Hilti PROFIS Engineering 3.1.10

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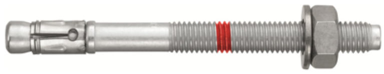
Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - 16 Jan 2025	Date:	16/01/2025
Fastening Point:			

Specifier's comments:

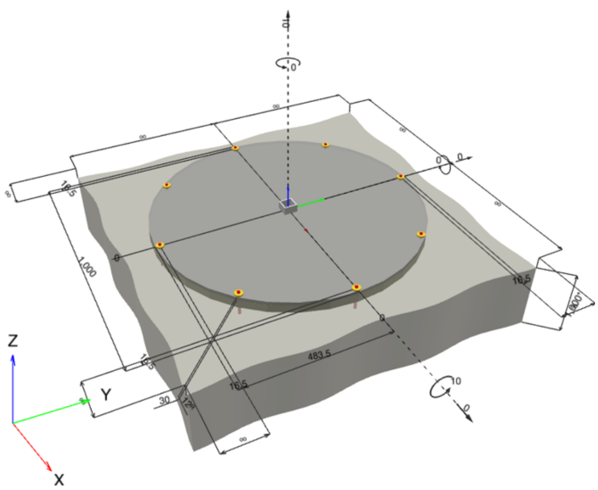
1 Input data



Anchor type and size:	**HST3 M10 hef1**
Return period (service life in years):	50
Item number:	2105714 HST3 M10x110 50/30
Hilti Filling Set or any suitable annular gap filling solution	
Specification text:	Hilti HST3 stud anchor with 40 mm embedment, M10 hef1, Steel galvanized, installation per ETA 98/0001, with annular gaps filled with Hilti Filling Set or any suitable gap solutions
Effective embedment depth:	$h_{ef,opti}$ = 40.0 mm ($h_{ef,limit}$ = 59.0 mm), h_{nom} = 48.0 mm
Material:	
Approval No.:	ETA 98/0001
Issued I Valid:	20/07/2023 | -
Proof:	SOFA based on EN 1992-4, Mechanical
Stand-off installation:	grouted standoff; restraint level (baseplate): 2.00; e_b = 30.0 mm; t = 12.0 mm grout compressive strength = 120.00 N/mm^2
Baseplate^R :	l_x x l_y x t = 1,000.0 mm x 1,000.0 mm x 12.0 mm; (Recommended plate thickness: not calculated)
Profile:	Square hollow, 50 x 50 x 5,0; (L x W x T) = 50.0 mm x 50.0 mm x 5.0 mm
Base material:	cracked concrete, C20/25, $f_{c,cyl}$ = 20.00 N/mm^2; h =1,000.0 mm, User-defined partial material safety factor γ_c = 1.500
Installation:	**Hammer drilled hole, Installation condition: Dry**
Reinforcement:	No reinforcement or Reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm) no longitudinal edge reinforcement

^{R} - The anchor calculation is based on a rigid baseplate assumption.

Geometry [mm] & Loading [kN, kNm]



1.1 Load combination

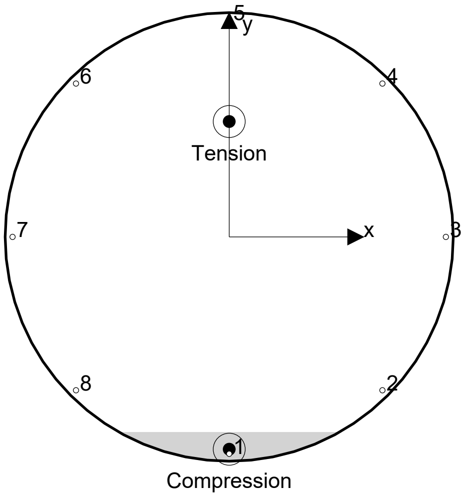
Case	Description	Forces [kN] / Moments [kNm]	Seismic	Fire	Max. Util. Anchor [%]
1	Combination 1	N = 10.000; V_x = 0.000; V_y = 0.000; M_x = 10.000; M_y = 0.000; M_z = 0.000;	no	no	91

2 Load case/Resulting anchor forces

Anchor reactions [kN]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0.000	0.000	0.000	0.000
2	0.546	0.000	0.000	0.000
3	2.489	0.000	0.000	0.000
4	4.431	0.000	0.000	0.000
5	5.236	0.000	0.000	0.000
6	4.431	0.000	0.000	0.000
7	2.489	0.000	0.000	0.000
8	0.546	0.000	0.000	0.000



