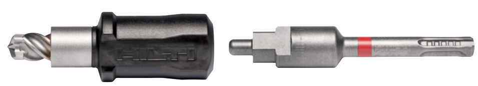
HDI-P TZ AND HDI-TZ TECHNICAL SUPPLEMENT

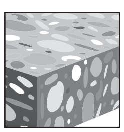
Edition 2024

HDI-P TZ AND HDI-TZ DROP-IN ANCHORS

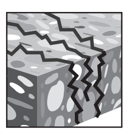
PRODUCT DESCRIPTION

HDI-P TZ and HDI-TZ Flush Anchors

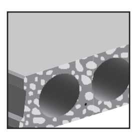
Anchor System		Features and Benefits
	Carbon steel HDI-P TZ and HDI-TZ	• Drop-in anchor with optimized length for reliable fastenings in post-tensioned cable concrete slabs • Suitable for uncracked and cracked concrete including seismic areas • Productive installation with HDI-P TZ and HDI-TZ automatic setting tool with hammer drill • Used with Hilti Dust Removal System (DRS) for compliance with Table 1 of OSHA 1926.1153 regulations for silica dust exposure • Shallow drilling for faster installations • Easier installation with Auto Setting Tool • Lip provides flush installation, consistent anchor depth, and easier rod alignment • Auto Setting Tool includes stop drill bit and setting tool, no tool change necessary
	Auto-setting tool HDI-P TZ and HDI-TZ	
	Hand-setting tool HDI-P TZ and HDI-TZ	



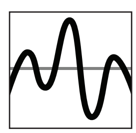
Uncracked concrete



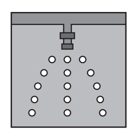
Cracked concrete



Hollow core concrete



Seismic design categories A-F



Fire sprinkler listings

PROFIS Engineering design software

Approvals/Listings	
ICC-ES (International Code Council)	ESR-4236 in concrete per ACI 318 Ch. 17 / ACI 355.2 / ICC-ES AC193
City of Los Angeles	2023 LABC Supplement (within ESR-4236)
Florida Building Code	2023 FBC Supplement (within ESR-4236)
FM (Factory Mutual)	Pipe hanger components for automatic sprinkler systems 3/8” HDI-P TZ (up to 4-inch nominal pipe diameter) 3/8” HDI-TZ (up to 4-inch nominal pipe diameter) 1/2” HDI-TZ (up to 8-inch nominal pipe diameter) 5/8” HDI-TZ (up to 12-inch nominal pipe diameter)
UL (Underwriters Laboratory)	Pipe hanger components for automatic sprinkler systems 3/8” HDI-P TZ (up to 4-inch nominal pipe diameter) 3/8” HDI-TZ (up to 4-inch nominal pipe diameter) 1/2” HDI-TZ (up to 8-inch nominal pipe diameter) 5/8” HDI-TZ (up to 12-inch nominal pipe diameter)

CITY LA DBS DEPARTMENT OF BUILDING AND SAFETY

FM APPROVED

c UL us LISTED

MATERIAL SPECIFICATIONS

HDI-P TZ and HDI-TZ drop-in anchors are manufactured from carbon steel with zinc plating per DIN EN ISO 4042 A2K.

INSTALLATION PARAMETERS

Table 1 — HDI-P TZ and HDI-TZ Setting Information

<table>
<tr><th colspan="2" rowspan="3">Setting Information</th><th rowspan="3">Symbol</th><th rowspan="3">Units</th><th colspan="8">Nominal Anchor Size / Internal Thread Dia. (in)</th></tr>
<tr><th colspan="5">HDI-P TZ</th><th colspan="3">HDI-TZ</th></tr>
<tr><th colspan="2">1/4</th><th colspan="2">3/8</th><th>1/2</th><th>3/8</th><th>1/2</th><th>5/8</th></tr>
<tr><td colspan="2">Internal Thread Diameter</td><td>d</td><td>in.</td><td colspan="2">1/4</td><td colspan="2">3/8</td><td>1/2</td><td>3/8</td><td>1/2</td><td>5/8</td></tr>
<tr><td colspan="2">Nominal Bit Diameter</td><td>d_{bit}</td><td>in.</td><td colspan="2">9/16</td><td colspan="2">9/16</td><td>5/8</td><td>9/16</td><td>5/8</td><td>27/32</td></tr>
<tr><td colspan="2">Effective Embedment</td><td>h_{ef}</td><td>in.
(mm)</td><td colspan="2">3/4
(19)</td><td colspan="2">3/4
(19)</td><td>1
(25)</td><td>1.42
(36)</td><td>1.65
(42)</td><td>3
(76)</td></tr>
<tr><td colspan="2">Nominal Embedment</td><td>h_{nom}</td><td>in.
(mm)</td><td colspan="2">3/4
(19)</td><td colspan="2">3/4
(19)</td><td>1
(25)</td><td>1-9/16
(40)</td><td>2
(51)</td><td>3-1/4
(83)</td></tr>
<tr><td colspan="2">Hole Depth in Base Material</td><td>h_o</td><td>in.
(mm)</td><td colspan="2">3/4
(19)</td><td colspan="2">3/4
(19)</td><td>1
(25)</td><td>1-9/16
(40)</td><td>2
(51)</td><td>3-1/4
(83)</td></tr>
<tr><td colspan="2">Thread Engagement Length</td><td>h_s</td><td>in.
(mm)</td><td colspan="2">3/16
(5)</td><td colspan="2">3/8
(10)</td><td>1/2
(13)</td><td>3/8 - 5/8
(10-16)</td><td>1/2 - 7/8
(13-22)</td><td>5/8 - 1-3/8
(16-35)</td></tr>
<tr><td colspan="2">Maximum Installation Torque for Threaded Element</td><td>T_{max}</td><td>ft-lb
(Nm)</td><td colspan="2">4.2
(6)</td><td colspan="2">5.0
(7)</td><td>10.4
(14)</td><td>5.0
(7)</td><td>10.4
(14)</td><td>20.8
(28)</td></tr>
<tr><td rowspan="3">Concrete</td><td>Min. Base Material Thickness</td><td>h_{min}</td><td>in.
(mm)</td><td>2-1/2
(64)</td><td>4
(102)</td><td>2-1/2
(64)</td><td>4
(102)</td><td>4
(102)</td><td>3-1/4
(83)</td><td>4
(102)</td><td>6
(152)</td></tr>
<tr><td>Minimum Edge Distance</td><td>c_{min}</td><td>in.
(mm)</td><td>6
(152)</td><td>2-1/2
(64)</td><td>6
(152)</td><td>2-1/2
(64)</td><td>2-1/2
(64)</td><td>3
(76)</td><td>6
(152)</td><td>8
(203)</td></tr>
<tr><td>Minimum Anchor Spacing</td><td>s_{min}</td><td>in.
(mm)</td><td>8
(203)</td><td>3
(76)</td><td>8
(203)</td><td>3
(76)</td><td>3
(76)</td><td>6
(152)</td><td>7
(178)</td><td>9
(229)</td></tr>
<tr><td rowspan="3">Hollowcore Concrete Panels</td><td>Min. Base Material Thickness</td><td>h_{min}</td><td>in.
(mm)</td><td colspan="2">1-3/8
(35)</td><td colspan="2">1-3/8
(35)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Minimum Edge Distance</td><td>c_{min}</td><td>in.
(mm)</td><td colspan="2">6
(152)</td><td colspan="2">6
(152)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Minimum Anchor Spacing</td><td>s_{min}</td><td>in.
(mm)</td><td colspan="2">8
(203)</td><td colspan="2">8
(203)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
</table>

