Technical Data Sheet
TDS-296-02968

IEA™HS

High Strength Injection Epoxy Adhesive

Building & Transportation | Oil, Gas & Industrial | Offshore & Onshore | Water & Wastewater

PRODUCT DESCRIPTION

The CTech-LLC® IEA™HS is a high-strength epoxy-based adhesive formulated for anchoring and doweling in cracked and uncracked concrete and masonry base materials.
Applied in one single action the two component IEA™HS injection adhesive will produce a cost effective, strong and chemical resistant fixing.

ADVANTAGES

- 1:1 two-component, high-solids, epoxy-based anchoring adhesive formula
- Passed the demanding ICC-ES AC308 adverse-condition tests pertaining to elevated temperatures and long-term sustained loads.
- Code listed under the IBC/IRC for cracked and uncracked concrete per ICC-ES ESR-2508
- Code listed under the IBC/IRC for masonry per IAPMO UES ER-265.
- Suitable for use under static and seismic loading conditions in cracked and uncracked concrete and masonry.
- Cure times: 24 hours at 70°F (21°C), 72 hours at 50°F (10°C)
- Easy hole-cleaning — no power-brushing required
- Suitable for use in dry or water-saturated concrete

TYPICAL USES

- Threaded rod anchoring and rebar doweling into concrete, masonry and URM (red brick)
- Recognized per AC308 to be used for rebar development and splice length design provisions of ACI 318.
- Suitable for horizontal, vertical and overhead applications

Codes

RR25965 (masonry); Florida FL15730.5; AASHTO M-235 and ASTM C881 (Type I and IV, Grade 3, Class C).

Test Criteria

Anchors installed with IEA™HS adhesive have been tested in accordance with ICC-ES. Acceptance Criteria for Post-Installed Adhesive Anchors in Masonry Elements (AC58) and Adhesive Anchors in Concrete Elements (AC308).

TECHNICAL DATA

Property	Test Method	Result*
Consistency	ASTM C881	Passed, Non-sag
Glass transition temperature	ASTM E1356	155°F
Heat deflection temperature	ASTM D648	136°F (58°C)
Bond strength (moist cure)	ASTM C882	2,916 psi (2 d) 3,366 psi (14 d)
Water absorption	ASTM D570	0.10%
Compressive yield strength	ASTM D695	14,110 psi
Compressive modulus	ASTM D695	612,970 psi (7 d)
Shore D Durometer	ASTM D2240	84
Gel time	ASTM C881	60 min
VOC	ASTM D2369	3 g/L

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

CURE SCHEDULE

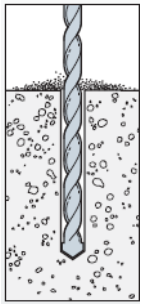
Base Material Temperature		Gel Time	Cure Time
°F	°C	Min	hr
50	10	75	72
60	16	60	48
70	21	45	24
90	32	35	24
110	43	20	24

Note: For water-saturated concrete (including damp and water-filled holes), the cure times must be doubled.

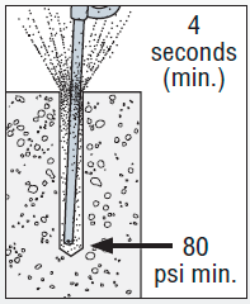
INSTALLATION PROCEDURE

HOLE PREPARATION

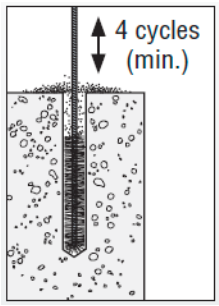
- Drill: Drill hole to specified diameter and depth.
- Blow: Remove dust from hole with oil-free compressed air for a minimum of four seconds. Compressed air nozzle must reach the bottom of the hole.
- Brush: Clean with a nylon brush for a minimum of four cycles. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.
- Blow: Remove dust from hole with oil-free compressed air for a minimum of four seconds. Compressed air nozzle must reach the bottom of the hole.



