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Phone I Fax:	|	E-Mail:	
Design:	Infill Beam 4 anchors (16") - Dec 13, 2019	Date:	1/8/2020
Fastening point:			

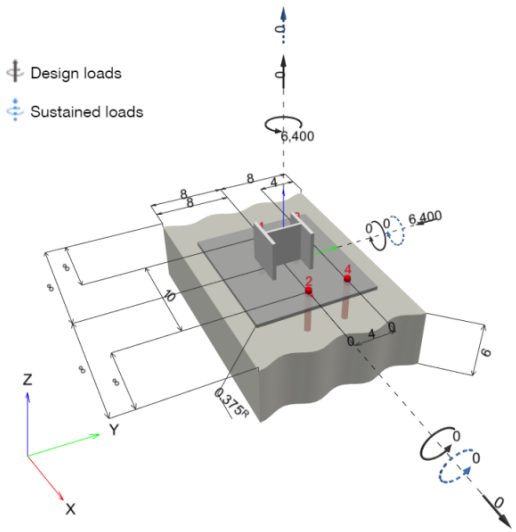
Specifier's comments:

1 Input data

Anchor type and diameter:	**HIT-HY 200 + HAS-V-36 (ASTM F1554 Gr.36) 5/8**
Return period (service life in years):	50
Item number:	2198024 HAS-V-36 5/8"x6" (element) / 2022793 HIT-HY 200-R (adhesive)
Effective embedment depth:	$h_{ef,act}$ = 4.000 in. ($h_{ef,limit}$ = - in.)
Material:	ASTM A 1554 Grade 36
Evaluation Service Report:	ESR-3187
Issued I Valid:	4/1/2019 | 3/1/2020
Proof:	Design Method ACI 318-11 / Chem
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.375 in.
Anchor plate[R]:	l_x x l_y x t = 14.000 in. x 11.998 in. x 0.375 in.; (Recommended plate thickness: not calculated)
Profile:	W shape (AISC), W4X13; (L x W x T x FT) = 4.160 in. x 4.060 in. x 0.280 in. x 0.345 in.
Base material:	cracked concrete, 3000, f_c' = 3,000 psi; h = 6.000 in., Temp. short/long: 32/32 °F
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: condition B, shear: condition B; 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]



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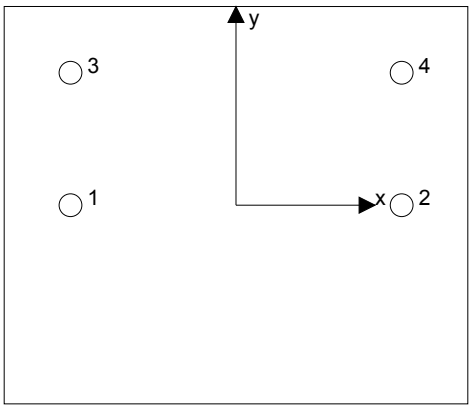
1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V_x = 0; V_y = -6,400; M_x = 0; M_y = 0; M_z = 6,400; N_{sus} = 0; $M_{x,sus}$ = 0; $M_{y,sus}$ = 0;	no	99

2 Load case/Resulting anchor forces

Load case: Design loads



Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0	1,880	111	-1,877
2	0	1,328	111	-1,323
3	0	1,880	-111	-1,877
4	0	1,328	-111	-1,323

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 ϕN_n [lb]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	N/A	N/A	N/A	N/A
Bond Strength**	N/A	N/A	N/A	N/A
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	N/A	N/A	N/A	N/A

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

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4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_V = V_{ua}/\phi V_n$	Status
Steel Strength*	1,880	5,112	37	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Bond Strength controls)**	6,400	13,757	47	OK
Concrete edge failure in direction y-**	6,404	6,503	99	OK

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

4.1 Steel Strength

V_{sa} = ESR value refer to ICC-ES ESR-3187
$\phi\ V_{steel} \geq V_{ua}$ ACI 318-11 Table D.4.1.1

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.23	58,000

Calculations

V_{sa} [lb]
7,865

Results

V_{sa} [lb]	ϕ_{steel}	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
7,865	0.650	5,112	1,880

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4.2 Pryout Strength (Bond Strength controls)

$V_{cpg} = k_{cp}\left[\left(\frac{A_{Na}}{A_{Na0}}\right) \psi_{ec1,Na}\ \psi_{ec2,Na}\ \psi_{ed,Na}\ \psi_{cp,Na}\ N_{ba}\right]$ ACI 318-11 Eq. (D-41)

$\phi\ V_{cpg} \geq V_{ua}$ ACI 318-11 Table (D.4.1.1)

A_{Na} see ACI 318-11, Part D.5.5.1, Fig. RD.5.5.1(b)