Figure 1 — Hilti HDI-P TZ installation parameters

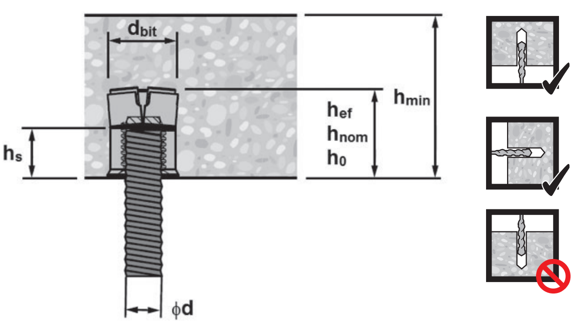
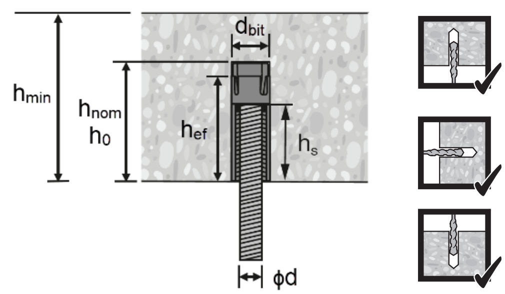


Figure 2 — Hilti HDI-TZ Installation Parameters



DESIGN DATA IN CONCRETE PER ACI 318

ACI 318 Chapter 17 Design

The design tables in Tables 2 to 11 are Hilti Simplified Design Tables. The load values were developed using the design parameters and variables of ICC Evaluation Services ESR-4236 and the equations within ACI 318 Chapter 17 as amended by ICC-ES AC193. The strength design capacities calculated from the tables below are to be compared to the factored loads determined from strength design load combinations. For a detailed explanation of the Hilti Simplified Design Tables, refer to Section 3.1.8 of Hilti's North American Anchor Fastening Technical Guide, Edition 22. Data tables from ESR-4236 are not contained in this section, but can be found at www.hilti.com or www.icc-es.org.

Table 2 — Hilti HDI-P TZ design strength based on concrete failure modes in uncracked concrete per ACI 318 Ch. 17 [1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - ΦN_n				Shear (lesser of concrete breakout or pryout) - ΦV_n			
		f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)
1/4	3/4 (19)	310 (1.4)	340 (1.5)	395 (1.8)	485 (2.2)	350 (1.6)	385 (1.7)	445 (2.0)	545 (2.4)
3/8	3/4 (19)	310 (1.4)	340 (1.5)	395 (1.8)	485 (2.2)	350 (1.6)	385 (1.7)	445 (2.0)	545 (2.4)
1/2	1 (25)	480 (2.1)	525 (2.3)	605 (2.7)	745 (3.3)	540 (2.4)	590 (2.6)	685 (3.0)	835 (3.7)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular values are for a single anchor with no influence from nearby edges, concrete thickness, or additional anchors. For designs with the influence of nearby edges, concrete thickness, or additional anchors, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17.
3 Compare concrete tabular values to the steel values in Table 6. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.68.
For all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.

Table 3 — Hilti HDI-P TZ design strength based on concrete failure modes in cracked concrete per ACI 318 Ch. 17 [1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - ΦN_n				Shear (lesser of concrete breakout or pryout) - ΦV_n			
		f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)
1/4	3/4 (19)	190 (0.8)	200 (0.9)	220 (1.0)	255 (1.1)	250 (1.1)	270 (1.2)	315 (1.4)	385 (1.7)
3/8	3/4 (19)	190 (0.8)	200 (0.9)	220 (1.0)	255 (1.1)	250 (1.1)	270 (1.2)	315 (1.4)	385 (1.7)
1/2	1 (25)	365 (1.6)	390 (1.7)	430 (1.9)	495 (2.2)	475 (2.1)	520 (2.3)	600 (2.7)	730 (3.2)

1 Linear interpolation between embedment depths and masonry compressive strengths is not permitted.
2 Tabular values are for a single anchor with no influence from nearby edges, concrete thickness, or additional anchors. For designs with the influence of nearby edges, concrete thickness, or additional anchors, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17.
3 Compare concrete tabular values to the steel values in Table 6. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.68.
For all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. For seismic loads, multiply design strength values in tension and shear by the following reduction factors:
1/4-in and 3/8-in diameter = 0.74
1/2-in diameter = 0.68

Table 4 — Hilti HDI-TZ design strength based on concrete failure modes in uncracked concrete per ACI 318 Ch. 17 [1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - ΦN_n				Shear (lesser of concrete breakout or pryout) - ΦV_n			
		f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)
3/8	1.42 (36)	810 (3.6)	890 (4.0)	1,025 (4.6)	1,260 (5.6)	915 (4.1)	1,000 (4.4)	1,155 (5.1)	1,415 (6.3)
1/2	1.65 (42)	1,860 (8.3)	2,035 (9.1)	2,355 (10.5)	2,880 (12.8)	2,005 (8.9)	2,195 (9.8)	2,535 (11.3)	3,105 (13.8)
5/8	3 (76)	4,055 (18.0)	4,440 (19.8)	5,125 (22.8)	6,280 (27.9)	8,730 (38.8)	9,565 (42.5)	11,040 (49.1)	13,525 (60.2)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular values are for a single anchor with no influence from nearby edges, concrete thickness, or additional anchors. For designs with the influence of nearby edges, concrete thickness, or additional anchors, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17.
3 Compare concrete tabular values to the steel values in Table 7. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.68.
For all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.

Table 5 — Hilti HDI-TZ design strength based on concrete failure modes in cracked concrete per ACI 318 Ch. 17 [1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - ΦN_n				Shear (lesser of concrete breakout or pryout) - ΦV_n			
		f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)
3/8	1.42 (36)	710 (3.2)	780 (3.5)	900 (4.0)	1,100 (4.9)	800 (3.6)	875 (3.9)	1,010 (4.5)	1,240 (5.5)
1/2	1.65 (42)	1,655 (7.4)	1,810 (8.1)	2,090 (9.3)	2,560 (11.4)	1,780 (7.9)	1,950 (8.7)	2,250 (10.0)	2,760 (12.3)
5/8	3 (76)	3,545 (15.8)	3,885 (17.3)	4,485 (20.0)	5,495 (24.4)	7,640 (34.0)	8,365 (37.2)	9,660 (43.0)	11,835 (52.6)

1 Linear interpolation between embedment depths and masonry compressive strengths is not permitted.
2 Tabular values are for a single anchor with no influence from nearby edges, concrete thickness, or additional anchors. For designs with the influence of nearby edges, concrete thickness, or additional anchors, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17.
3 Compare concrete tabular values to the steel values in Table 7. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.68.
For all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. For seismic loads, multiply design strength values in tension and shear by the following reduction factor: 0.75.