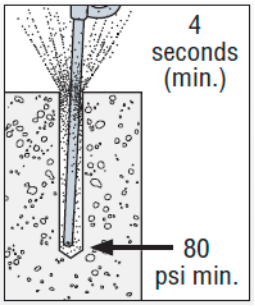
Drill



Blow



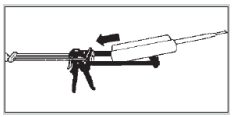
Brush



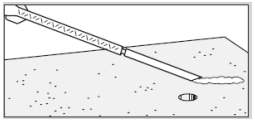
Blow

Cartridge Preparation

- Insert: Insert cartridge into dispensing tool.
- Dispense: Dispense adhesive to the side until properly mixed (uniform color).



Insert



Dispense

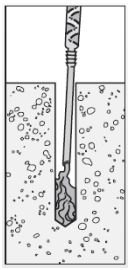
FILLING THE HOLE

- *FOR SOLID BASE MATERIALS*

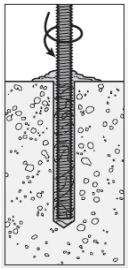
Fill: Fill hole completely full, starting from bottom of hole to prevent water pockets. Withdraw nozzle as hole fills up.

Insert: Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the hole.

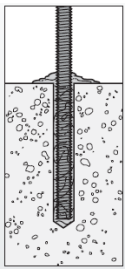
Do not disturb: Do not disturb anchor until fully cured.



Fill



Insert



Do not disturb

IEA™HS Design Information

IEA™HS Installation Information and Additional Data for Threaded Rod and Rebar in Normal-Weight Concrete[1]

Characteristic		Symbol	Units	Nominal Anchor Diameter (in.) / Rebar Size						
				3/8 / #3	1/2 / #4	5/8 / #5	3/4 / #6	7/8 / #7	1 / #8	1 1/4 / #10
Installation Information										
Drill Bit Diameter		d_{hole}	in.	1/2	5/8	3/4	7/8	1	1 1/8	1 3/8
Maximum Tightening Torque		T_{inst}			20	30	45	60	80	125
Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2 3/8	2 3/4	3 1/8	3 1/2	3 3/4	4	5
	Maximum	h_{ef}	in.	7 1/2	10	12 1/2	15	17 1/2	20	25
Minimum Concrete Thickness		h_{min}	in.	$h_{ef} + 5d_{hole}$						
Critical Edge Distance[2]		c_{ac}	in.	See footnote 2						
Minimum Edge Distance		c_{min}	in.	1 3/4						2 3/4
Minimum Anchor Spacing		s_{min}	in.	3						6

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
2. $c_{ac} = h_{ef} (\tau_{k,uncr} / 1{,}160)^{0.4} \times [3.1 - 0.7(h/h_{ef})]$, where:
$[h/h_{ef}] \leq 2.4$
$\tau_{k,uncr}$ = the characteristic bond strength in uncracked concrete, given in the tables that follow $\leq k_{uncr} ((h_{ef} \times f'_c)^{0.5}/(\pi \times d_{hole}))$
h = the member thickness (inches)
h_{ef} = the embedment depth (inches)

IEA™HS Tension Strength Design Data for Threaded Rod in Normal-Weight Concrete[1]