$A_{Na0} = (2\ c_{Na})^2$ ACI 318-11 Eq. (D-20)

$c_{Na} = 10\ d_a \sqrt{\frac{\tau_{uncr}}{1100}}$ ACI 318-11 Eq. (D-21)

$\psi_{ec,Na} = \left(\frac{1}{1 + \frac{e'_N}{c_{Na}}}\right) \leq 1.0$ ACI 318-11 Eq. (D-23)

$\psi_{ed,Na} = 0.7 + 0.3\left(\frac{c_{a,min}}{c_{na}}\right) \leq 1.0$ ACI 318-11 Eq. (D-25)

$\psi_{cp,Na} = MAX\left(\frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}}\right) \leq 1.0$ ACI 318-11 Eq. (D-27)

$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \pi \cdot d_a \cdot h_{ef}$ ACI 318-11 Eq. (D-22)

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	2,261	0.625	4.000	4.000	1,192

$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	c_{ac} [in.]	λ_a
1.002	0.000	8.684	1.000

Calculations

c_{Na} [in.]	A_{Na} [in.^{2}]	A_{Na0} [in.^{2}]	$\psi_{ed,Na}$
8.920	445.44	318.25	0.835

$\psi_{ec1,Na}$	$\psi_{ec2,Na}$	$\psi_{cp,Na}$	N_{ba} [lb]
0.899	1.000	1.000	9,358

Results

V_{cpg} [lb]	$\phi_{concrete}$	$\phi\ V_{cpg}$ [lb]	V_{ua} [lb]
19,653	0.700	13,757	6,400

4.3 Concrete edge failure in direction y-

$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ec,V}\ \psi_{ed,V}\ \psi_{c,V}\ \psi_{h,V}\ \psi_{parallel,V}\ V_b$ ACI 318-11 Eq. (D-31)

$\phi\ V_{cbg} \geq V_{ua}$ ACI 318-11 Table D.4.1.1

A_{Vc} see ACI 318-11, Part D.6.2.1, Fig. RD.6.2.1(b)

$A_{Vc0} = 4.5\ c_{a1}^2$ ACI 318-11 Eq. (D-32)

$\psi_{ec,V} = \left(\frac{1}{1 + \frac{2e_v'}{3c_{a1}}}\right) \leq 1.0$ ACI 318-11 Eq. (D-36)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ ACI 318-11 Eq. (D-38)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ ACI 318-11 Eq. (D-39)

$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2}\sqrt{d_a}\right) \lambda_a \sqrt{f_c'}\ c_{a1}^{1.5}$ ACI 318-11 Eq. (D-33)

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\psi_{c,V}$	h_a [in.]
8.000	-	0.864	1.000	6.000

l_e [in.]	λ_a	d_a [in.]	f_c' [psi]	$\psi_{parallel,V}$
4.000	1.000	0.625	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]
204.00	288.00	0.933	1.000	1.414	9,942

Results

V_{cbg} [lb]	$\phi_{concrete}$	$\phi\ V_{cbg}$ [lb]	V_{ua} [lb]
9,290	0.700	6,503	6,404

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5 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2018, 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 318-11, Part D.9.1
- The characteristic bond resistances depend on the return period (service life in years): 50

Fastening meets the design criteria!

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6 Installation data

Profile: W shape (AISC), W4X13; (L x W x T x FT) = 4.160 in. x 4.060 in. x 0.280 in. x 0.345 in.

Hole diameter in the fixture: d_f = 0.688 in.

Plate thickness (input): 0.375 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and diameter: HIT-HY 200 + HAS-V-36 (ASTM F1554 Gr.36) 5/8

Item number: 2198024 HAS-V-36 5/8"x6" (element) / 2022793 HIT-HY 200-R (adhesive)

Installation torque: 720 in.lb

Hole diameter in the base material: 0.750 in.

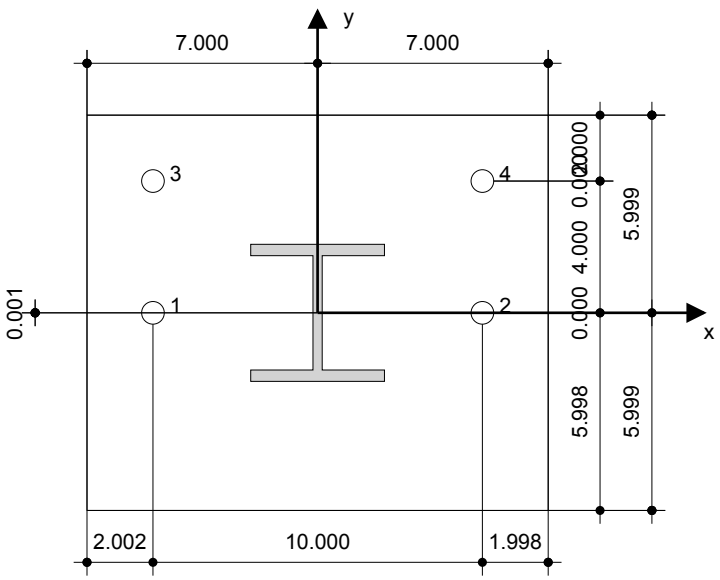
Hole depth in the base material: 4.000 in.