Max. concrete compressive strain: 0.04 [‰]

Max. concrete compressive stress: 1.27 [N/mm^2]

Resulting tension force in (x/y)=(-0.0/257.3): 20.167 [kN]

Resulting compression force in (x/y)=(0.0/-473.3): 10.167 [kN]

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

3 Tension load (EN 1992-4, Section 7.2.1)

	Load [kN]	Capacity [kN]	Utilization β_N [%]	Status
Steel failure*	5.236	23.214	23	OK
Pull-out failure*	5.236	5.808	91	OK
Concrete Breakout failure**	5.236	5.808	91	OK
Splitting failure**	N/A	N/A	N/A	N/A

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

3.1 Steel failure

$$N_{Ed} \leq N_{Rd,s} = \frac{N_{Rk,s}}{\gamma_{Ms}}$$ EN 1992-4, Table 7.1

$N_{Rk,s}$ [kN]	γ_{Ms}	$N_{Rd,s}$ [kN]	N_{Ed} [kN]
32.500	1.400	23.214	5.236

3.2 Pull-out failure

$$N_{Ed} \leq N_{Rd,p} = \frac{\psi_c \cdot N_{Rk,p}}{\gamma_{Mp}}$$ EN 1992-4, Table 7.1

$N_{Rk,p}$ [kN]	ψ_c	γ_{Mp}	$N_{Rd,p}$ [kN]	N_{Ed} [kN]
8.712	1.000	1.500	5.808	5.236

3.3 Concrete Breakout failure

$N_{Ed} \leq N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{Mc}}$	EN 1992-4, Table 7.1
$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{M,N}$	EN 1992-4, Eq. (7.1)
$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1,5}$	EN 1992-4, Eq. (7.2)
$A^0_{c,N} = s_{cr,N} \cdot s_{cr,N}$	EN 1992-4, Eq. (7.3)
$\psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}} \leq 1.00$	EN 1992-4, Eq. (7.4)
$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{N,1}}{s_{cr,N}}\right)} \leq 1.00$	EN 1992-4, Eq. (7.6)
$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{N,2}}{s_{cr,N}}\right)} \leq 1.00$	EN 1992-4, Eq. (7.6)
$\psi_{M,N} = 1$	EN 1992-4, Eq. (7.7)

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	$f_{c,cyl}$ [N/mm^2]
14,400	14,400	60.0	120.0	20.00

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$	z [mm]
0.0	1.000	0.0	1.000	1.000	1.000	730.5

$\psi_{M,N}$	k_1	$N^0_{Rk,c}$ [kN]	γ_{Mc}	$N_{Rd,c}$ [kN]	N_{Ed} [kN]
1.000	7.700	8.712	1.500	5.808	5.236

Group anchor ID
5

4 Shear load (EN 1992-4, Section 7.2.2)

	Load [kN]	Capacity [kN]	Utilization β_V [%]	Status
Steel failure (without lever arm)*	N/A	N/A	N/A	N/A
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout failure*	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)
When the input edge distance is set to "infinity", edge breakout verification is not performed in that direction

5 Displacements (highest loaded anchor)

Short term loading:

N_{Sk}	=	3.878 [kN]	δ_N	=	0.5412 [mm]
V_{Sk}	=	0.000 [kN]	δ_V	=	0.0000 [mm]
			δ_{NV}	=	0.5412 [mm]

Long term loading:

N_{Sk}	=	3.878 [kN]	δ_N	=	1.1725 [mm]
V_{Sk}	=	0.000 [kN]	δ_V	=	0.0000 [mm]
			δ_{NV}	=	1.1725 [mm]

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the baseplate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid baseplates 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 baseplate are not considered - the baseplate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required baseplate thickness with CBFEM to limit the stress of the baseplate based on the assumptions explained above. The proof if the rigid baseplate 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!
- The equations presented in this report are based on metric units. When inputs are displayed in imperial units, the user should be aware that the equations remain in their metric format.
- Design is only valid if hole is filled to remove clearance, clearance as per EN 1992-4 Table 6.1
- Checking the transfer of loads into the base material is required in accordance with EN 1992-4, Annex A!
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 6.1 of EN 1992-4! For larger diameters of the clearance hole see section 6.2.2 of EN 1992-4!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- For the determination of the $\psi_{re,v}$ (concrete edge failure) the minimum concrete cover defined in the design settings is used as the concrete cover of the edge reinforcement.
- Please note that this design utilizes user defined material safety factor values that differ from the default values recommended in EN1992-4. Partial Safety factor value: γ_c = 1.500
- The characteristic bond resistances depend on the return period (service life in years): 50

Fastening meets the design criteria!

