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

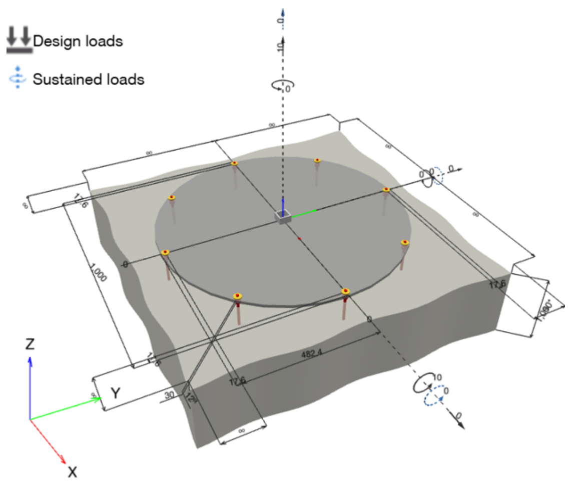
Specifier's comments:

1 Input data

Anchor type and size:	**HUS4-A Bonded Screw 10 M12**
Return period (service life in years):	50
Item number:	2293575 HUS4-A 10x165 M12x49 / 55 (insert) / 2294729 HUS4-MAX 10 (capsule)
Hilti Filling Set or any suitable annular gap filling solution	
Specification text:	Hilti HUS Carbon Steel screw anchor with MAX capsule mortar with 85 mm embedment hef, 10 M12, Steel galvanized, Hammer drilling installation per ETA-18/1160, with annular gaps filled with Hilti Filling Set or any suitable gap solutions
Effective embedment depth:	h_{ef} = 85.0 mm, h_{nom} = 85.0 mm
Material:	Carbon Steel
Approval No.:	ETA-18/1160
Issued I Valid:	27/07/2022 | -
Proof:	SOFA based on EN 1992-4, Mechanical, EOTA TR 075
Stand-off installation:	without clamping (anchor); restraint level (baseplate): 2.00; e_b = 30.0 mm; t = 12.0 mm
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, Temp. short/long: 0/0 °C, 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.

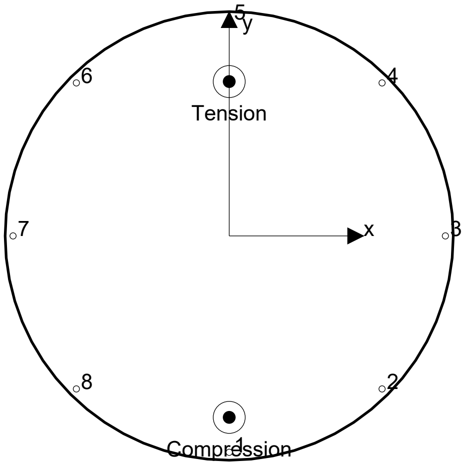
Geometry [mm] & Loading [kN, kNm]



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	39

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	-3.933	0.000	0.000	0.000
2	-2.415	0.000	0.000	0.000
3	1.250	0.000	0.000	0.000
4	4.915	0.000	0.000	0.000
5	6.433	0.000	0.000	0.000
6	4.915	0.000	0.000	0.000
7	1.250	0.000	0.000	0.000
8	-2.415	0.000	0.000	0.000

Max. concrete compressive strain:	- [‰]
Max. concrete compressive stress:	- [N/mm^2]
Resulting tension force in (x/y)=(-0.0/344.1):	18.762 [kN]
Resulting compression force in (x/y)=(-0.0/-404.5):	8.762 [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*	6.433	36.667	18	OK
Combined pullout-concrete cone failure**	18.762	48.430	39	OK
Concrete Breakout failure**	6.433	17.990	36	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]
55.000	1.500	36.667	6.433

3.2 Combined pullout-concrete cone failure

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

$N_{Rk,p} = N^0_{Rk,p} \cdot \frac{A_{p,N}}{A^0_{p,N}} \cdot \psi_{g,Np} \cdot \psi_{s,Np} \cdot \psi_{re,N} \cdot \psi_{ec1,Np} \cdot \psi_{ec2,Np}$ EOTA TR 075, Eq. (1)