Minimum thickness of the base material: 5.500 in.

5/8 Hilti HAS Carbon steel threaded rod with Hilti HIT-HY 200 Safe Set System

6.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Compressed air with required accessories to blow from the bottom of the hole • Proper diameter wire brush	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-4.998	-0.001	-	-	8.000	8.000
2	5.002	-0.001	-	-	8.000	8.000
3	-4.998	3.999	-	-	12.000	4.000
4	5.002	3.999	-	-	12.000	4.000

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7 Remarks; Your Cooperation Duties

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- 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.

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Design:	Infill Beam 4 anchors (16") - Dec 13, 2019	Date:	11/17/2020
Fastening point:			

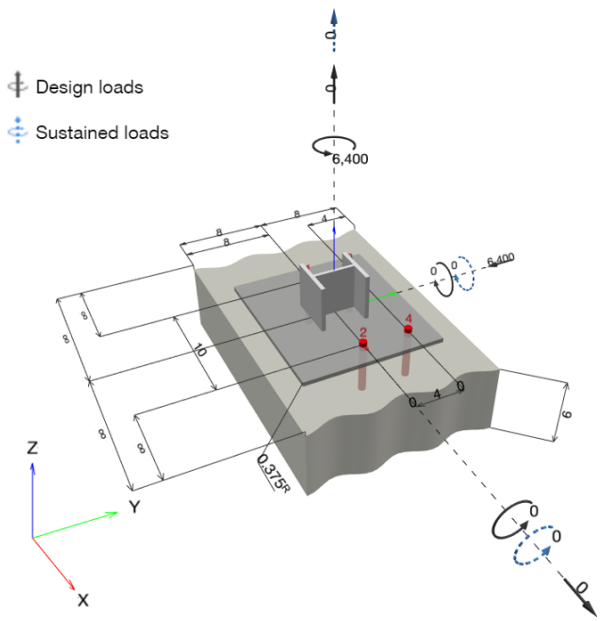
Specifier's comments:

1 Input data

Anchor type and diameter:	**HIT-HY 200 + HAS-V-36 (ASTM F1554 Gr.36) 5/8**
Item number:	2198024 HAS-V-36 5/8"x6" (element) / 2022793 HIT-HY 200-R (adhesive)
Effective embedment depth:	$h_{ef,act}$ = 4.000 in. ($h_{ef,limit}$ = - in.)
Material:	ASTM A 1554 Grade 36
Evaluation Service Report:	ESR-3187
Issued I Valid:	4/1/2020 | 3/1/2022
Proof:	Design Method ACI 318-11 / Chem
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.375 in.
Anchor plate[R]:	l_x x l_y x t = 14.000 in. x 11.998 in. x 0.375 in.; (Recommended plate thickness: not calculated)
Profile:	W shape (AISC), W4X13; (L x W x T x FT) = 4.160 in. x 4.060 in. x 0.280 in. x 0.345 in.
Base material:	cracked concrete, 3000, f_c' = 3,000 psi; h = 6.000 in., Temp. short/long: 32/32 °F
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: condition B, shear: condition B; 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]



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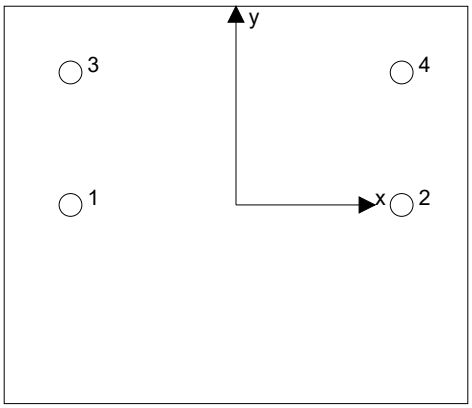
1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V_x = 0; V_y = -6,400; M_x = 0; M_y = 0; M_z = 6,400; N_{sus} = 0; $M_{x,sus}$ = 0; $M_{y,sus}$ = 0;	no	131

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	0	1,880	111	-1,877
2	0	1,328	111	-1,323
3	0	1,880	-111	-1,877
4	0	1,328	-111	-1,323