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Address:		Specifier:	
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Design:	Concrete - 16 Jan 2025	Date:	16/01/2025
Fastening Point:			

7 Installation data

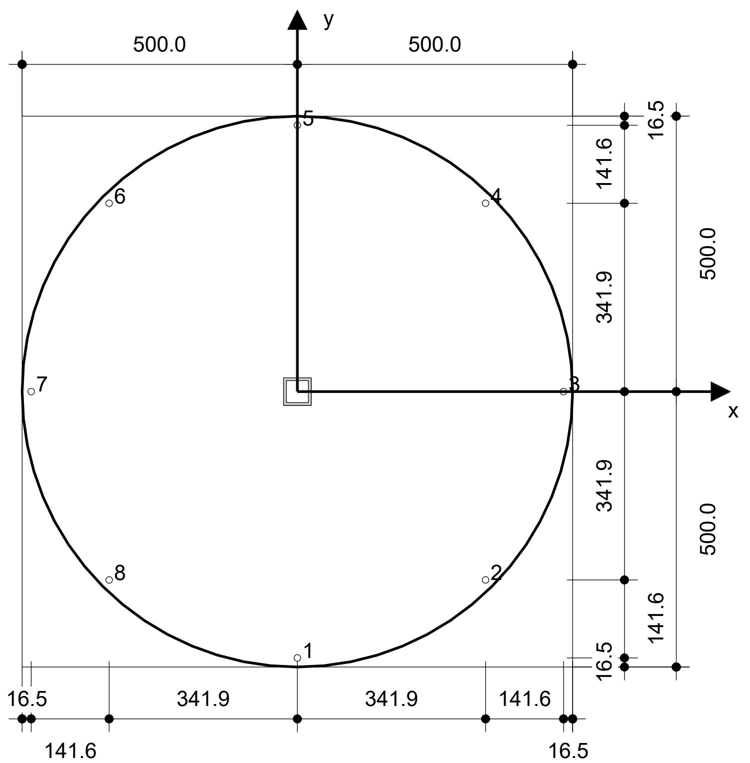
Baseplate, steel: S 235; E = 210,000.00 N/mm^2; f_{yk} = 235.00 N/mm^2
Profile: Square hollow, 50 x 50 x 5,0; (L x W x T) = 50.0 mm x 50.0 mm x 5.0 mm
Hole diameter in the fixture: d_f = 12.0 mm
Plate thickness (input): 12.0 mm
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: No cleaning of the drilled hole is required

Anchor type and size: HST3 M10 hef1
Item number: 2105714 HST3 M10x110 50/30
Maximum installation torque: 45 Nm
Hole diameter in the base material: 10.0 mm
Hole depth in the base material: 65.0 mm
Minimum thickness of the base material: 80.0 mm

Hilti HST3 stud anchor with 40 mm embedment, M10 hef1, Steel galvanized, installation per ETA 98/0001, with annular gaps filled with Hilti Filling Set or any suitable gap solutions

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• No accessory required	• Torque controlled cordless impact tool • Torque wrench • Hammer



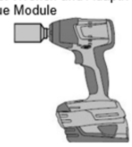
Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.0	-483.5	-	-	-	-
2	341.9	-341.9	-	-	-	-
3	483.5	0.0	-	-	-	-
4	341.9	341.9	-	-	-	-

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
5	0.0	483.5	-	-	-	-
6	-341.9	341.9	-	-	-	-
7	-483.5	0.0	-	-	-	-
8	-341.9	-341.9	-	-	-	-

8 Drilling and installation

HST3 (-R) subject to:

Anchor size	M8	M10	M12	M16	M20	M24
Hammer drilling*	TE2(-A) – TE30(-A)				TE40 – TE70	
Diamond core drilling* 	DD-30W, DD-EC1					
Setting tool*	Setting tool HS-SC				-	
Hollow drill bit drilling* 	-		TE-CD, TE-YD			
Seismic Set/ Filling Set** 	Seismic/Filling Set M8-M20 (Carbon and Stainless Steel A4)					-
Impact Wrench and Adaptive Torque Module 	Impact Wrench SIW 6AT-A22 and adaptive torque module SI-AT-A22				-	

***Installation methods provided in ETA-98/0001**
**Seismic set needed to fill the annular gap between anchor and fixture:
No annular gap, double design resistance (agap=1)

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.
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