Characteristic			Symbol	Units	Nominal Anchor Diameter (in.)						
					3/8	1/2	5/8	3/4	7/8	1	11/4
Steel Strength in Tension											
Threaded Rod	Minimum Tensile Stress Area		A_{se}	in^2	0.078	0.142	0.226	0.334	0.462	0.606	0.969
	Tension Resistance of Steel — ASTM F1554, Grade 36		N_{sa}	lb.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
	Tension Resistance of Steel — ASTM A193, Grade B7				9,750	17,750	28,250	41,750	57,750	75,750	121,125
	Tension Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)				8,580	15,620	24,860	36,740	50,820	66,660	106,590
	Tension Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)				4,445	8,095	12,880	19,040	26,335	34,540	55,235
	Strength Reduction Factor — Steel Failure		ϕ	—	0.75[7]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)[12]											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65[9]						
Bond Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)[12]											
Uncracked Concrete[2,3,4]	Characteristic Bond Strength[5,13]		$\tau_{k,uncr}$	psi	770	1,150	1,060	970	885	790	620
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2 3/8	2 3/4	3 1/8	3 1/2	3 3/4	4	5
		Maximum			7 1/2	10	12 1/2	15	17 1/2	20	25
Cracked Concrete[2,3,4]	Characteristic Bond Strength[5,10,11,13]		$\tau_{k,cr}$	psi	595	510	435	385	355	345	345
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	3	4	5	6	7	8	10
		Maximum			7 1/2	10	12 1/2	15	17 1/2	20	25
Bond Strength in Tension — Bond Strength Reduction Factors for Continuous Special Inspection											
Strength Reduction Factor — Dry Concrete			$\phi_{dry,ci}$	—	0.65[8]						
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} \le 12d_a$			$\phi_{sat,ci}$	—	0.55[8]		0.45[8]				
Additional Factor for Water-Saturated Concrete — $h_{ef} \le 12d_a$			$K_{sat,ci}$[6]	—	N/A		1			0.84	
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} > 12d_a$			$\phi_{sat,ci}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete — $h_{ef} > 12d_a$			$k_{sat,ci}$[6]	—	0.57						
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			$\phi_{dry,pi}$	—	0.55[8]						
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} \le 12d_a$			$\phi_{sat,pi}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete — $h_{ef} \le 12d_a$			$K_{sat,pi}$[6]	—	1		0.93			0.71	
Strength Reduction Factor — Water-Saturated Concrete — $h_{ef} > 12d_a$			$\phi_{sat,pi}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete — $h_{ef} > 12d_a$			$K_{sat,pi}$[6]	—	0.48						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 or ACI 318-11.
2. Temperature Range: Maximum short-term temperature of 150°F. Maximum long-term temperature of 110°F.
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term concrete temperatures are constant temperatures over a significant time period.
5. For anchors that only resist wind or seismic loads, bond strengths may be increased by 72%.
6. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat}.
7. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
8. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
9. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318-11 Section 9.2 are used and the requirements of ACI 318-11 D.4.4 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.5 to determine the appropriate value of ϕ.
10. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for 7/8" anchors must be multiplied by $\psi_{N,seis}$ = 0.80.
11. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for 1" anchors must be multiplied by $\psi_{N,seis}$ = 0.92.
12. The values of f'_c used for calculation purposes must not exceed 8,000 psi (55.1 MPa) for uncracked concrete. The value of f'_c used for calculation purposes must not exceed 2,500 psi (17.2 MPa) for tension resistance in cracked concrete.
13. For applications where maximum short-term temperature is 110ºF (43ºC) and the maximum long-term temperature is 75ºF (24ºC), bond strengths may be increased 93%. No additional increase is permitted for anchors that only resist wind or seismic loads.

IEA™HS Tension Strength Design Data for Rebar in Normal-Weight Concrete[1]

