HDI, HDI-L, HDI+ and HDI-L+ Drop-in Anchor 3.3.11

3.3.11.1 Product description

HDI+, HDI-L+ and HDI drop-in anchors are internally threaded, flush mounted expansion anchors for use in concrete.

Product features

HDI+, HDI-L+ and HDI

- Anchor, setting tool and Hilti drill bit form a matched tolerance system to provide reliable fastenings
- Allows shallow embedment without sacrificing performance
- Lip allows accurate flush surface setting, independent of hole depth for the HDI-L+
- Ideal for repetitive fastenings with threaded rods of equal length
- HDI+ and HDI-L+ have an innovative stepped plug that reduces number of hammer blows by up to 50%
- HDI+ and HDI-L+ can be installed with the new HDI+ Setting Tool system (stop drill bit and machine setting tool) for improved productivity

Guide specifications

Expansion anchor shall be drop-in, shell or flush type. Carbon steel anchors are zinc plated in accordance with ASTM B633, SC 1, Type III. Stainless steel anchors are manufactured from AISI Type 303 stainless steel. Anchors shall be Hilti HDI+ (HDI-L+) (HDI) anchors as supplied by Hilti.

Listings/Approvals

FM (Factory Mutual)
Pipe Hanger Components for Automatic Sprinkler Systems HDI+ 3/8, HDI-L+ 3/8, HDI+1/2, HDI-L+ 1/2, HDI 5/8 and HDI 3/4

UL LLC
UL 203 Pipe Hanger Equipment for Fire Protection Services HDI+ 3/8, HDI-L+ 3/8, HDI+1/2, HDI-L+ 1/2, HDI 5/8 and HDI 3/4

3.3.11.2 Material specifications

HDI+, HDI-L+ and HDI anchors are manufactured from mild carbon steel. Anchor bodies are zinc plated in accordance with ASTM B633, SC 1, Type III.

HDI stainless steel anchors are manufactured from AISI Type 303 stainless steel.

3.3.11.3 Technical data

Table 1 - Hilti HDI+, HDI-L+ and HDI specifications[1]

Setting Information	Symbol	Units	HDI+ and HDI-L+			HDI	
			1/4	3/8	1/2	5/8	3/4
Insert thread	d	UNC	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10
Nominal bit diameter	d_{bit}	in.	3/8	1/2	5/8	27/32	1
Nominal embedment Anchor length Hole depth	h_{nom} ℓ h_o	in. (mm)	1 (25)	1-9/16 (40)	2 (51)	2-9/16 (65)	3-3/16 (81)
Useable thread length	ℓ_{th}	in. (mm)	7/16 (11)	5/8 (15)	11/16 (17)	7/8 (22)	1-3/8 (34)
Installation torque	T_{inst}	ft-lb (Nm)	4 (5)	11 (15)	22 (30)	37 (50)	80 (109)
Minimum slab thickness	h	in. (mm)	3 (76)	3-1/8 (79)	4 (102)	5-1/8 (130)	6-3/8 (162)

1 HDI+ and HDI-L+ are available in 1/4-, 3/8- and 1/2-in. The HDI is available in 5/8- and 3/4-in.

Combined shear and tension loading

$$\left(\frac{N_d}{N_{rec}}\right)^{5/3} + \left(\frac{V_d}{V_{rec}}\right)^{5/3} \leq 1.0$$

3.3.11 HDI, HDI-L, HDI+ and HDI-L+ Drop-in Anchor

Table 2 - Hilti HDI+, HDI-L+ and HDI carbon steel allowable loads in concrete (lb)[1,2]

Anchor type	Nominal anchor diameter in.	f'_c = 2,000		f'_c = 4,000		f'_c = 6,000	
		Tension	Shear	Tension	Shear	Tension	Shear
HDI+	1/4	500	450	570	625	790	700
	3/8	635	965	920	1,250	1,260	1,500
	1/2	945	1,500	1,605	1,940	1,950	2,500
HDI	5/8	1,875	2,500	2,920	3,250	3,715	3,750
	3/4	2,500	3,875	4,065	5,000	5,565	5,500