Table 6 — Hilti HDI-P TZ design strength based on steel failure per ACI 318 Ch. 17 [1,2]

Nominal anchor diameter in.	Steel Strength of HDI-P TZ Anchor			Steel Strength of ASTM A36 Threaded Rod		
	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic Shear[5] $\phi V_{sa,eq}$ lb (kN)	Tensile[3] $\phi N_{sa,rod}$ lb (kN)	Shear[6] $\phi V_{sa,rod}$ lb (kN)	Seismic Shear[7] $\phi V_{sa,rod,eq}$ lb (kN)
1/4	1,300 (5.8)	585 (2.6)	585 (2.6)	1,385 (6.2)	720 (3.2)	505 (2.2)
3/8	4,065 (18.1)	585 (2.6)	585 (2.6)	3,370 (15.0)	1,750 (7.8)	1,225 (5.4)
1/2	4,120 (18.3)	2,280 (10.1)	1,430 (6.4)	6,175 (27.5)	3,210 (14.3)	2,250 (10.0)

1 Steel strength in tension and shear determined from the lesser of the HDI-P TZ or the inserted threaded rod.
2 Hilti HDI-P TZ anchors are considered a brittle steel element. ASTM A36 threaded rod is considered a ductile steel element.
3 Tensile $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Ch. 17.
4 Shear values for HDI-P TZ determined by static shear tests with $\phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17.
5 Seismic shear values for HDI-P TZ determined by seismic shear tests with $\phi V_{sa,eq} \leq \phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17.
6 Shear values for threaded rod determined by $\phi V_{sa,rod} = \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17.
7 Seismic shear values for threaded rod determined by $\phi V_{sa,rod,eq} = \phi\ 0.70\ V_{sa,rod}$.

Table 7 — Hilti HDI-TZ design strength based on steel failure per ACI 318 Ch. 17 [1,2]

Nominal anchor diameter in.	Steel Strength of HDI-TZ Anchor			Steel Strength of ASTM A36 Threaded Rod		
	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic Shear[5] $\phi V_{sa,eq}$ lb (kN)	Tensile[3] $\phi N_{sa,rod}$ lb (kN)	Shear[6] $\phi V_{sa,rod}$ lb (kN)	Seismic Shear[7] $\phi V_{sa,rod,eq}$ lb (kN)
3/8	3,750 (16.7)	2,080 (9.3)	1,415 (6.3)	3,370 (15.0)	1,750 (7.8)	1,225 (5.4)
1/2	3,890 (17.3)	2,155 (9.6)	1,560 (6.9)	6,175 (27.5)	3,210 (14.3)	2,250 (10.0)
5/8	7,965 (35.4)	4,410 (19.6)	3,160 (14.1)	9,835 (43.7)	5,110 (22.7)	3,580 (15.9)

1 Steel strength in tension and shear determined from the lesser of the HDI-TZ or the inserted threaded rod.
2 Hilti HDI-TZ anchors are considered a brittle steel element. ASTM A36 threaded rod is considered a ductile steel element.
3 Tensile $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Ch. 17.
4 Shear values for HDI-TZ determined by static shear tests with $\phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17.
5 Seismic shear values for HDI-TZ determined by seismic shear tests with $\phi V_{sa,eq} \leq \phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17.
6 Shear values for threaded rod determined by $\phi V_{sa,rod} = \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17.
7 Seismic shear values for threaded rod determined by $\phi V_{sa,rod,eq} = \phi\ 0.70\ V_{sa,rod}$.

Table 8 — Hilti HDI-P TZ design strength in the soffit of uncracked lightweight concrete over metal deck per ACI 318 Ch. 17 [1,2,3,4,5,6]

Nominal anchor diameter in.	Effective embed. in. (mm)	Minimum concrete thickness [7] in. (mm)	Installation per Figure 3			Installation per Figure 4		
			Tension - ΦN_n		Shear - ΦV_n	Tension - ΦN_n		Shear - ΦV_n
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c ≥ 3000 psi (20.7 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c ≥ 3000 psi (20.7 MPa) lb (kN)
1/4	3/4 (19)	2 (51)	330 (1.5)	365 (1.6)	1,795 (8.0)	210 (0.9)	235 (1.0)	1,065 (4.7)
3/8	3/4 (19)	2 (51)	330 (1.5)	365 (1.6)	1,795 (8.0)	210 (0.9)	235 (1.0)	1,065 (4.7)
1/2	1 (25)	2 (51)	495 (2.2)	545 (2.4)	2,055 (9.1)	370 (1.6)	410 (1.8)	1,280 (5.7)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
3 Tabular values are lightweight concrete and no additional reduction factor is needed.
4 No additional reduction factors for spacing or edge distance need to be applied.
5 Compare tabular values to the steel values in Table 6. The lesser of the values is to be used for the design.
6 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.
7 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 3 and 4.

Table 9 — Hilti HDI-P TZ design strength in the soffit of cracked lightweight concrete over metal deck per ACI 318 Ch. 17 [1,2,3,4,5,6,7]

Nominal anchor diameter in.	Effective embed. in. (mm)	Minimum concrete thickness [8] in. (mm)	Installation per Figure 3			Installation per Figure 4		
			Tension - ΦN_n		Shear - ΦV_n	Tension - ΦN_n		Shear - ΦV_n
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c ≥ 3000 psi (20.7 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c ≥ 3000 psi (20.7 MPa) lb (kN)
1/4	3/4 (19)	2 (51)	160 (0.7)	175 (0.8)	1,795 (8.0)	100 (0.4)	115 (0.5)	1,065 (4.7)
3/8	3/4 (19)	2 (51)	160 (0.7)	175 (0.8)	1,795 (8.0)	100 (0.4)	115 (0.5)	1,065 (4.7)
1/2	1 (25)	2 (51)	375 (1.7)	415 (1.8)	2,055 (9.1)	280 (1.2)	310 (1.4)	1,280 (5.7)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
3 Tabular values are lightweight concrete and no additional reduction factor is needed.
4 No additional reduction factors for spacing or edge distance need to be applied.
5 Compare tabular values to the steel values in Table 6. The lesser of the values is to be used for the design.
6 Tabular values are for static loads only. For seismic tension loads, multiply design strength values in tension by the following reduction factors:
1/4-in and 3/8-in diameter = 0.74
1/2-in diameter = 0.68
7 Tabular values are for static loads only. For seismic shear loads for the 1/2-inch diameter anchor, multiply design strength values in shear by the following reduction factor: 0.63.
8 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 3 and 4.

Table 10 — Hilti HDI-TZ design strength in the soffit of uncracked lightweight concrete over metal deck per ACI 318 Ch. 17 [1,2,3,4,5,6]

Nominal anchor diameter in.	Effective embed. in. (mm)	Minimum concrete thickness [7] in. (mm)	Installation per Figure 3			Installation per Figure 4		
			Tension - ΦN_n		Shear - ΦV_n	Tension - ΦN_n		Shear - ΦV_n
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c ≥ 3000 psi (20.7 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c ≥ 3000 psi (20.7 MPa) lb (kN)
3/8	1.42 (36)	2 (51)	530 (2.4)	590 (2.6)	1,925 (8.6)	430 (1.9)	475 (2.1)	1,420 (6.3)
1/2	1.65 (42)	2 (51)	1,240 (5.5)	1,375 (6.1)	2,155 (9.6)	900 (4.0)	995 (4.4)	1,460 (6.5)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
3 Tabular values are lightweight concrete and no additional reduction factor is needed.
4 No additional reduction factors for spacing or edge distance need to be applied.
5 Compare tabular values to the steel values in Table 7. The lesser of the values is to be used for the design.
6 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.
7 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 3 and 4.