Characteristic			Symbol	Units	Rebar Size						
					#3	#4	#5	#6	#7	#8	#10
Steel Strength in Tension											
Rebar	Minimum Tensile Stress Area		A_{se}	in²	0.11	0.2	0.31	0.44	0.6	0.79	1.23
	Tension Resistance of Steel — Rebar (ASTM A615 Grade 60)		N_{sa}	lb.	9,900	18,000	27,900	39,600	54,000	71,100	110,700
	Strength Reduction Factor — Steel Failure		□	—	0.65[7]						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)[10]											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}	—	17						
Strength Reduction Factor — Breakout Failure			□	—	0.65[9]						
Bond Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)[10]											
Uncracked Concrete [2,3,4]	Characteristic Bond Strength[5,11]		□$_{k,uncr}$	psi	895	870	845	820	795	770	720
	Permitted Embedment Depth Range		h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Cracked Concrete [2,3,4]	Characteristic Bond Strength[5,11]		□$_{k,cr}$	psi	365	735	660	590	515	440	275
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	3	4	5	6	7	8	10
		Maximum			7½	10	12½	15	17½	20	25
Bond Strength in Tension — Bond Strength Reduction Factors for Continuous Special Inspection											
Strength Reduction Factor — Dry Concrete			□$_{dry,ci}$	—	0.65[8]						
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} \le 12d_a$			□$_{sat,ci}$	—	0.55[8]		0.45[8]				
Additional Factor for Water-Saturated Concrete – $h_{ef} \le 12d_a$			$K_{sat,ci}$[6]	—	N/A		1			0.84	
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} > 12d_a$			□$_{sat,ci}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete – $h_{ef} > 12d_a$			$K_{sat,ci}$[6]	—	0.57						
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			□$_{dry,pi}$	—	0.55[8]						
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} \le 12d_a$			□$_{sat,pi}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete – $h_{ef} \le 12d_a$			$K_{sat,pi}$[6]	—	1		0.93			0.71	
Strength Reduction Factor — Water-Saturated Concrete – $h_{ef} > 12d_a$			□$_{sat,pi}$	—	0.45[8]						
Additional Factor for Water-Saturated Concrete – $h_{ef} > 12d_a$			$K_{sat,pi}$[6]	—	0.48						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 or ACI 318-11.
2. Temperature Range: Maximum short-term temperature of 150°F. Maximum long-term temperature of 110°F.
3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
4. Long-term concrete temperatures are constant temperatures over a significant time period.
5. For anchors that only resist wind or seismic loads, bond strengths may be increased by 72%.
6. In water-saturated concrete, multiply □$_{k,uncr}$ and □$_{k,cr}$ by K_{sat}.
7. The value of □□applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of □.
8. The value of □□applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of □.
9. The value of □□applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.4 (c) for Condition B are met. If the load combinations of ACI 318-11 Section 9.2 are used and the requirements of ACI 318-11 D.4.4 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of □. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.5 to determine the appropriate value of □.
10. The values of f'_c used for calculation purposes must not exceed 8,000 psi (55.1 MPa) for uncracked concrete. The value of f'_c used for calculation purposes must not exceed 2,500 psi (17.2 MPa) for tension resistance in cracked concrete.
11. For applications where maximum short-term temperature is 110˚F (43˚C) and the maximum long-term temperature is 75˚F (24˚C), bond strengths may be increased 93%. No additional increase is permitted for anchors that only resist wind or seismic loads.

IEA™HS Shear Strength Design Data for Threaded Rod in Normal-Weight Concrete[1]

Characteristic		Symbol	Units	Nominal Anchor Diameter (in.)						
				3/8	1/2	5/8	3/4	7/8	1	11/4
Steel Strength in Shear										
Threaded Rod	Minimum Shear Stress Area	A_{se}	in^2	0.078	0.142	0.226	0.334	0.462	0.606	0.969
	Shear Resistance of Steel — ASTM F1554, Grade 36	V_{sa}	lb.	2,260	4,940	7,865	11,625	16,080	21,090	33,720
	Shear Resistance of Steel — ASTM A193, Grade B7			4,875	10,650	16,950	25,050	34,650	45,450	72,675
	Shear Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)			4,290	9,370	14,910	22,040	30,490	40,000	63,955
	Shear Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 & B8M)			2,225	4,855	7,730	11,420	15,800	20,725	33,140
	Reduction for Seismic Shear — ASTM F1554, Grade 36	$\alpha_{V,seis}$[5]	—	0.87	0.78	0.68				0.65
	Reduction for Seismic Shear — ASTM A193, Grade B7			0.87	0.78	0.68				0.65
	Reduction for Seismic Shear — Stainless (ASTM A193, Grade B6)			0.69	0.82	0.75			0.83	0.72
	Reduction for Seismic Shear — Stainless (ASTM A193, Grade B8 & B8M)			0.69	0.82	0.75			0.83	0.72
	Strength Reduction Factor — Steel Failure	ϕ	—	0.65[2]						
Concrete Breakout Strength in Shear										
Outside Diameter of Anchor		d_o	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load Bearing Length of Anchor in Shear		ℓ_e	in.	h_{ef}						
Strength Reduction Factor — Breakout Failure		ϕ	—	0.70[3]						
Concrete Pry-out Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	1.0 for $h_{ef} < 2.50"$; 2.0 for $h_{ef} \geq 2.50"$						
Strength Reduction Factor — Pryout Failure		ϕ	—	0.70[4]						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
2. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.3 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
4. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 5.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
5. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V,seis}$ for the corresponding anchor steel type.