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*	N/A	N/A	N/A	N/A
Bond Strength**	N/A	N/A	N/A	N/A
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	N/A	N/A	N/A	N/A

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

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4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	1,880	5,112	37	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Bond Strength controls)**	6,400	13,757	47	OK
Concrete edge failure in direction y-**	6,404	4,921	131	not recommended

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

4.1 Steel Strength

V_{sa} [lb]	ϕ	ϕ V_{sa} [lb]	V_{ua} [lb]
7,865	0.650	5,112	1,880

4.2 Pryout Strength (Bond Strength controls)

A_{Na} [in.^{2}]	A_{Na0} [in.^{2}]	c_{Na} [in.]	$c_{a,min}$ [in.]	c_{ac} [in.]
445.43	318.25	8.920	4.000	8.684

$\alpha_{overhead}$	$\tau_{k,uncr}$ [psi]	$\tau_{k,cr}$ [psi]
1.000	2,261	1,192

$e_{c1,N}$ [in.]	$\psi_{ec1,Na}$	$e_{c2,N}$ [in.]	$\psi_{ec2,Na}$	$\psi_{ed,Na}$	$\psi_{cp,Na}$
1.002	0.899	0.000	1.000	0.835	1.000

λ_a	N_{ba} [lb]	ϕ	ϕ V_{cpg} [lb]	V_{ua} [lb]
1.000	9,358	0.700	13,757	6,400

4.3 Concrete edge failure in direction y-

l_e [in.]	d_a [in.]	c_{a1} [in.]	A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]
4.000	0.625	8.000	144.00	288.00

$\psi_{ed,V}$	$\psi_{parallel,V}$	$e_{c,V}$ [in.]	$\psi_{ec,V}$	$\psi_{c,V}$	$\psi_{h,V}$
1.000	1.000	0.000	1.000	1.000	1.414

λ_a	V_b [lb]	ϕ	ϕ V_{cbg} [lb]	V_{ua} [lb]
1.000	9,942	0.700	4,921	6,404

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5 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2018, 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 318-11, Part D.9.1

Fastening does not meet the design criteria!

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6 Installation data

Profile: W shape (AISC), W4X13; (L x W x T x FT) = 4.160 in. x 4.060 in. x 0.280 in. x 0.345 in.

Hole diameter in the fixture: d_f = 0.687 in.

Plate thickness (input): 0.375 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and diameter: HIT-HY 200 + HAS-V-36 (ASTM F1554 Gr.36) 5/8

Item number: 2198024 HAS-V-36 5/8"x6" (element) / 2022793 HIT-HY 200-R (adhesive)

Installation torque: 720 in.lb

Hole diameter in the base material: 0.750 in.

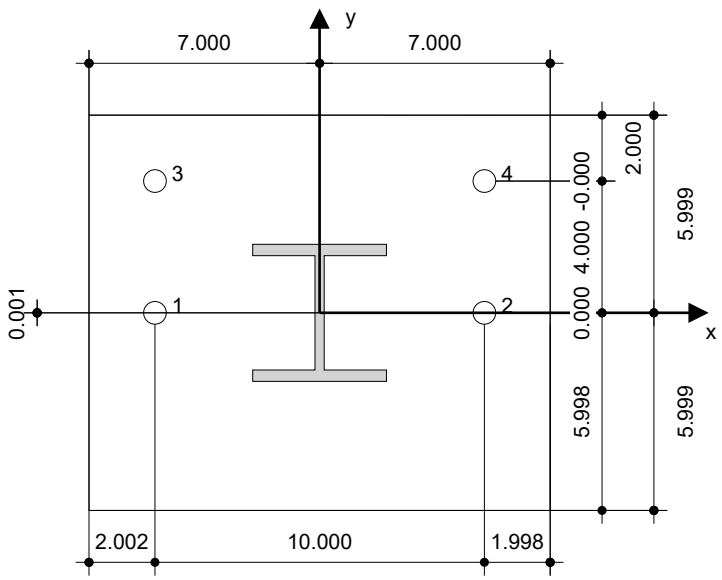
Hole depth in the base material: 4.000 in.

Minimum thickness of the base material: 5.500 in.

5/8 Hilti HAS Carbon steel threaded rod with Hilti HIT-HY 200 Safe Set System

6.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Compressed air with required accessories to blow from the bottom of the hole • Proper diameter wire brush	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-4.998	-0.001	-	-	8.000	8.000
2	5.002	-0.001	-	-	8.000	8.000
3	-4.998	3.999	-	-	12.000	4.000
4	5.002	3.999	-	-	12.000	4.000

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Fastening point:			

7 Remarks; Your Cooperation Duties

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