$N^0_{Rk,p} = \psi_{sus} \cdot N'_{Rk,p}$ EOTA TR 075, Eq. (2)

$\psi_{sus} = 1$ EN 1992-4, Eq.(7.14a)

$A^0_{p,N} = s_{cr,Np} \cdot s_{cr,Np}$

$s_{cr,Np} = 4.1 \cdot \left(\psi_{sus} \cdot \frac{d}{h_{ef}} \cdot N_{Rk,p,ucr,C20/25}\right)^{0.5} \leq 3 \cdot h_{ef}$ EOTA TR 075, Eq. (3)

$c_{cr,Np} = \frac{s_{cr,Np}}{2}$

$\psi_{g,Np} = \psi^0_{g,Np} - \left(\frac{s}{s_{cr,Np}}\right)^{0.5} \cdot (\psi^0_{g,Np} - 1) \geq 1.00$ EOTA TR 075, Eq. (4)

$\psi^0_{g,Np} = \sqrt{n} - (\sqrt{n} - 1) \cdot \left(\frac{N'_{Rk,p}}{N_{Rk,c}}\right)^{1.5} \geq 1.00$ EOTA TR 075, Eq. (5)

$N_{Rk,c} = k_3 \cdot h_{ef}^{1.5} \cdot \sqrt{f_{ck}}$ EOTA TR 075, Eq. (6)

$\psi_{s,Np} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,Np}} \leq 1.00$ EN 1992-4, Eq.(7.20)

$\psi_{ec1,Np} = \frac{1}{1 + \frac{2 \cdot e_{1,N}}{s_{cr,Np}}} \leq 1.00$ EN 1992-4, Eq.(7.21)

$\psi_{ec2,Np} = \frac{1}{1 + \frac{2 \cdot e_{2,N}}{s_{cr,Np}}} \leq 1.00$ EN 1992-4, Eq.(7.21)

d [mm]	h_{ef} [mm]	$N_{Rk,p,ucr,C20/25}$ [kN]	$s_{cr,Np}$ [mm]	$c_{cr,Np}$ [mm]	$N'_{Rk,p}$ [kN]	ψ_{sus}
10.0	85.0	38.000	255.0	127.5	24.000	1.000

$N^0_{Rk,p}$ [kN]	$A^0_{p,N}$ [mm^2]	$A_{p,N}$ [mm^2]	k_3	f_{ck} [N/mm^2]	$N_{Rk,c}$ [kN]	n
24.000	65,025	325,125	7.70	20.00	26.986	5

$\psi^0_{g,Np}$	s [mm]	$\psi_{g,Np}$	c_{min} [mm]	$\psi_{s,Np}$	$\psi_{re,Np}$	$e_{1,N}$ [mm]
1.199	488.3	1.000	10,000.0	1.000	1.000	0.0

$\psi_{ec1,Np}$	$e_{2,N}$ [mm]	$\psi_{ec2,Np}$	$N_{Rk,p}$ [kN]	γ_{Mp}	$N_{Rd,p}$ [kN]	N_{Ed} [kN]
1.000	111.2	0.605	72.646	1.500	48.430	18.762

Group anchor ID
3-7

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]
65,025	65,025	127.5	255.0	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	748.6

$\psi_{M,N}$	k_1	$N^0_{Rk,c}$ [kN]	γ_{Mc}	$N_{Rd,c}$ [kN]	N_{Ed} [kN]
1.000	7.700	26.986	1.500	17.990	6.433

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} = 4.765 [kN] δ_N = 0.1361 [mm]

V_{Sk} = 0.000 [kN] δ_V = 0.0000 [mm]

δ_{NV} = 0.1361 [mm]

Long term loading:

N_{Sk} = 4.765 [kN] δ_N = 0.2723 [mm]

V_{Sk} = 0.000 [kN] δ_V = 0.0000 [mm]