Table 11 — Hilti HDI-TZ design strength in the soffit of cracked lightweight concrete over metal deck per ACI 318 Ch. 17 [1,2,3,4,5,6,7]

Nominal anchor diameter in.	Effective embed. in. (mm)	Minimum concrete thickness [8] in. (mm)	Installation per Figure 3			Installation per Figure 4		
			Tension - ΦN_n		Shear - ΦV_n	Tension - ΦN_n		Shear - ΦV_n
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c ≥ 3000 psi (20.7 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c ≥ 3000 psi (20.7 MPa) lb (kN)
3/8	1.42 (36)	2 (51)	465 (2.1)	515 (2.3)	1,925 (8.6)	375 (1.7)	415 (1.8)	1,420 (6.3)
1/2	1.65 (42)	2 (51)	1,100 (4.9)	1,220 (5.4)	2,155 (9.6)	805 (3.6)	890 (4.0)	1,460 (6.5)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
3 Tabular values are lightweight concrete and no additional reduction factor is needed.
4 No additional reduction factors for spacing or edge distance need to be applied.
5 Compare tabular values to the steel values in Table 7. The lesser of the values is to be used for the design.
6 Tabular values are for static loads only. For seismic tension loads, multiply design strength values in tension by the following reduction factor: 0.75.
7 Tabular values are for static loads only. For seismic shear loads, multiply design strength values in shear by the following reduction factors:
3/8-in diameter = 0.68
1/2-in diameter = 0.72
8 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 3 and 4.

Figure 3 — Installation of Hilti HDI-P TZ and HDI-TZ in the soffit of concrete over metal deck floor and roof assemblies — W deck

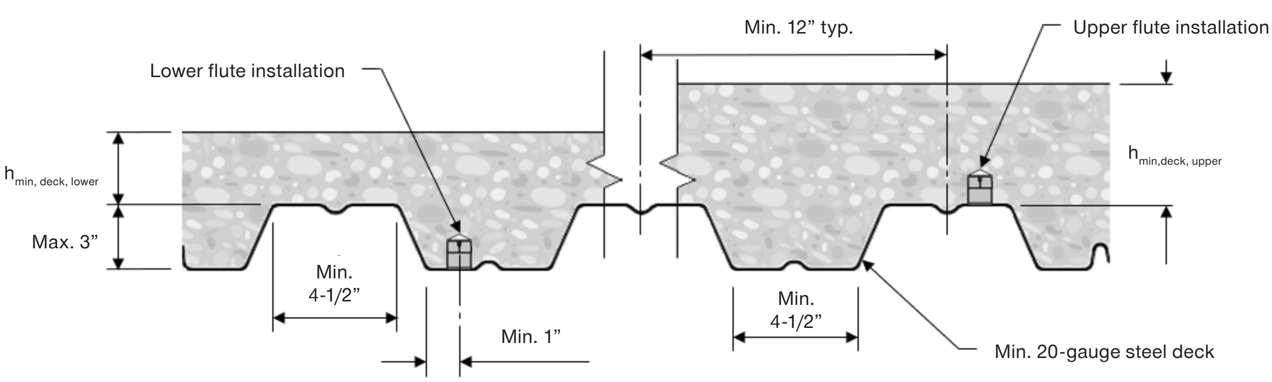


Figure 4 — Installation of Hilti HDI-P TZ and HDI-TZ in the soffit of concrete over metal deck floor and roof assemblies — B deck

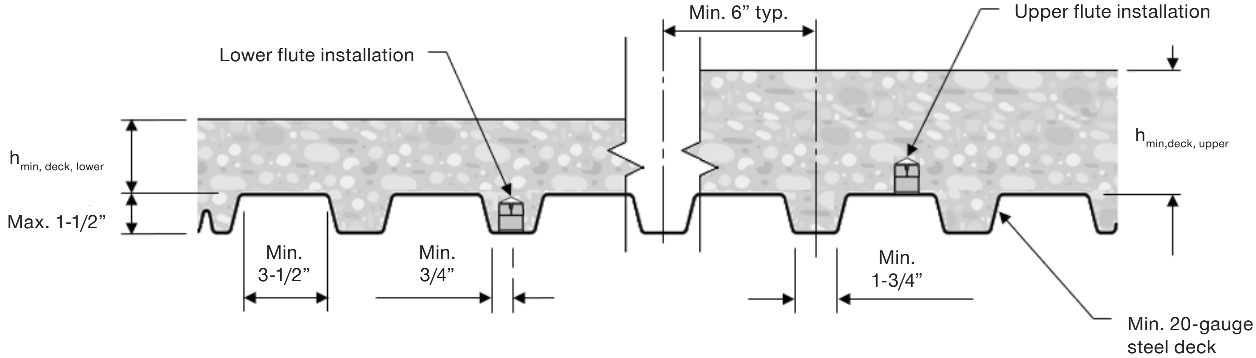


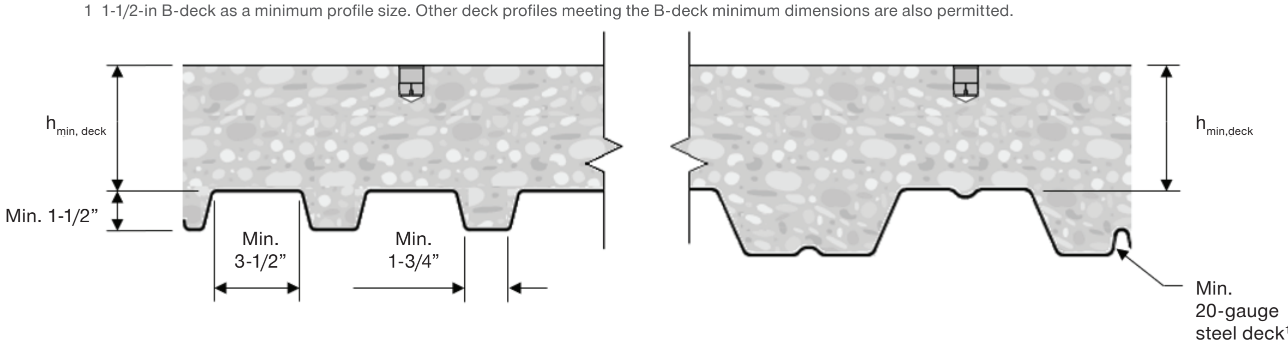
Table 12 — Hilti HDI-TZ setting information for installation on the top of concrete-filled profile steel deck assemblies according to Figure 5 [1,2,3]

Setting Information	Symbol	Units	Nominal Anchor Size / Internal Thread Dia. (in)		
			3/8	1/2	5/8
Effective Embedment Depth	h_{ef}	in. (mm)	1.42 (36)	1.65 (42)	3 (76)
Nominal Embedment Depth	h_{nom}	in. (mm)	1-9/16 (40)	2 (51)	3-1/4 (83)
Minimum Hole Depth	h_o	in. (mm)	1-9/16 (40)	2 (51)	3-1/4 (83)
Minimum Concrete Thickness[4]	$h_{min,deck}$	in. (mm)	2-1/2 (64)	2-1/2 (64)	3-1/4 (83)
Critical Edge Distance	$c_{ac,deck,top}$	in. (mm)	5-1/2 (140)	6-1/2 (165)	16 (406)
Minimum Edge Distance	$c_{min,deck,top}$	in. (mm)	2 (51)	2 (51)	2 (51)
Minimum Spacing	$s_{min,deck,top}$	in. (mm)	4 (102)	4 (102)	4 (102)

1 Installations must comply with Figure 5 of this report.
2 Design capacity shall be based on calculations according to values in Tables 4 and 5 of this report.
3 Applicable for $h_{min,deck} < h_{min,Table 1}$. For $h_{min,deck} > h_{min,Table 1}$, use setting information in Table 1 of this report.
4 Minimum concrete thickness refers to concrete thickness above the upper flute. See Figure 5.

