type and diameter: KWIK-X 1/2 (3) hnom1
 Item number: 418072 KH-EZ 1/2"x3 1/2" (element) /
 2346810 KHC 1/2" SMALL (capsule)

Maximum installation torque: -

Hole diameter in the base material: 0.500 in.

Hole depth in the base material: 3.750 in.

Minimum thickness of the base material: 5.000 in.

Hilti KH-EZ screw anchor with KHC capsule mortar with 3 in embedment hef, 1/2 (3) hnom1, Carbon steel, Hammer drilled installation per ESR-5065

7.1 Recommended accessories

Drilling

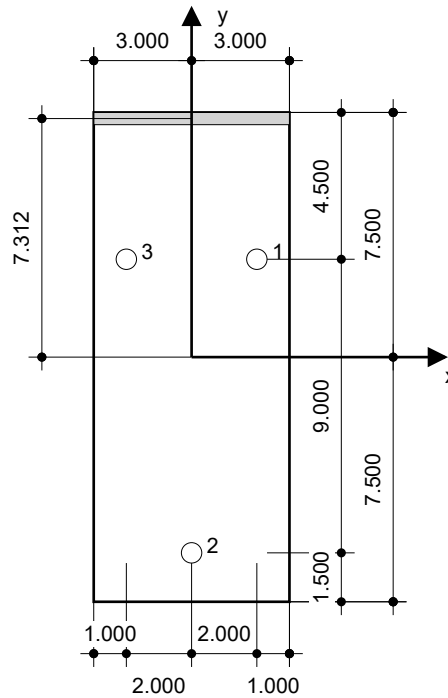
- Suitable Rotary Hammer
- Properly sized drill bit

Cleaning

- No accessory required

Setting

- SIW 6-A22 Impact Screw Driver



Coordinates Anchor [in.]

Anchor	x	y	c _{-x}	c _{+x}	c _{-y}	c _{+y}
1	2.000	3.000	-	-	-	4.500
2	-0.000	-6.000	-	-	-	13.500
3	-2.000	3.000	-	-	-	4.500



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Fastening point:

Page:
Specifier:
E-Mail:
Date:

11

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.