IEA™HS Shear Strength Design Data for Rebar in Normal-Weight Concrete[1]

Characteristic		Symbol	Units	Rebar Size						
				#3	#4	#5	#6	#7	#8	#10
Steel Strength in Shear										
Rebar	Minimum Shear Stress Area	A_{se}	in²	0.11	0.2	0.31	0.44	0.6	0.79	1.23
	Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	4,950	10,800	16,740	23,760	32,400	42,660	66,420
	Reduction for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V,seis}$[5]	—	0.85	0.88	0.84		0.77		0.59
	Strength Reduction Factor — Steel Failure	ϕ	—	0.60[2]						
Concrete Breakout Strength in Shear										
Outside Diameter of Anchor		d_o	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear		ℓ_e	in.	h_{ef}						
Strength Reduction Factor — Breakout Failure		ϕ	—	0.70[3]						
Concrete Pryout Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	1.0 for h_{ef} < 2.50"; 2.0 for h_{ef} ≥ 2.50"						
Strength Reduction Factor — Pryout Failure		ϕ	—	0.70[4]						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 or ACI 318-11.
2. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
3. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.3 to determine the appropriate value of ϕ. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ
4. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 5.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ.
5. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V,seis}$.

IEA™HS Development Length for Rebar Dowels in Normal-Weight Concrete

Development Length, in. (mm)							
Rebar Size	Drill Bit Diameter (in.)	Clear Cover in. (mm)	f'_c=2,500psi (17.2 MPa) Concrete	f'_c=3,000psi (20.7 MPa) Concrete	f'_c=4,000psi (27.6 MPa) Concrete	f'_c=6,000psi (41.4 MPa) Concrete	f'_c=8,000psi (55.2 MPa) Concrete
#3 (9.5)	1/2	1**1/2** (38)	12 (305)	12 (305)	12 (305)	12 (305)	12 (305)
#4 (12.7)	5/8	1**1/2** (38)	14.4 (366)	14 (356)	12 (305)	12 (305)	12 (305)
#5 (15.9)	3/4	1**1/2** (38)	18 (457)	17 (432)	14.2 (361)	12 (305)	12 (305)
#6 (19.1)	7/8	1**1/2** (38)	21.6 (549)	20 (508)	17.1 (434)	14 (356)	13 (330)
#7 (22.2)	1	3 (76)	31.5 (800)	29 (737)	25 (635)	21 (533)	18 (457)
#8 (25.4)	11/8	3 (76)	36 (914)	33 (838)	28.5 (724)	24 (610)	21 (533)
#9 (28.7)	13/8	3 (76)	40.5 (1,029)	38 (965)	32 (813)	27 (686)	23 (584)
#10 (32.3)	13/8	3 (76)	45 (1,143)	42 (1,067)	35.6 (904)	30 (762)	26 (660)
#11 (35.8)	13/4	3 (76)	51 (1,295)	47 (1,194)	41 (1,041)	33 (838)	29 (737)

1. Taulated development lengths are for static, wind and seismic load cases in Seismic Design Category A and B.
Development lengths in SDC C through F must comply with ACI 318-14 Chapter 18 or ACI 318-11 Chapter 12, as applicable. The value of f'_c used to calculate development lengths shall not exceed 2,500 psi in SDC C through F.
2. Rebar is assumed to be ASTM A615 Grade 60 or A706 (f_y = 60,000 psi). For rebar with a higher yield strength, multiply tabulated values by f_y / 60,000 psi.
3. Concrete is assumed to be normal-weight concrete. For lightweight concrete, multiply tabulated values by 1.33.
4. Tabulated values assume bottom cover of less than 12" cast below rebars (ψ_t = 1.0).
5. Uncoated rebar must be used.
6. The value of K_{tr} is assumed to be 0. Refer to ACI 318 Section 12.2.3.

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