Figure 5 — Installation of Hilti HDI-P TZ and HDI-TZ in the top of concrete filled profile steel deck assemblies

1 1-1/2-in B-deck as a minimum profile size. Other deck profiles meeting the B-deck minimum dimensions are also permitted.



DESIGN DATA IN CONCRETE PER CSA A23.3

CSA A23.3 Annex D Design

Limit State Design of anchors is described in the provisions of CSA A23.3 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. Tables 19 and 20 in this section contains the Limit State Design tables that are based on the published loads in ICC Evaluation Services ESR-4236 and converted for use with CSA A23.3 Annex D. Tables 13 to 18 and 21 to 24 below are Hilti Simplified Design Tables which are prefactored resistance tables based on the design parameters and variables in Tables 19 and 20. All the figures in the previous ACI 318 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures. For a detailed explanation of the tables developed in accordance with CSA A23.3 Annex D, refer to Section 3.1.8 of Hilti's North American Anchor Fastening Technical Guide, Edition 22. Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.ca.

Table 13 — Hilti HDI-P TZ factored resistance based on concrete failure modes in uncracked concrete per CSA A23.3 Annex D [1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - N_r				Shear (lesser of concrete breakout or pryout) - V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)"	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	3/4 (19)	325 (1.5)	365 (1.6)	400 (1.8)	460 (2.1)	380 (1.7)	425 (1.9)	465 (2.1)	540 (2.4)
3/8	3/4 (19)	325 (1.5)	365 (1.6)	400 (1.8)	460 (2.1)	380 (1.7)	425 (1.9)	465 (2.1)	540 (2.4)
1/2	1 (25)	500 (2.2)	560 (2.5)	615 (2.7)	710 (3.2)	585 (2.6)	655 (2.9)	715 (3.2)	830 (3.7)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular values are for a single anchor with no influence from nearby edges, concrete thickness, or additional anchors. For designs with the influence of nearby edges, concrete thickness, or additional anchors, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from CSA A23.3 Annex D.
3 Compare concrete tabular values to the steel values in Table 17. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.68.
For all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.

Table 14 — Hilti HDI-P TZ factored resistance based on concrete failure modes in cracked concrete per CSA A23.3 Annex D [1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - N_r				Shear (lesser of concrete breakout or pryout) - V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)"	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	3/4 (19)	195 (0.9)	210 (0.9)	225 (1.0)	245 (1.1)	270 (1.2)	300 (1.3)	330 (1.5)	380 (1.7)
3/8	3/4 (19)	195 (0.9)	210 (0.9)	225 (1.0)	245 (1.1)	270 (1.2)	300 (1.3)	330 (1.5)	380 (1.7)
1/2	1 (25)	375 (1.7)	405 (1.8)	430 (1.9)	475 (2.1)	515 (2.3)	575 (2.6)	630 (2.8)	730 (3.2)

1 Linear interpolation between embedment depths and masonry compressive strengths is not permitted.
2 Tabular values are for a single anchor with no influence from nearby edges, concrete thickness, or additional anchors. For designs with the influence of nearby edges, concrete thickness, or additional anchors, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from CSA A23.3 Annex D.
3 Compare concrete tabular values to the steel values in Table 17. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.68.
For all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. For seismic loads, multiply design strength values in tension and shear by the following reduction factors:
1/4-in and 3/8-in diameter = 0.74
1/2-in diameter = 0.68

Table 15 — Hilti HDI-TZ factored resistance based on concrete failure modes in uncracked concrete per CSA A23.3 Annex D [1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - N_r				Shear (lesser of concrete breakout or pryout) - V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)"	f'_c = 40 MPa (5,800 psi) lb (kN)
3/8	1.42	850	950	1,040	1,200	990	1,110	1,215	1,400
	(36)	(3.8)	(4.2)	(4.6)	(5.3)	(4.4)	(4.9)	(5.4)	(6.2)
1/2	1.65	2,005	2,240	2,455	2,835	2,005	2,240	2,455	2,835
	(42)	(8.9)	(10.0)	(10.9)	(12.6)	(8.9)	(10.0)	(10.9)	(12.6)
5/8	3	4,345	4,860	5,325	6,145	8,695	9,720	10,650	12,295
	(76)	(19.3)	(21.6)	(23.7)	(27.3)	(38.7)	(43.2)	(47.4)	(54.7)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular values are for a single anchor with no influence from nearby edges, concrete thickness, or additional anchors. For designs with the influence of nearby edges, concrete thickness, or additional anchors, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from CSA A23.3 Annex D.
3 Compare concrete tabular values to the steel values in Table 18. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.68.
For all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.

Table 16 — Hilti HDI-TZ factored resistance based on concrete failure modes in cracked concrete per CSA A23.3 Annex D [1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - N_r				Shear (lesser of concrete breakout or pryout) - V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)"	f'_c = 40 MPa (5,800 psi) lb (kN)
3/8	1.42	745	835	915	1,055	870	975	1,070	1,235
	(36)	(3.3)	(3.7)	(4.1)	(4.7)	(3.9)	(4.3)	(4.8)	(5.5)
1/2	1.65	1,775	1,980	2,170	2,505	1,775	1,980	2,170	2,505
	(42)	(7.9)	(8.8)	(9.7)	(11.2)	(7.9)	(8.8)	(9.7)	(11.1)
5/8	3	3,825	4,275	4,685	5,410	7,650	8,555	9,370	10,820
	(76)	(17.0)	(19.0)	(20.8)	(24.1)	(34.0)	(38.1)	(41.7)	(48.1)

1 Linear interpolation between embedment depths and masonry compressive strengths is not permitted.
2 Tabular values are for a single anchor with no influence from nearby edges, concrete thickness, or additional anchors. For designs with the influence of nearby edges, concrete thickness, or additional anchors, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from CSA A23.3 Annex D.
3 Compare concrete tabular values to the steel values in Table 18. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.68.
For all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. For seismic loads, multiply design strength values in tension and shear by the following reduction factor: 0.75.