Table 3 - Hilti HDI+, HDI-L+ and HDI carbon steel ultimate loads in concrete (lb)[1]

Anchor type	Nominal anchor diameter in.	f'_c = 2,000		f'_c = 4,000		f'_c = 6,000	
		Tension	Shear	Tension	Shear	Tension	Shear
HDI+	1/4	1,995	1,800	2,270	2,500	3,150	2,800
	3/8	2,540	3,850	3,685	5,000	5,035	6,000
	1/2	3,780	6,000	6,425	8,500	7,810	10,000
HDI	5/8	7,500	10,000	11,685	13,000	14,865	15,000
	3/4	10,000	15,500	16,260	20,000	22,250	22,000

1 The shear tests were conducted with SAE Grade 5 bolts with minimum yield strength of 85 ksi and minimum tension strength of 120 ksi. Shear testing for the 1/4-in. models were conducted with SAE Grade 8 bolts with minimum yield strength of 120 ksi and minimum tension strength of 150 ksi in 6,000 psi concrete. High-strength bolts were used to force concrete failure modes. When using steel bolts with a lower tensile strength, steel failure must be considered.

2 Allowable loads calculated with a factor of safety of 4.

Table 4 - Hilti HDI+, HDI-L+ and HDI carbon steel allowable loads in lightweight concrete and lightweight concrete poured over metal deck (lb)[1,2,3,4]

Anchor type	Nominal anchor diameter in.	Lightweight concrete		Lightweight concrete poured over metal deck			
				Upper flute		Lower flute	
		Tension	Shear	Tension	Shear	Tension	Shear
HDI+	1/4	465	340	530	335	375	250
	3/8	720	940	810	1,010	500	500
	1/2	1,035	1,700	1,035	1,755	625	750
HDI	5/8	1,465	2,835			875	875
	3/4	2,075	3,680			1,250	1,000

1 The shear tests were conducted with SAE Grade 5 bolts with minimum yield strength of 85 ksi and minimum tension strength of 120 ksi. Shear testing for the 1/4-in. models were conducted with SAE Grade 8 bolts with minimum yield strength of 120 ksi and minimum tension strength of 150 ksi in 6,000 psi concrete. High-strength bolts were used to force concrete failure modes. When using steel bolts with a lower tensile strength, steel failure must be considered.

2 Minimum compressive strength of structural lightweight concrete is 3,000 psi.

3 See figure 1 for typical details.

4 Allowable loads calculated with a factor of safety of 4.

Table 5 - Hilti HDI stainless steel allowable loads in concrete (lb)[1,2,3]

Nominal anchor diameter in.	f'_c = 4,000		f'_c = 6,000	
	Tension	Shear	Tension	Shear
1/4	480	600	740	600
3/8	1,040	1,230	1,460	1,230
1/2	1,840	2,760	2,410	2,760
5/8	2,630	4,510	3,770	4,510
3/4	3,830	5,580	5,030	5,580

Table 6 - Hilti HDI stainless steel ultimate loads in concrete (lb)[1,2]

Nominal anchor diameter in.	f'_c = 4,000		f'_c = 6,000	
	Tension	Shear	Tension	Shear
1/4	1,930	2,400	2,950	2,400
3/8	4,170	4,920	5,850	4,920
1/2	7,350	11,040	9,630	11,040
5/8	10,540	18,040	15,100	18,040
3/4	15,340	22,320	20,130	22,320

1 Stainless steel models available in HDI version only.

2 Shear testing conducted with 18-8 stainless steel bolts.

3 Allowable loads calculated with a factor of safety of 4.

Figure 1 - Installation of Hilti HDI drop-in anchor in the soffit of concrete over metal deck floor and roof assemblies W – deck