δ_{NV} = 0.2723 [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
- In general, the conditions given in ETAG 001, Annex C, section 4.2.2.1 and 4.2.2.3 b) are not fulfilled because the diameter of the clearance hole in the fixture acc. to Annex 3, Table 3 is greater than the values given in Annex C, Table 4.1 and AS5126 for the corresponding diameter of the anchor. Therefore the design resistance for anchor groups is limited to twice the steel resistance (of a single anchor) in accordance with the approval.
- Checking the transfer of loads into the base material is required in accordance with EN 1992-4, Annex A!
- Attention! In case of compressive anchor forces a buckling check as well as the proof of the local load transfer into and within the base material (incl. punching) has to be done separately.
- 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!

7 Installation data

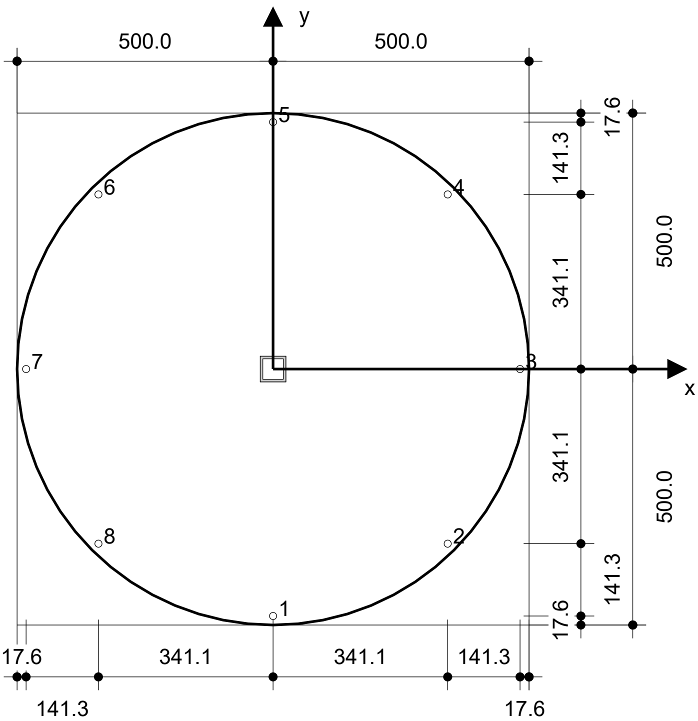
Baseplate, steel: S 235; E = 210,000.00 N/mm^2; f_{yk} = 235.00 N/mm^2
Profile: Square hollow, 50 x 50 x 5,0; (L x W x T) = 50.0 mm x 50.0 mm x 5.0 mm
Hole diameter in the fixture: d_f = 14.0 mm
Plate thickness (input): 12.0 mm
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Clean the drill hole. Under the conditions - according to fastener size and drilling direction - given in the Assessment document and MPII (IFU), the cleaning of the drill hole may be omitted.

Anchor type and size: HUS4-A Bonded Screw 10 M12
Item number: 2293575 HUS4-A 10x165 M12x49 / 55 (insert) / 2294729 HUS4-MAX 10 (capsule)
Maximum installation torque: 40 Nm
Hole diameter in the base material: 10.0 mm
Hole depth in the base material: 95.0 mm
Minimum thickness of the base material: 140.0 mm

Hilti HUS Carbon Steel screw anchor with MAX capsule mortar with 85 mm embedment hef, 10 M12, Steel galvanized, Hammer drilling installation per ETA-18/1160, 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	• Manual blow-out pump	• Hilti SIW 22T-A impact screw driver



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.0	-482.4	-	-	-	-
2	341.1	-341.1	-	-	-	-
3	482.4	0.0	-	-	-	-
4	341.1	341.1	-	-	-	-

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
5	0.0	482.4	-	-	-	-
6	-341.1	341.1	-	-	-	-
7	-482.4	0.0	-	-	-	-
8	-341.1	-341.1	-	-	-	-

8 Remarks; Your Cooperation Duties

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