Table 17 — Hilti HDI-P TZ factored resistance based on steel failure per CSA A23.3 Annex D [1,2]

Nominal anchor diameter in.	Steel Strength of HDI-P TZ Anchor			Steel Strength of ASTM A36 Threaded Rod		
	Tensile[3] ϕN_{sar} lb (kN)	Shear[4] ϕV_{sar} lb (kN)	Seismic Shear[5] $\phi V_{sar,eq}$ lb (kN)	Tensile[3] $\phi N_{sar,rod}$ lb (kN)	Shear[6] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[7] $\phi V_{sar,rod,eq}$ lb (kN)
1/4	1,190 (5.3)	540 (2.4)	540 (2.4)	1,255 (5.6)	705 (3.1)	495 (2.2)
3/8	3,720 (16.5)	540 (2.4)	540 (2.4)	3,055 (13.6)	1,720 (7.7)	1,200 (5.3)
1/2	3,770 (16.8)	2,100 (9.3)	1,320 (5.9)	5,595 (24.9)	3,150 (14.0)	2,205 (9.8)

1 Steel strength in tension and shear determined from the lesser of the HDI-P TZ or the inserted threaded rod.
2 Hilti HDI-P TZ anchors are considered a brittle steel element. ASTM A36 threaded rod is considered a ductile steel element.
3 Tensile $N_{sar} = \phi_s A_{se,N\ futa}$ R as noted in CSA A23.3 Annex D.
4 Shear values for HDI-P TZ determined by static shear tests with $V_{sar} \leq \phi_s$ 0.60 $A_{se,V}$ f_{uta} R as noted in CSA A23.3 Annex D.
5 Seismic shear values for HDI-P TZ determined by seismic shear tests with $V_{sar,eq} \leq V_{sar} \leq \phi_s$ 0.60 $A_{se,V}$ f_{uta} R as noted in CSA A23.3 Annex D.
6 Shear values for threaded rod determined by $V_{sar,rod} = \phi_s$ 0.60 $A_{se,V}$ f_{uta} R as noted in CSA A23.3 Annex D.
7 Seismic shear values for threaded rod determined by $V_{sar,rod,eq}$ = 0.70 $V_{sar,rod}$.

Table 18 — Hilti HDI-TZ factored resistance based on steel failure per CSA A23.3 Annex D [1,2]

Nominal anchor diameter in.	Steel Strength of HDI-TZ Anchor			Steel Strength of ASTM A36 Threaded Rod		
	Tensile[3] ϕN_{sar} lb (kN)	Shear[4] ϕV_{sar} lb (kN)	Seismic Shear[5] $\phi V_{sar,eq}$ lb (kN)	Tensile[3] $\phi N_{sar,rod}$ lb (kN)	Shear[6] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[7] $\phi V_{sar,rod,eq}$ lb (kN)
3/8	3,435 (15.3)	1,915 (8.5)	1,300 (5.8)	3,055 (13.6)	1,720 (7.7)	1,200 (5.3)
1/2	3,560 (15.8)	1,985 (8.8)	1,435 (6.4)	5,595 (24.9)	3,150 (14.0)	2,205 (9.8)
5/8	7,290 (32.4)	4,060 (18.1)	2,910 (12.9)	8,915 (39.7)	5,015 (22.3)	3,510 (15.6)

1 Steel strength in tension and shear determined from the lesser of the HDI-TZ or the inserted threaded rod.
2 Hilti HDI-TZ anchors are considered a brittle steel element. ASTM A36 threaded rod is considered a ductile steel element.
3 Tensile $N_{sar} = \phi_s A_{se,N}$ f_{uta} R as noted in CSA A23.3 Annex D.
4 Shear values for HDI-TZ determined by static shear tests with $V_{sar} \leq \phi_s$ 0.60 $A_{se,V}$ f_{uta} R as noted in CSA A23.3 Annex D.
5 Seismic shear values for HDI-TZ determined by seismic shear tests with $V_{sar,eq} \leq V_{sar} \leq \phi_s$ 0.60 $A_{se,V}$ f_{uta} R as noted in CSA A23.3 Annex D.
6 Shear values for threaded rod determined by $V_{sar,rod} = \phi_s$ 0.60 $A_{se,V}$ f_{uta} R as noted in CSA A23.3 Annex D.
7 Seismic shear values for threaded rod determined by $V_{sar,rod,eq}$ = 0.70 $V_{sar,rod}$.

Table 19 — HDI-P TZ and HDI-TZ design information in accordance with CSA A23.3 [1]

Design Information	Symbol	Units	Nominal Anchor Size / Internal Thread Dia. (in)					
			HDI-P TZ			HDI-TZ		
			1/4	3/8	1/2	3/8	1/2	5/8
Anchor O.D.	d_a	in. (mm)	0.561 (14.2)	0.561 (14.2)	0.625 (15.9)	0.561 (14.2)	0.625 (15.9)	0.844 (21.4)
Effective Embedment	h_{ef}	in. (mm)	3/4 (19)	3/4 (19)	1 (25)	1.42 (36)	1.65 (42)	3 (76)
Tension Failure Modes — Steel and Concrete								
Steel Embedment Material Resistance Factor for Reinforcement	ϕ_s	-	0.85	0.85	0.85	0.85	0.85	0.85
Resistance Modification Factor for Tension, Steel Failure Modes[2,3]	$R_{s,N}$	-	0.70	0.70	0.70	0.70	0.70	0.70
Min. Specified Yield Strength	f_{ya}	psi (N/mm^2)	70,400 (485)	70,400 (485)	70,400 (485)	79,600 (549)	70,400 (485)	58,000 (400)
Min. Specified Ult. Strength	f_{uta}	psi (N/mm^2)	88,000 (607)	88,000 (607)	88,000 (607)	99,500 (686)	88,000 (607)	72,500 (500)
Effective Cross-sectional Steel Area in Tension	$A_{se,N}$	in^2 (mm^2)	0.071 (45.8)	0.071 (45.8)	0.072 (46.5)	0.058 (37.4)	0.068 (43.9)	0.169 (109.0)
Factored Steel Resistance in Tension[4]	N_{sa}	lb (kN)	2,000 (8.9)	6,250 (27.8)	6,335 (28.2)	5,770 (25.7)	5,985 (26.6)	12,255 (54.5)
Concrete Material Resistance Factor	ϕ_c	-	0.65	0.65	0.65	0.65	0.65	0.65
Anchor Category	-	-	1	1	1	1	1	1
Resistance Modification Factor for Tension, Concrete Failure[3]	$R_{c,N}$	-	0.60	0.60	0.60	0.60	1.00	1.00
Coefficient for Factored Concrete Breakout Resistance, Uncracked Concrete	$k_{c,uncr}$	in-lb (SI)	24 (10.0)	24 (10.0)	24 (10.0)	24 (10.0)	27 (11.3)	24 (10.0)
Coefficient for Factored Concrete Breakout Resistance, Cracked Concrete	$k_{c,cr}$	in-lb (SI)	17 (7.1)	17 (7.1)	21 (8.8)	21 (8.8)	24 (10.0)	21 (8.8)
Modification Factor for Anchor Resistance in Tension, Uncracked Conc.[5]	$\psi_{c,N}$	-	1.0	1.0	1.0	1.0	1.0	1.0
Critical Edge Distance	c_{ac}	in. (mm)	6.5 (165)	6.5 (165)	4.0 (102)	5.5 (140)	6.5 (165)	12.0 (305)
Factored Pullout Resistance in 20 MPa Uncracked Concrete[6]	$N_{pr,uncr}$	lb (kN)	N/A	N/A	N/A	N/A	N/A	N/A
Factored Pullout Resistance in 20 MPa Cracked Concrete[6]	$N_{pr,cr}$	lb (kN)	495 (2.2)	495 (2.2)	960 (4.3)	N/A	N/A	N/A
Factored Pullout Resistance in 20 MPa Cracked Concrete, Seismic[6]	$N_{pr,eq}$	lb (kN)	490 (2.2)	490 (2.2)	865 (3.8)	N/A	N/A	N/A
Shear Failure Modes — Steel and Concrete								
Resistance Modification Factor for Shear, Steel Failure Modes[2,3]	$R_{s,V}$	-	0.65	0.65	0.65	0.65	0.65	0.65
Factored Steel Resistance in Shear[7]	V_{sa}	lb (kN)	975 (4.3)	975 (4.3)	3,800 (16.9)	3,465 (15.4)	3,590 (16.0)	7,350 (32.7)
Factored Steel Resistance in Shear, Seismic [7]	$V_{sa,eq}$	lb (kN)	975 (4.3)	975 (4.3)	2,385 (10.6)	2,355 (10.5)	2,600 (11.6)	5,265 (23.4)
Resistance Modification Factor for Shear, Concrete Failure Modes[3]	$R_{c,V}$	-	0.70	0.70	0.70	0.70	1.00	1.00
Load Bearing Length of Anchor in Shear	l_e	in. (mm)	3/4 (19.1)	3/4 (19.1)	1 (25.4)	1.42 (36.1)	1.65 (41.9)	3 (76.2)
Coefficient for Pryout Strength	k_{cp}	-	1.0	1.0	1.0	1.0	1.0	2.0

1 Design information is taken from ICC-ES ESR-4236, dated March 2024, Table 2, and converted for use with CSA A23.3 Annex D.
2 The HDI-P TZ and HDI-TZ are considered brittle steel elements as defined by CSA A23.3 Annex D Section D.2.
3 All values of R are applicable with the load combinations of CSA A23.3 Chapter 8. For concrete failure modes, no increase for Condition A is permitted.
4 $N_{sar} = N_{sa}\ \phi_s\ R_{s,N}$ where N_{sa} tabular value above is precalculated from $A_{se,N}\ f_{uta}$.
5 For all design cases, $\psi_{c,N} = 1.0$. The appropriate effectiveness factor for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
6 For all design cases, $\psi_{c,P} = 1.0$. Tabular value for pullout resistance is for a concrete compressive strength of 20 MPa (2,900 psi). Pullout resistance for concrete compressive strength greater than 20 MPa (2,900 psi) may be increased by multiplying the tabular pullout resistance by $(f'_c / 20)^{0.35}$ for MPa or $(f'_c / 2{,}900)^{0.35}$ for psi. NA (not applicable) denotes that pullout resistance does not need to be considered for design.
7 Shear and seismic shear tests are all performed in cracked concrete member according to ICC-ES AC193 section 9.4 and 9.6 respectively. Value of $V_{sa(,eq)} < 0.6\ A_{se,V}\ f_{uta}$ for all cases. Multiply V_{sa} tabular value above by $\phi_s\ R_{s,V}$ to get V_{sar} and $V_{sar,eq}$.

Table 20 — Steel Design Information for Inserted Threaded Rod Used with HDI-P TZ and HDI-TZ Anchors, in Accordance with CSA A23.3 [1]

Design Information		Symbol	Units	Nominal Anchor Size / Internal Thread Dia. (in)			
				1/4	3/8	1/2	5/8
Nominal Rod Diameter		d_{rod}	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Steel Embedment Material Resistance Factor for Reinforcement		f_s	-	0.85	0.85	0.85	0.85
Min. Specified Ult. Strength, ASTM A36 Steel Material		f_{uta}	psi (MPa)	58,000 (400)	58,000 (400)	58,000 (400)	58,000 (400)
Rod Effective Cross-sectional Area		$A_{se,rod}$	in.^{2} (mm^2)	0.0318 (21)	0.0775 (50)	0.1419 (92)	0.2260 (146)
A36 Steel Material	Resistance Modification Factor for Tension, Steel Failure Modes [2]	$R_{s,N}$	-	0.80	0.80	0.80	0.80
	Factored Steel Resistance in Tension [3]	$N_{sa,rod}$	lb (kN)	1,845 (8.2)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)
	Factored Steel Resistance in Tension, Seismic [3]	$N_{sa,rod,eq}$	lb (kN)	1,845 (8.2)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)
	Resistance Modification Factor for Shear, Steel Failure Modes [2]	$R_{s,V}$	-	0.75	0.75	0.75	0.75
	Factored Steel Resistance in Shear [4]	$V_{sa,rod}$	lb (kN)	1,105 (4.9)	2,695 (12.0)	4,940 (22.0)	7,865 (35.0)
	Factored Steel Resistance in Shear, Seismic [4]	$V_{sa,rod,eq}$	lb (kN)	775 (3.4)	1,885 (8.4)	3,460 (15.4)	5,505 (24.5)

1 Values provided for steel element material types, or equivalent, based on minimum specified strengths and calculated in accordance with CSA A23.3 Eq. D.2 and Eq. D.31. $V_{sa,rod,eq}$ must be taken as $0.7V_{sa,rod}$.
2 All values of R are applicable with the load combinations of CSA A23.3 Chapter 8. Values correspond to a ductile steel element.
3 $N_{sar,rod(eq)} = N_{sa,rod(eq)}) \phi_s R_{s,N}$ where $N_{sa,rod(eq)}$ tabular value above is precalculated from $A_{se,rod}\ f_{uta}$. N_{sar} shall be the lower of $N_{sar,rod}$, $N_{sar,HDI\text{-}P\ TZ}$, or $N_{sar,HDI\text{-}TZ}$, as applicable, for static steel strength in tension; for seismic loads, $N_{sar,eq}$ shall be the lower of $N_{sar,rod,eq}$, $N_{sar,eq,HDI\text{-}P\ TZ}$, or $N_{sar,eq,HDI\text{-}TZ}$, as applicable.
4 $V_{sar,rod(eq)} = V_{sa,rod(eq)} \phi_s R_{s,V}$ where $V_{sa,rod}$ tabular value above is precalculated from $0.60\ A_{se,rod}\ f_{uta}$, and $V_{sa,rod,eq}$ must be taken as $0.70\ V_{sa,rod}$. V_{sar} shall be the lower of $V_{sar,rod}$, $V_{sar,HDI\text{-}P\ TZ}$, or $V_{sar,HDI\text{-}TZ}$, as applicable, for static steel strength in shear; for seismic loads, $V_{sar,eq}$ shall be the lower of $V_{sar,rod,eq}$, $V_{sar,eq,HDI\text{-}P\ TZ}$, or $V_{sar,eq,HDI\text{-}TZ}$, as applicable.

Table 21 — Hilti HDI-P TZ design strength in the soffit of uncracked lightweight concrete over metal deck per CSA A23.3 Annex D [1,2,3,4,5,6]

Nominal anchor diameter in.	Effective embed. in. (mm)	Minimum concrete thickness [7] in. (mm)	Installation per Figure 3			Installation per Figure 4		
			Tension - ΦN_r		Shear - ΦV_r	Tension - ΦN_r		Shear - ΦV_r
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)
1/4	3/4 (19)	2 (51)	320 (1.4)	365 (1.6)	1,655 (7.4)	205 (0.9)	235 (1.0)	980 (4.4)
3/8	3/4 (19)	2 (51)	320 (1.4)	365 (1.6)	1,655 (7.4)	205 (0.9)	235 (1.0)	980 (4.4)
1/2	1 (25)	2 (51)	475 (2.1)	550 (2.4)	1,890 (8.4)	355 (1.6)	410 (1.8)	1,175 (5.2)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
3 Tabular values are lightweight concrete, and no additional reduction factor is needed.
4 No additional reduction factors for spacing or edge distance need to be applied.
5 Compare tabular values to the steel values in Table 17. The lesser of the values is to be used for the design.
6 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.
7 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 3 and 4.

Table 22 — Hilti HDI-P TZ design strength in the soffit of cracked lightweight concrete over metal deck per CSA A23.3 Annex D [1,2,3,4,5,6,7]

Nominal anchor diameter in.	Effective embed. in. (mm)	Minimum concrete thickness [8] in. (mm)	Installation per Figure 3			Installation per Figure 4		
			Tension - ΦN_r		Shear - ΦV_r	Tension - ΦN_r		Shear - ΦV_r
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)
1/4	3/4 (19)	2 (51)	155 (0.7)	180 (0.8)	2,545 (11.3)	100 (0.4)	115 (0.5)	980 (4.4)
3/8	3/4 (19)	2 (51)	155 (0.7)	180 (0.8)	2,545 (11.3)	100 (0.4)	115 (0.5)	980 (4.4)
1/2	1 (25)	2 (51)	360 (1.6)	415 (1.8)	2,910 (12.9)	270 (1.2)	310 (1.4)	1,175 (5.2)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
3 Tabular values are lightweight concrete, and no additional reduction factor is needed.
4 No additional reduction factors for spacing or edge distance need to be applied.
5 Compare tabular values to the steel values in Table 17. The lesser of the values is to be used for the design.
6 Tabular values are for static loads only. For seismic tension loads, multiply design strength values in tension by the following reduction factors:
1/4-in and 3/8-in diameter = 0.74
1/2-in diameter = 0.68
7 Tabular values are for static loads only. For seismic shear loads for the 1/2-inch diameter anchor, multiply design strength values in shear by the following reduction factor: 0.63.
8 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 3 and 4.

Table 23 — Hilti HDI-TZ design strength in the soffit of uncracked lightweight concrete over metal deck per CSA A23.3 Annex D [1,2,3,4,5,6]

Nominal anchor diameter in.	Effective embed. in. (mm)	Minimum concrete thickness [7] in. (mm)	Installation per Figure 3			Installation per Figure 4		
			Tension - ΦN_r		Shear - ΦV_r	Tension - ΦN_r		Shear - ΦV_r
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)
3/8	1.42	2	515	590	1,775	410	475	1,310
	(36)	(51)	(2.3)	(2.6)	(7.9)	(1.8)	(2.1)	(5.8)
1/2	1.65	2	735	850	1,985	535	615	1,345
	(42)	(51)	(3.3)	(3.8)	(8.8)	(2.4)	(2.7)	(6.0)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
3 Tabular values are lightweight concrete, and no additional reduction factor is needed.
4 No additional reduction factors for spacing or edge distance need to be applied.
5 Compare tabular values to the steel values in Table 18. The lesser of the values is to be used for the design.
6 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.
7 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 3 and 4.

Table 24 — Hilti HDI-TZ design strength in the soffit of cracked lightweight concrete over metal deck per CSA A23.3 Annex D [1,2,3,4,5,6,7]

Nominal anchor diameter in.	Effective embed. in. (mm)	Minimum concrete thickness [8] in. (mm)	Installation per Figure 3			Installation per Figure 4		
			Tension - ΦN_r		Shear - ΦV_r	Tension - ΦN_r		Shear - ΦV_r
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)
3/8	1.42	2	450	515	2,730	360	420	1,310
	(36)	(51)	(2.0)	(2.3)	(12.1)	(1.6)	(1.9)	(5.8)
1/2	1.65	2	655	755	3,050	475	550	1,345
	(42)	(51)	(2.9)	(3.4)	(13.6)	(2.1)	(2.4)	(6.0)

1 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
2 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
3 Tabular values are lightweight concrete, and no additional reduction factor is needed.
4 No additional reduction factors for spacing or edge distance need to be applied.
5 Compare tabular values to the steel values in Table 18. The lesser of the values is to be used for the design.
6 Tabular values are for static loads only. For seismic tension loads, multiply design strength values in tension by the following reduction factor: 0.75.
7 Tabular values are for static loads only. For seismic shear loads, multiply design strength values in shear by the following reduction factors:
3/8-in diameter = 0.68
1/2-in diameter = 0.72
8 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 3 and 4.

INSTALLATION INSTRUCTIONS

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at www.hilti.com or www.hiti.ca. Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

ORDERING INFORMATION

HDI-P TZ and HDI-TZ — Carbon Steel

Description	Anchor Thread Size	Anchor Diameter	Anchor Length	Qty / Box	Item number
HDI-P TZ 1/4"	1/4"	9/16"	3/4"	100	2351867
HDI-P TZ 3/8"	3/8"	9/16"	3/4"	100	2351768
HDI-P TZ 1/2"	1/2"	5/8"	1"	50	2351769
HDI-TZ 3/8"	3/8"	9/16"	1-9/16"	50	2351791
HDI-TZ 1/2"	1/2"	5/8"	2"	50	2351792
HDI-TZ 5/8"	5/8"	27/32"	3-1/4"	25	2351793

Setting Tools for HDI-P TZ and HDI-TZ

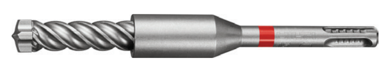
Anchor	Setting Tool Type	Legend	Item number
HDI-P TZ 1/4"	Standard Hand Setting Tool	①	2422172
	Grip Hand Setting Tool	②	2421859
	2-in-1 Setting Tool	③	2417737
	2-in-1 Setting Tool Spare Drill Bit	④	2419224
	Stop Drill Bit	⑤	2419472
HDI-P TZ 3/8"	Standard Hand Setting Tool	①	2422180
	Standard Notch Setting Tool	⑥	2204110
	Grip Hand Setting Tool	②	2422170
	2-in-1 Setting Tool	③	2204112
	2-in-1 Setting Tool Spare Drill Bit	④	2419471
	Stop Drill Bit	⑤	2419472
HDI-P TZ 1/2"	Standard Hand Setting Tool	①	2034016
	Grip Hand Setting Tool	②	401552
	2-in-1 Setting Tool	③	2112765
	2-in-1 Setting Tool Spare Drill Bit	④	2112771
	Stop Drill Bit	⑤	2417766
HDI-TZ 3/8"	Standard Hand Setting Tool	①	32979
	Grip Hand Setting Tool	②	243742
	2-in-1 Setting Tool	③	2417749
	2-in-1 Setting Tool Spare Drill Bit	④	2419225
	Stop Drill Bit	⑤	2419226
HDI-TZ 1/2"	Standard Hand Setting Tool	①	32980
	Grip Hand Setting Tool	②	243743
	2-in-1 Setting Tool	③	2112766
	2-in-1 Setting Tool Spare Drill Bit	④	2112772
	Stop Drill Bit	⑤	2313922
HDI-TZ 5/8"	Standard Hand Setting Tool	①	2422181
	Grip Hand Setting Tool	②	2425171
	Stop Drill Bit	⑤	2418818
	TE Setting Tool	⑦	2417738


①


②


③


④


⑤


⑥


⑦


⑧

Open Clip Extraction Head for TE 4/6 DRS

Anchor	Setting Tool Type	Legend	Item number
HDI-P TZ (all sizes) **HDI-TZ (3/8"-1/2")**	Extraction head HKD/HDI TE DRS	⑧	2154076

Hilti, Inc.
1-800-879-8000 | en español 1-800-879-5000
www.hilti.com

Hilti (Canada) Corporation
1-800-363-4458
www.hilti.ca

LLM • 10/24